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Using the Computer to Support Health Care and Patient Education

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S E C T I O N

Three

Specialty Applications

CHAPTER **16**
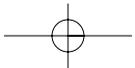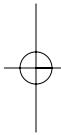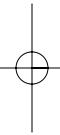
Using the Computer to Support Healthcare and Patient Education

After completing this chapter, you should be able to:

1 Identify specific ways that computer technology may be used to support and enhance education.

2 List benefits associated with *Virtual Learning Environments (VLE)*, *distance learning*, and *Web-based instruction (WBI)*.

3 Compare and contrast *e-learning* with other educational uses of computers.

4 Provide examples of how computer technology may support education in each of the following settings: formal nursing programs, continuing education, and client or consumer education.

5 Compare and contrast various Web 2.0 applications and describe their use in education, social networking, professional collaborations, and patient care.

6 Explain to a colleague the various mobile learning technologies and demonstrate the ability to find information regarding the development of these tools for educational purposes.

Educational applications of computer technology can enhance the presentation of content, ease the burdens associated with course management for faculty, erase geographic boundaries for students, make learning opportunities available 24 hours a day, tailor instruction to individual learning needs, improve learning outcomes, provide a safe learning environment, and reduce the challenge of acquiring, maintaining, collaborating with other educators, and expanding skill sets—helping to keep the present workforce competent (Bradley 2003). Proponents see its potential to revolutionize education for healthcare professionals and consumers and promote critical thinking and problem-solving skills. The realization of this potential requires well-developed learning objectives, good planning, design, wise use, and evaluation by educators and administrators. Technology is increasingly prevalent in today's mobile society and dynamic workplaces. Technology should be a part of the education process but only when there is a match with the objectives of the curriculum, it is well used, and it facilitates the learning process. Educators must become adept in the evaluation and use of the technology that they plan to use. Today's students and healthcare consumers expect access to emerging technologies that will assist them with searching for healthcare content by category and that will allow them to actively participate in topical online groups.

INSTRUCTIONAL APPLICATIONS OF COMPUTER TECHNOLOGY

Computer-related technology may be used in a variety of ways to support, provide, and enrich learning. These often include:

- Word-processing software to prepare student handouts.
- Slide presentation software to create presentations and audio-visual aids.
- Spreadsheets or course management tools to maintain attendance records and grades.
- Course management system (CMS) tools to develop, administer, and score examinations and provide formative evaluation tools.
- Communication tools such as instant messaging, e-mail, weblogs (blogs), podcasts, threaded discussions, chats, and wikis to answer student questions and provide feedback to students on their progress.
- Online literature searches that may be used to research content prior to developing or revising a presentation. Searches can be done directly through databases available through libraries or through Websites such as Sigma Theta Tau's Virginia Henderson Library and the National Library of Medicine's portal For Healthcare Professionals (www.nlm.nih.gov/portals/healthcare.html). Abstracts and some full text articles can also be retrieved online.

Other instructional applications of computer technology include Virtual Learning Environments (VLE), competency-based training, teleconferencing, multimedia presentations, simulation, virtual reality, and distance education. Some examples of instructional applications may be found at www. Merlot.org.

Merlot.org is an online, multimedia educational resource housing various types of learning packages that can be accessed without charge. Content is submitted by the authors, evaluated by peers, and made available to the academic community at no cost. Box 16–1 lists some ways that computers may be used to facilitate education.

Virtual Learning Environment

A Virtual Learning Environment (VLE) is a system that uses the Internet to assist the educator in developing, managing, and administering educational materials for students. Other terms used for VLEs are *Course Management System (CMS)*, *Managed Learning Environment (MLE)*, and *Learning Management Systems (LMS)*. These programs facilitate electronic learning (e-learning), may track students' progress in a course, and generally run on servers (Wikipedia 2007a). Examples of VLEs are Moodle Learning Management System, CyberExtension Virtual Managed Learning, Blackboard, and WebCt. The Sakai Project (2007) is an example of a free and open-source CMS. This project is spearheaded by a group of academic institutions and volunteer organizations around the world that have developed an online collaboration and learning environment. This open-source learning platform provides generic "collaboration" tools, such as

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BOX 16–1   Applications of Computers in Healthcare Education

Formal opportunities

- Continuing education
- Distance education
- Online journal retrieval
- Client education

Informal opportunities

- E-mail
- Listservs and Real Simple Syndication (RSS) (automatic news retrieval)
- Support groups
- Online literature searches and databases
- Chats or instant messaging
- Blogs
- Podcasts
- Wikis
- Social Networking Applications

Administrative support

- Webcasts
- Preparation of presentations, handouts, and slides
- Record keeping
- Course management tools inclusive of test administration scoring and statistical analysis
- Student services

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threaded discussion boards, an announcement board, Web content, a chat room, and more. The "core" tools consist of teaching tools, such as a grade book, course syllabus, and assignments. Furthermore, there are portfolio tools that allow the student and educator to use templates, forms, and evaluations for professional electronic portfolios.

Advocates of VLE allege that it enhances computer literacy, facilitates decision-making skills, reduces computer anxiety, and positively affects student achievement. Although originally designed to promote individualized learning, VLE and Web 2.0 applications can enhance group learning as well (Calderone 1994; Maag 2006). Numerous studies have been conducted comparing the efficacy of VLE to traditional instruction. The general finding is that a VLE is at least as effective as traditional instruction although some critics find the methodology of many of these studies faulty—calling for more research (Wang & Sleeman 1993a, 1993b; Rouse 2000). It has been suggested that VLE may provide a means to introduce technology into the curriculum and even to pave the way for distance education (Greco & O'Connor 2000; Kozlowski 2002). A VLE is often used to supplement classroom instruction (Myles 2000; Second Health 2007).

VLE offers the following advantages:

- *Improved reading habits.* Learners can proceed at a pace conducive to comprehension.
- *Convenience.* VLE can be offered at any site that has computer access. Programs may be available for single users on freestanding PCs or via network connections.
- *Reduced learning time.* Because learners can proceed at their own pace, they can skim through familiar content and focus on weak areas.
- *Increased retention.* The active nature of the media facilitates learner participation, which in turn, improves retention.
- *Twenty-four-hour access.* VLE is available at any time of the day or night so that learners can use it at times convenient to them.
- *Consistent instruction in a safe environment.* VLE allows learners to practice new skills without fear of harm to themselves or others.
- *Flexibility of faculty schedules.* VLE makes it easier to teach around clinical instruction.

Three major variables influence VLE effectiveness: quality of the software, the environment of computer use, and characteristics of the learner. Some factors that can lead to negative attitudes toward VLE include the following design issues:

- *Poor design.* Many VLE applications do nothing more than automate page turning.
- *Lack of feedback on incorrect answers.* This is frustrating to learners who want to know why their selections were wrong.
- *Lack of control.* Control encompasses the ability to advance, repeat, or review portions of the program, or to quit at any point.
- *Lack of intellectual stimulation.* Programs that fail to maintain interest may cause learners to feel that they wasted their time.

Drug calculation programs are a common VLE application in many nursing schools. These programs are popular because drug calculation is a basic skill needed by all nurses, and, as such, drug calculation programs fit well into the curriculum, while programs on other content areas may not match curriculum objectives. An example of an interactive VLE that assists students and nurses with drug dosages is the "Med-Calc Tutorial" (Hansen 2007a).

Competency-Based Training

Competency-based training and testing are particularly important in the clinical setting as institutions need to demonstrate that staff are able to perform skills safely (Bradley 2003; O'Gara 2003). Simulation technology allows users to learn and then demonstrate their skills or test different scenarios without negative consequences. Initial research indicates highly positive effects of simulation on skill and knowledge acquisition (Ravert 2002). Computer-based competency training and testing have the potential to free instructor time, streamline instruction and testing, and eliminate costs associated with employee travel. An example of a high fidelity simulation and case-based learning lab is at the University of Tasmania School of Nursing and Midwifery (2007). The manikins used in the simulation lab assist students in practicing assessment skills through computer-assisted case scenarios. It is vital that the case studies be developed around well-planned learning objectives, and that the students' learning outcomes be evaluated on a continuous basis. Simulation labs are popular in healthcare education; however, caution needs to be taken so that they do not totally replace clinical education.

Multimedia

Nursing education has always used multimedia, whether that media included chalkboard diagrams, overhead transparencies, slide presentations, videos, skill demonstrations, computer-based instruction, interactive video disks (IVDs), compact discs (CDs), digital video discs (DVDs), or streaming video (Batscha 2002; Billings 1995; Calderone 1994; Gleydura et al. 1995; Simpson 2002; Smith-Stoner & Willer 2003; Sternberger & Meyer 2001). Now it is possible to add virtual reality to the list of examples. Quite simply, multimedia refers to presentations that combine text, voice or sound, images, and video, or hardware and software that can support the same. Interactive technological tools that facilitate different forms of online communication, learning, and collaboration among educators, students, and colleagues include Web 2.0 technologies. According to Wikipedia (2007b), Web 2.0 is "a second phase of development of the World Wide Web, including its architecture and its applications." (O'Reilly 2005). The concept of Web 2.0 began with a brainstorming session in which O'Reilly participated. These technologies include blogs, podcasts, vodcasts, wikis, and YouTube (see Appendix). Murray and Maag (2006) claimed these tools could enhance effective communication, manage information, and enrich professional collaboration. Currently, health informaticians are proposing an International Medical Informatics Association (IMIA) Web 2.0 exploratory task force in order to provide knowledge about these applications (Moura, Murray,

Hammond, Hansen, & Erdley, 2007). Another novel online interactive learning tool is "Second Health: The Future of Healthcare Communication" (2007). The three dimensional (3D) virtual world of Second Life is an exciting online tool that allows healthcare students and professionals to interact with other visitors in a virtual hospital and help shape future healthcare.

While interactive multimedia is an excellent approach for nurses because they are required to learn and communicate complex issues to clients, specific learning objectives need to be in place before the multimedia is presented. Research has shown that learning retention is facilitated with an approach that incorporates seeing, hearing, doing, interactivity, and repetition (Mayer 2001; Barrett, Lacey, Sekara, Linden, & Gracely 2004). Multimedia has been found to be at least as effective as traditional instruction, offers greater satisfaction, and has value as an additional learning resource (Maag 2004a; Palmer & Devitt 2007). Group-paced instruction with multimedia decreases costs associated with individual instruction, increases comfort with computers, and improves learning as long as the environment is conducive to group use. Nurse educators need to select and use multimedia well and creatively to realize its benefits (Cuellar 2002; Ross & Tuovinen 2001). Multimedia can be incorporated into formative and summative evaluation as well (Rossignol & Scollin 2001; Hansen 2007b). Virtual reality is a form of multimedia that fully envelops learners in an environment. It is already used to help medical students, surgeons, and other healthcare professionals with procedural skills such as the insertion of urinary catheters and surgical procedures (Go Virtual Medical 2007). Virtual reality offers the next best option to performing the skill on a real person but without any risks to the learner or the client. More research is being conducted in order to determine if a carefully engineered integrated simulator and an i-Pod video for male and female urinary catheter insertion will increase student confidence levels and enhance skill acquisition and retention (Doherty et al., 2007; Hansen et al., 2007c).

Changing technology now makes tailored multimedia presentations feasible via the use of CDs, DVDs, and videoclips on the Web (Calderone 1994; Gleydura et al. 1995; Goodman & Blake 1996; Smith-Stoner & Willer 2003). The tools to produce streaming video are increasingly available. Streaming video can be uploaded to Web pages or course management tools such as Blackboard and WebCT. Streaming video may also be reproduced and distributed on CDs. Video is converted to a digital format for use on the Web or CD. Quality multimedia should reduce labor costs for instructor and participant time, improve overall instructional effectiveness, and foster productivity through user satisfaction and enjoyment. DVD drives are standard equipment on PCs that support CDs as well as DVDs. Multimedia enhances VLE by using the interactivity, information management, and decision-making capabilities of computers (Billings 1994; Cambre & Castner 1993; Goodman & Blake 1996). Skiba (2007) reports that students entering higher education are digital natives who understand multimedia, prefer multimedia, and are comfortable using technology. The aforementioned author suggested that nurse educators think about using "YouTube" in order to transform nursing education. "YouTube is a place for people to engage in new ways with video by sharing, commenting on, and viewing videos" (YouTube Website, 2007).

Authoring tools allow program design to match learning objectives and foster higher cognitive development. Authoring tools are software applications designed to allow persons with little or no programming expertise to create instructional programs. These tools require time for mastery: As many as 50 to 200 hours may be needed to prepare one hour of instruction and work out the program bugs. Educators can exercise creativity in the design of multimedia. It is possible to use slide presentation software to prepare and customize programs for student learning (Batscha 2002; Smith-Stoner & Willer 2003). Slide presentation software is easily learned, is adaptable, allows the insertion of simple programming commands, and is easily revised. It can also be used to house streaming video presentations or narrate audio. Faculty who are comfortable with the various forms of multimedia usually do a better job of integrating it into their instruction for optimal student benefit. Figure 16–1 depicts an online tutorial on arterial blood gases that was developed by a faculty member.

Videoteleconferencing

Videoteleconferencing is the use of computers, audio and video equipment, and high-grade dedicated telephone lines to provide interactive communication between persons at two or more sites. Recent developments make videoteleconferencing capability possible from desktop computers. Teleconferencing
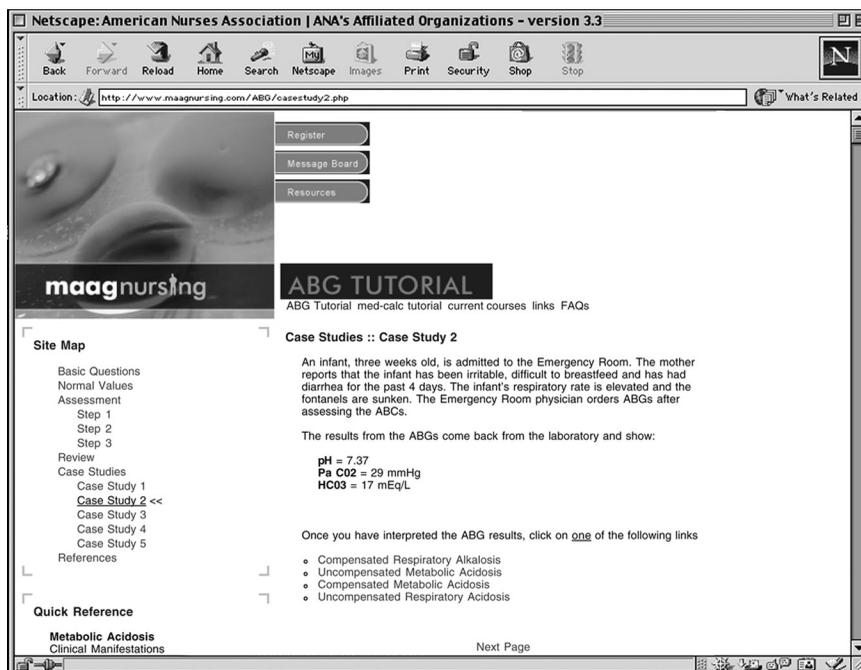
FIGURE 16–1 • An example of online educational offering (Reproduced with the permission of the author Dr. Margaret Maag.)

is particularly useful for graduate and doctoral students and staff nurses because it brings educational opportunities to areas that may not otherwise offer courses or programs. In teleconferencing, learners at one site view and interact with an instructor and other learners at separate locations. Participants can pool resources to establish collaborative programs, thus maximizing resources through shared classes and conferences. Videoteleconferencing requires start-up funds and an investment in equipment, transmission media, and adaptation in communication methods, particularly when used in conjunction with traditional on-site classes. Classes, assignments, and feedback may be offered entirely online. Content may be clinically oriented or focus on nursing informatics. Videoteleconferencing extends the reach of educational programs and continuing education courses by accommodating students who would otherwise be unable to attend programs because of their distance from offered programs. The drawbacks associated with videoteleconferencing are eye contact and appearance self-consciousness. Advanced technology is capable of addressing the problem of eye contact. As people experience more video interaction, their feelings of self-consciousness before a video camera will subside.

Another technology that is free to the public is Skype. Skype is a "peer-to-peer" Internet telephony network that allows individuals to call one another via the computer and communicate via microphone and a video camera. Its popularity is rising around the globe. According to Wikipedia (2007c) there are 240 million users. The program offers instant messaging, file transfer, short messaging, video phone, and videoteleconferencing. Nurse educators may benefit from using Skype as an educational and collaborative tool.

There are some guidelines that educators may wish to consider before embarking on videoconferencing. Broadband is requisite as well as equipment that is easy to use with a cross-platform capability. Individuals may need to collaborate on editing the video that is produced for educational purposes. Some users may be interested in viewing and intereacting with all attendees if it is a small group while others prefer collaborative editing. Still others may prefer still photos as the video portion of the production. The equipment for the videoconferencing should meet standards, and the individual making the video should decide if head or full body shots are desirable. The individual making the video needs to consider how many people are required to control the cameras (distant, local, or both). Participants should be made aware of any other information technology or software that is needed during the videoconferencing or presenation (Erdley 2008).

Distance Education

Distance education is the use of print, audio, video, computer, teleconferencing capability, or the World Wide Web to connect faculty and students who are located at a minimum of two different locations. Print media is inexpensive and low technology and can be developed quickly. Audio conferences may take place over the telephone or via Skype. Video and teleconferencing have been popular in recent years. Video signals may be one-way or two-way transmissions over telephone

lines, cable, satellite, or network connections. Improved Internet capabilities, telephone use, and teleconferencing have virtually eliminated the barriers faced by nurses in remote locations who wish to further their education via formal study or through continuing education programs, or who require additional job training (Corwin 2000; Kozlowski 2002). Distance education may occur in real, or synchronous, time or via a delay. In real time, all parties participate in the activity at the same time; this may include a classroom session or chat. With the delayed, or asynchronous, approach, the learner reviews material at a convenient time, which is generally not at the same time as other participants. Asynchronous learning can be enhanced with the incorporation of ongoing electronic discussion to aid the clarification of ideas, promote retention, and aid critical thinking (Cartwright 2000; Harden 2003). Synchrony influences instructional design, delivery, and interaction. Distance education requires additional course preparation and organization by faculty and a concerted effort on the part of students to remain active participants. The transition from traditional classroom to online learning is not easy. It can, however, be an effective means of instruction.

There is a strong push among institutions of higher learning to offer distance education as a means to improve student access, meet student demands, extend geographic boundaries, remain viable, and keep students on the cutting edge of technology (Bentley, Cook, Davis, Murphy, & Berding 2003; Charp 2003; Cuellar 2002). However, good market research and planning remain key to the success of distance education courses and programs (Wong, Greenhalgh, Russell, Boynton, & Toon 2003). Careful consideration must be given to the market, course objectives, choice of software platform, staff training, design of active learning, quality, technical and administrative issues, finances, and the fit with the overall institution. Distance education has rapidly become an acceptable mode of nursing education, with more than one-half of all schools of nursing surveyed by the American Association of Colleges of Nursing demonstrating some involvement in distance education (Faison 2003; Sapnas et al. 2002). As more institutions and faculty move toward Internet-based distance education, the Institute for Higher Education Policy prepared a report sponsored by the National Education Association and Blackboard Inc., an Internet education company, that identified 24 benchmarks deemed essential to ensure excellence in Internet-based distance education (IHEP 2000). These benchmarks are broken down into seven categories and are summarized here:

Institutional Support Benchmarks
- Documented technology plan that includes security measures such as password protection, encryption, and back-up systems
- Reliable technology delivery system
- Centralized support system for building and maintaining the distance education infrastructure

Course Development Benchmarks
- Guidelines that specify minimum standards for course development, design, and delivery

- Periodic review of instructional materials for compliance with program standards
- Course and program requirements call for students to use analysis, synthesis, and evaluation

Teaching/Learning Benchmarks
- Students interact with faculty and other students as a part of instruction; communication facilitated through voice and/or e-mail
- Timely and constructive faculty feedback to students on questions and assignments
- Instruction on the methods of effective research and evaluation of resources for students

Course Structure Benchmarks
- Counseling for students on online instruction before starting a course or program to determine if they meet the technology and commitment requirements
- Supplemental course materials that address course objectives, concepts, and learning outcomes
- Access for students to sufficient library resources
- Agreement by faculty and students on course expectations

Student Support Benchmarks
- Students receive program information inclusive of admission requirements, tuition and fees, and technical and proctoring requirements
- Hands-on training is provided to help students access electronic databases, interlibrary loans, government archives, news services, and other pertinent resources
- Technical assistance is available at all times
- Student services answer questions accurately and quickly and have a mechanism to handle complaints

Faculty Support Benchmarks
- Technical assistance is available to faculty
- Assistance is available to help faculty make the transition from traditional to online teaching
- Instructor training and assistance, including peer mentoring, are available all through online courses
- Faculty have written guidelines to help students with issues related to the use of electronically accessed data

Evaluation and Assessment Benchmarks
- Evaluation processes use several methods and specific standards to determine educational effectiveness
- Enrollment data, costs, and applications of technology are used to evaluate program effectiveness

- Learning outcomes are regularly reviewed for clarity, utility, and appropriateness
- Faculty must acquire new skills and teaching methodologies for distance education (Geibert 2000; Im & Lee 2003; Kozlowski 2004; McKenna & Samarawickrema 2003)

Communication and flexibility are essential qualities. Students may feel isolated, particularly if they experience difficulties in getting online. For this reason, technical assistance should be readily available for all involved. Faculty are wise to maintain frequent communication with students in order to maintain a feeling of connection. This communication may take place through postings to the class as well as e-mail to an individual or a group of students. Students come to distance education with varying levels of technical skills. Students must be enrolled in the course and the electronic roster for access to the distance education offering. Late course registration, servers that are not working, and poor computer skills can frustrate students. Internet access is necessary for online instruction. Time spent on e-mail may seem excessive but actually frees up time otherwise spent in group meetings addressing concerns (VandeVusse & Hanson 2000). All assignments should be clearly communicated via a well-planned CMS. Course requirements need to stipulate file formats for paper submission. Faculty must realize that students may experience difficulty with firewalls, file transfer, and occasional Internet problems. A sense of community needs to be established by the instructor in order to prevent students' feelings of isolation. Online collaboration may be accomplished via the use of e-mail, videoconferences, online supported group projects, instant messaging, threaded discussions, bulletin board postings, and the use of Web 2.0 applications. Thurmond (2003) stated that interaction opportunities are a core element of online courses. Learners must engage with course content, other learners, the instructor, and technology. Learner-content interaction occurs when students examine content and participate in class activities. Print media is less likely to engage a learner than are hyperlinks, interactive software, and discussions. Reciprocal action aids learning. Learner-to-learner interactions provide an opportunity to share ideas and benefit from the experiences of others. Collaborative projects facilitate this interaction through the creation of a community. Learner-to-instructor interactions occur with prompt feedback and scheduled meetings. Frequent communication through postings, e-mail, and online discussion facilitates this process. Learner-to-interface interaction is facilitated when students are successful in getting online and accessing course materials. Today's Internet savvy student requests automatic "push technology" instead of "pull technology." This entails a change in how course materials are provided. Traditionally faculty expect students to obtain data from the course management system via downloads or "pulling" the information from the CMS. Students now request that educators set up tools that will automatically disseminate (or "push") the information out to them. An example of this "push" technology is iTunes University. Podcasting lectures has become a mainstay over the past few years (Kaplan-Leiserson 2005; Lane 2006; Maag 2006; Malan 2007; Murray & Maag 2006).

Distance education offers many advantages, but it also requires student commitment. Distance learners must assume responsibility for active learning, thus becoming more independent and self-disciplined (Theile 2003). Box 16–2 lists key points for the participant in distance education. Distance education broadens educational opportunities and eliminates long commutes. For this reason it may serve as a recruitment and retention mechanism for schools of nursing and healthcare agencies. It can provide access to experts and cut costs by paying faculty to teach at one site rather than multiple sites. Despite these advantages, distance education often faces budget constraints as well as slow planning and decision making.

The growth of distance education programs has implications for library services as well (Gandhi 2003). Academic libraries must demonstrate the ability to provide equivalent resources and services electronically or through some other means to both on-campus and distance learners to meet accreditation requirements. Some institutions have distance education librarians who work closely with faculty who teach distance education. This may be done through digitizing reserve materials and placing them on electronic reserves accessible only to students enrolled in the course. Restricted access, along with a prominent display of copyright notices on all readings, helps to ensure compliance with copyright and fair use laws. Permission should be obtained from the copyright holder for each item used. Reserve lists must be submitted in sufficient time to allow librarians time to scan materials.

As more schools of nursing move to distance education, there are concerns over the ability to socialize students to the profession. Obviously, this aspect of education requires careful attention in any setting. It is even more critical when there are no regular, face-to-face meetings between faculty and student. Studies

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BOX 16–2 Key Points for Students Involved in Distance Learning

- Reception sites may be in students' homes, workplaces, or recreational areas.
- Increases educational opportunities by eliminating long commutes.
- Class rosters with phone numbers and addresses are generally distributed to all class members (pending individual approval) as a means to encourage interaction among students.
- Faculty may hold office hours online and provide feedback by telephone, electronic posting, Instant Messaging, e-mail, and Skype as well as during class time.
- Students may remain online after class to ask questions.
- The sponsoring agency notifies students of information pertaining to hardware and software requirements, reception sites, parking, and technical support.
- Additional effort is required from both students and faculty to maintain interactive aspects of the education process.
- Some modifications may be required in the use of audiovisual aids. Additional attention must be given to how well audiovisual aids transmit and whether they are visible to persons at other sites.
- Successful offerings are the result of a team effort that involves instructional designers, graphic artists, faculty training, and technical support.

indicate that it can take place in distance education, although additional research into this area is suggested (Faison 2003). Hirumi (2002) noted that technological advances are happening faster than research can keep up with the effectiveness of these advances. There are also issues related to faculty workload, effective class size, and intellectual property rights for electronic courses (Bentley et al. 2003).

Web-Based Instruction

Web-based instruction (WBI) uses the attributes and resources of the World Wide Web, such as hypertext links and multimedia, for educational purposes. WBI may be offered as a stand-alone course or as a complement to traditional classes. Independent WBI provides access to most or all class materials, resources, and interaction via Internet technology. This is in contrast to Web-enhanced courses that rely on physical meetings of students and teachers but integrate assignments, readings, computer-mediated communications, and/or links to sites into the course activities. Some synonyms for WBI include Web-based training (WBT), Web-assisted instruction (WAI), Internet-based training (IBT), Web-based learning (WBL), Web interactive training (WIT), and online courses.

WBI is a popular educational use of computers (Cragg, Edwards, Yue, Xin, & Hui 2003; Cragg, Humbert, & Douchette 2004; Geibert 2000). It shares many of the advantages associated with VLE, such as self-paced learning, 24-hour availability, prompt feedback, and interactivity. Web-based instruction also supports multimedia, a high level of learner interactivity, and hypertext links, which enable learner-centered control over information and learning (Vogt, Kumrow, & Kazlauskas 2001). WBI is free from geographic constraints and can be revised as needed. The Web provides a user-friendly format along with access to multimedia in a fairly consistent manner. Most WBI sites provide basic course information, such as syllabus, schedule, announcements, and reading lists. Many other sites include synchronous or asynchronous communication, online testing, discussion groups, conferences, whiteboards, streaming audio and video, and, in some cases, online help. WBI can be used as a stand-alone course for distance education or as a complement to traditional courses. Teleconferencing capability is sometimes included. There is debate as to whether WBI is actually cost effective when development and support costs are considered. In the case of course materials, printing costs are shifted from the institution to the student.

It is important to consider a number of issues before Web-based instruction is offered (Bruckley 2003; Chen 2003; Choi 2003; Gould III 2003; Rose, Frisby, Hamlin, & Jones 2000; Sakraida & Draus 2003). These include:

- *Institutional commitment of resources.* WBI requires human and material resources. It is labor intensive to develop and manage. It requires administrative support for needed equipment, technical staff, and help for faculty interested in using this medium. Good design requires input from software specialists, service technicians, learning specialists, and possibly psychologists.
- *The technology infrastructure.* Networking and technical support staff should be consulted to determine server and network specifications, technical

standards, bandwidth, and software requirements for Web-based instruction. Requirements to support and receive instruction must be identified.

- *Web course management tools and online peer collaboration tools.* This type of software provides the infrastructure, or shell, for faculty to present content, documents, and media (Kropf 2002; Mills 2000). Common features include tracking, threaded discussions, chat capability, a whiteboard, e-mail, the ability to post information, scheduling capability, templates, the ability to share files, grading components, exam and evaluation capability, and administrative and security features that limit access to authorized users. Some examples include Blackboard, FirstClass, TopClass, LearningSpace, LearnLinc I-Net, and Centra Software's Symposium. Course management tools may be used to supplement traditional instruction or to supplant it. Some course management tools are fairly intuitive while others require a higher learning curve for faculty use. Typically colleges and universities make the software available and provide instruction and support to faculty and students seeking to use it (Sakraida & Draus 2003).
- *Adaptation of course materials and delivery for online instruction.* Successful WBI makes use of the hypertext capabilities of the Web; this includes links to other sites of potential interest. It represents a deviation from traditional class structures and acknowledges that the locus of control for learning lies with the learner. For this reason, activities that require active involvement on the part of the learner such as structured or threaded discussions and group projects are recommended.
- *Faculty commitment.* Web-based instruction is time consuming to create and maintain. Students require more feedback than might be needed in a traditional setting. Faculty must learn the tools and the teaching methodologies and keep materials and links up-to-date.
- *Practice time before the actual start of instruction.* One cannot assume that faculty or students come to Web-based instruction with an intuitive grasp of the technology. For this reason, it is important to practice using the tool before the start of a course. Preparatory tutorials ensure that instructional time is not squandered on technical assistance for a few. Faculty must consider that Web-based courses generally have a slow start because Web-based learning is still a new learning environment for many students. They must exercise patience and ensure that technical support is available until all students demonstrate the basic skills required to navigate the course. Support may be available via orientation sessions, written and online materials, and telephone support.
- *Develop and communicate a contingency plan.* While the advantages of WBI include 24-hour availability from any location, there may be instances when access cannot be accomplished. This may be related to an individual's PC or Internet service provider, power outages, or problems with the organization's infrastructure. It is of particular concern when classes are synchronous. Identify alternative means of communicating assignments early in the class.

Box 16–3 includes a few suggestions for faculty who are developing Web-based instruction or considering its use.

WBI requires time for planning, implementation, and maintenance. Course design needs to incorporate learning activities that encourage collaborative efforts. Faculty and student roles shift with the move from a content-driven or teacher-centered approach to a student-centered approach. Faculty must move

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BOX 16–3   Do's and Don'ts for Teaching a Web-Based Course

Do's

- **Communicate software standards.** Tell students what office productivity software is supported by the school and will be used for shared course files. Even with established software standards there may be instances when the institution and many of the students are in a transition phase between different operating systems and versions of productivity and browser software. Be prepared to save files in the older software version during this phase.
- **Humanize the course.** Encourage students to provide background information about themselves and their goals at the onset of the course. Providing students with a profile of yourself and a current photograph will add a personal touch that the student will appreciate.
- **Post materials prior to class and discussions.** This provides reinforcement and promotes active listening when WBI is used as an adjunct to traditional classes.
- **Provide mechanisms for student feedback.** Use threaded discussions, chats, e-mail, blogs, wikis, tagging, and whiteboard capability.
- **Keep lessons short and modular.** Long documents online do not facilitate learning.
- **Use methods to foster interaction.** Include situations and ask participants to identify how they would respond. Encourage discussion among classmates. Assign group projects suggesting that students use the collaborative work space for real-time efforts or rely on e-mail to develop their work.
- **Incorporate a mechanism to access library resources.** Provide reserve lists to the library well in advance to allow time for signing.
- **Use formative feedback.** This will allow faculty to modify the course as needed to benefit students.
- **Provide information related to resources for technical support.**
- **Be flexible.** Not all students have the same level of computer skills; therefore, provide them with a frequently asked questions (FAQ) printout at the beginning of the course.

    Give students opportunities to check back with the faculty and other students following the completion of the course by providing an alumni event.

Don'ts

- **Don't assume preexisting knowledge.** Provide a tutorial prior to class or as part of the first class to familiarize students with the technology.
- **Don't assume that everyone has the latest versions of software or the fastest processor.** Students who cannot access all documents or portions of the class will become frustrated.
- **Avoid items that take a long time to download.** People will not wait. Large files also place a heavy demand on the server and network.
- **Avoid "plug-ins."** These programs can change the way the user's computer processes tasks as well as place additional demands on the processor.

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into the role of facilitator as they help students to organize information and use critical thinking (Kozlowski 2002). WBI increases access to educational offerings but learners still need access to computers and the Internet and basic computer skills before they enter the workforce. Students will be encouraged to become self-regulated learners as they are given more opportunity to access assignments that are to be "self-learned" online and when they are provided with the necessary expert support throughout the learning experience.

E-learning

E-learning is the delivery of content and stimulation of learning primarily through the use of online telecommunication technologies such as blogs, podcasts, streamed video recorded videos, e-mail, bulletin board systems, electronic whiteboards, inter-relay chat, desktop video conferencing, and the World Wide Web (Hirumi 2002; Maag 2006). It may also occur as the result of a satellite broadcast, audio/video tape, interactive TV, YouTube, and/or CD-ROM. E-learning is often associated with advanced learning technology (ALT), which not only includes the specific technology but also the methodology involved in the learning process associated with e-learning. E-learning offers convenience, flexibility, availability anytime and anywhere there is an Internet connection, and self-paced instruction within a semi-formal environment. As cities around the world become wireless, there will be more of an opportunity for mobile learning opportunities. Imagine students riding a city bus or subway and having access to e-learning via mobile technologies, such as iPods or cellular phones. Another important aspect of e-learning is the ability to network with fellow students who may be anywhere around the globe. However, there have been reports that some students feel isolated in e-learning environments. This feeling of isolation may be ameliorated by giving assignments that foster the use of technologies, such as video-enabled Skype, message boards, whiteboards, and instant messaging that create an interactive environment.

Web 2.0 Applications in Education, Healthcare, and Social Networking

Interactive technological tools that facilitate different forms of online communication, learning, and collaboration among educators, students, and colleagues across international borders are becoming popular in healthcare education and clinical practice. Blogs, podcasts, wikis, and some other Web 2.0 applications that are evolving in healthcare education and clinical practice will be covered herein. While not all of these cutting-edge technologies are mobile per se, many of them are, and as technology advances, common items, such as the ubiquitous cell phone, will become handy learning tools. Therefore, the term *mobile learning*, or *m-learning*, is a popular term that denotes the use of mobile technologies, such as the mobile phone, personal digital assistant (PDA), and iPod. There is grant funding available for healthcare educators who wish to pursue this area of educational research (Cell Phone 2007). An extremely comprehensive explanation of Web 2.0/3.0 is available

for healthcare educators who are interested in technological advances to improve, enhance, and/or stimulate learning for healthcare students, professionals, and patients (Yourdon 2007). Since Web 2.0 is now considered the "read-write-listen" Web, it provides an avenue for users to comment, annotate, create, mix, and share content that is related to health education (Boulos 2007).

Blogs

Weblogs, also known as "blogs," are innovative writing tools that are exciting and intuitive to use, Internet based, and encourage health profession students to write and publish their writing instantaneously. Lewis (2004) reported "blogs" as innovative pedagogical aids for students studying different disciplines, such as medicine, business, and journalism. The Institute of Medicine (2003) recommended that healthcare professionals be taught to use informatics in order to "communicate, manage knowledge, mitigate error, and support decision making using information technology" (p. 46). The use of blogs as social networking and professional collaborating tools is evident on the Internet (Erdley, Murray, Hansen, Oyri, Ward, & Perry 2007; Ward 2007). Blood (2000) wrote about the culture, theory, and creation of weblogs, and discussed the change of the nomenclature from "wee-blog," initially proposed by Peter Merholz. Maag (2004b) described a "blogger toolbox" as containing software programs that are free to use on the Internet and are based on Real Simple Syndication (RSS). Yensen (2005) explained RSS and how this feed to the World Wide Web fuels frequently updated content in order for individuals to access information on blogs, podcasts, and latest news headlines Some of the blogging tools include, but are not limited to, *Blogger, Moveable Type, Haloscan, Typepad, Slash,* and *now.Mac.* Maag (2004b) provided a step-by-step method of creating a blog and gave various examples of how blogs may be utilized in healthcare education and clinical settings (see Appendix). A blog is generally edited, organized, and published using a Content Management System (CMS), many of which are built with Linux/Apache/MySQL/PHP architecture (Murray & Maag 2006). Moreover, there are various applications available that link posts from different blogs containing similar subject matter, using either permalinks or tags, such as Technorati tags (2007).

Clinical educators may encourage healthcare students to blog about their clinical experiences. This Web 2.0 application is ideal for this aspect of education because it is convenient for students, and educators may respond online to the students' experience in a timely fashion via the "comment" component of the blog. Clinical blogs may be easily password protected in order to prevent inadvertent disclosure of a patient's identity via a blog. Educators need to keep in mind the Family Education Rights and Privacy Act (FERPA) in order to respect and protect students' privacy. An anonymous posting or a pseudonym may be used by the student blogger. Clinical cases and images may be delivered automatically via RSS and viewed on iGoogle. This free program offered by Google allows the user to create his or her own private Web page and allows for YouTube videos to be selected and viewed. The user may add RSS feeds as tabs, such as medical journals,

medical podcasts, updates in hospital medicine, and healthcare informatics for daily updates. Educators could ask healthcare students to create their own iGoogle pages as an online assignment; this would provide the student and educator with a gateway to current healthcare information. It is easy to create an iGoogle page, and the user may use creativity and create "widgets" to add to his or her personal Web page. An example of a self-created widget is seen as "The hi-blogs.info krew" (http://www.differance-engine.net/krew/); widgets may be shared with colleagues and peers. All that is needed is a free Google e-mail account in order to create an iGoogle home page. Another interesting example of a healthcare blog that examines Web 2.0 applications in healthcare is the "Constructive Medicine: Bench side to Bed side 2.0" (2007). Improved patient care may be achieved through the collaboration of healthcare professionals, sharing of knowledge, and active discussion via Internet-based platforms, such as blogs, podcasts, vodcasts (video-enhanced podcasts), and dynamic wikis.

Students who blog their clinical experiences have been known to increase their writing over time, interact with the instructor and peers more readily, and share experiences as the semester progresses. Students' writing has been observed to improve over the course of the semester. In order to make the clinical assignment more interactive, students may be asked to comment on a peer's blog each week; this, in turn, enhances communication and support of the student who is blogging. Software applications, such as Blogger, have a comment button that may be activated by the reader of the blog. Furthermore, students may create an audio blog (PodBean 2007), and this may prove to be convenient for the student following a long clinical day. Moreover, a school of nursing blog may spark students' interests in posting their artwork, poetry, and other creative musings. Healthcare providers may encourage their patients to blog about their medical experiences, thereby allowing patients to share with others their challenges and experiences, and to offer support to others who are newly diagnosed with a similar disease process. Another popular use of blogs is by universities who wish to showcase students' ideas about their experiences in a specific field of study. An example of this is the University of Michigan School of Medicine blog (2007).

Podcasts

Podcasting, a portmanteau of "broadcasting" and the popular "iPod" (Apple Computer's MP3 player), is another example of an Internet-based technology that allows for an audio event, conversation, lecture, presentation, speech, group-learning occurrence, video, or a song to be distributed via RSS. The beauty of a podcast is that it may be listened to via a desktop computer or from a MP3 player via free podcasting software, such as Apple iTunes or iPodder. An enhanced podcast involves the creation of text, chapters, images, and/or video. Educators have the ability to create enhanced podcasts by using software packages, such as Podcast Maker or Apple iLife07. The audio, text, and video components provide many creative opportunities for truly "any time, anywhere" distance education. As more cities around the globe become wireless, learners will be able to access podcasts, YouTube videos, and blogs with great ease in a car, train, bus, or subway.

Jeiesiewicz (2007) reported that iPods help facilitate stethoscope skills among medical students at Temple University School of Medicine and Hospital. Listening repeatedly (400 times) to five common heart murmurs via iPods improved students' heart sound identification by 80%. Medical students studying at the University of Michigan have the opportunity to listen and view lecture and exam video podcasts (2007). These are examples of how this mobile technology may assist with education and with the healthcare of patients. Malan (2007) reported that 45% of students attending Harvard University stated that a lecture podcast was used for "review" rather than as an alternative to attendance (18%). Furthermore, Malan stated that 71% of the students in the study were more inclined to listen to or watch lectures on their desktop computers, versus 19% of the participants relying on audio-only or 10% on video iPods. Maag (2006) examined podcasting and MP3 technology in nursing education by providing portability for listening to lectures (iTunes "Maag" Podcasts 2007), training more clinicians, and using podcasts to reach the public at large. Many universities are subscribing to iTunes University, therefore, making it easier for educators to make their lectures, presentations, and students' work available on the Internet. Maag (2006) provided a step-wise instruction on how to create a podcast. The technical components and interactions of podcasting are presented by Carnegie Mellon's teaching with technology white paper (2007). The authors of the white paper set out to evidence the "creation and distribution of lecture archives for review, the delivery of supplemental educational materials and content, and assignments requiring students to produce and submit their own podcasts" (2007, p.1). Educating the Net Generation requires educators to know and understand their audience prior to developing learning objectives and the delivery of educational materials. A new wave of learning and flexibility is available to our learners; students need not be anchored to desktops in computer labs. Palmer and Devitt (2007) demonstrate how case studies and anatomical images, such as a view of a patient's retina as seen via an ophthalmoscope, may be accessed via an iPod for clinical learning. Also, from a clinical standpoint, an iPod video may be just the prescription for an anxious patient awaiting surgery. The patient may view nature scenes and listen to relaxing music, guided imagery, or meditative audio via an iPod video.

Wikis

Web pages may now be created by individual users via dynamic "wikis." The well-known Wikipedia (2007), an online editable encyclopedia, is an example of such a Web page. A wiki, which actually means "quick" in Hawaiian, allows anyone visiting the Website to create, update, or change content at one's whim. This asynchronous group socialization tool provides a place for communication, collaboration, and archiving various writings and information. Another form of a wiki is Google Docs. This enhanced wiki is a technological application that is affecting education and professional development. It allows anyone to compose online (write and edit) as an electronic word processor, allowing collaboration with others in real time. As with the iGoogle page, Google Docs is free to Google mail (Gmail) users.

Wiki software programs, such as Wiki Media, (2007), are intuitive and easy to use. However, the important question to first ask is "why" am I creating a wiki or implementing any of these other tools? A specific purpose (such as a subject matter) should be kept in mind, and the user may consider how many people will be involved in the project and use/contribute to the interactive page. Another important issue is to decide how much of the content will be made public or kept private. Free guides for installing the wiki program are available at Free Software Daily (2007). Furthermore, Wikipedia (2007b) offered a nice table comparing various wiki software programs for those interested in comparing and contrasting various programs before constructing a wiki. Oyri (2007) shares a wiki project, "Biomedical Wireless Sensor Network Project," that demonstrates a wiki created by using TikiWiki. There are concerns regarding the "piracy" of wikis, since anyone who has access can change information on the Web page and potentially corrupt the validity of the information provided to the public. Hence, some instructors do not accept students citing Wikipedia in their assigned papers. Nonetheless, Wikipedia is being referenced more often by well-known authors. The validity of the information may be double-checked with a follow-up reference and then added to the wiki for future use by others.

VIRTUAL LEARNING ENVIRONMENTS

Educational applications of computers adapt well to a diversity of settings and learners. The very flexibility of the educational application of computer technology makes it suitable for use in formal healthcare education programs, as well as continuing education and consumer education.

Formal Healthcare Education

Advocates of computer-enhanced education note that its applications in healthcare are limited only by imagination (Bloom & Hough 2003; Charp 2003; Greco & O'Connor 2000). Critics of e-learning claim that computers and the Internet only promise to revolutionize the way that nursing content is delivered not the overall methodology. As instruction moves away from the traditional classroom lecture and clinical instruction to modalities that better accommodate the learning needs of individual students, the development of critical thinking skills and skills needed in the workplace are fostered (Bentley et al. 2003; Choi 2003; Cragg et al. 2003). The activities that can accomplish this may include simulations, virtual reality, VLE as a supplement to classroom instruction, slide presentations, Internet searches, collaborative learning, computerized testing, and the availability of reference materials online and on Personal Digital Assistants (PDAs) (Bloom & Hough 2003; Myles 2000). IBM (2007) recently released a three-dimensional (3D) anatomic and symbolic mapper engine that provides physicians with the ability to interact with medical data as they would with a human being. The interactive 3D software program allows healthcare students to get under simulated skin to view the cardiovascular and muscular systems. Furthermore, a physician or student clicks on the anatomical part the patient is complaining about, such as pain in the elbow, and all of the

patient's important medical records (such as lab reports, body scans, and x-ray results) regarding the body part are displayed on the screen for immediate review. This software program is like an electronic health record (EHR) with interactive 3D images of the human body. These activities may replace, or supplement, the traditional lecture format, which supports passive rather than active learning. Institutions are also responding to consumer demands for new models and methods for instructional delivery. Computer-enhanced communication and education may increase student access to experts and educational programs through the removal of geographical boundaries. The inclusion of computers in education is vital to the development of basic computer skills needed in the workplace. Many programs suggest, and some require, that students purchase and use PDAs in the classroom and clinical settings to access reference materials and take notes. Computers are used in the clinical setting to document client care on hospital information systems. As a result of this expanding use of computers, most nursing programs have institutional academic computer plans, policies, and facilities. This reflects expectations that nursing graduates possess basic computer literacy skills (AACN 1998; ANA 2001). Nursing education programs are a logical place to introduce or expand basic computer skills such as word processing, Internet access, e-mail, electronic searches, and spreadsheet and database applications. These computer literacy skills are important in the everyday workplace, as they serve to increase access to information, facilitate the teaching/learning process, decrease anxiety associated with computer use, and enhance job skills. Basic computer literacy provides a framework for the development of another skill set expected of new graduates, namely rudimentary information management. For these reasons, basic nursing programs require that students take an introductory computer course, and an increasing number require an introduction to a nursing informatics course.

While in school, many nursing students are exposed to the Health Education Systems, Incorporated (HESI) exit exams and the National Council Licensure Examination for Registered Nurses (NCLEX-RN) review programs. The HESI exams serve as a predictor of NCLEX performance. Exposure to these examinations is important because all nurses in the United States take their licensure examination via computer. The NCLEX-RN examination uses computer adaptive testing (CAT) with the goal of determining candidate ability based on the difficulty of questions answered correctly, not the number answered correctly (NCSBN 2008; Wendt 2003). When a question is missed, the candidate is given an easier item to answer. If the candidate is able to answer the easier item correctly, the next item is more difficult. The NCLEX-RN uses an established minimum number of questions that must be answered but the total number of questions will vary by candidate. CAT offers several advantages over paper-and-pencil examinations. It saves time by matching items to individual ability, examinations are tailored to the individual, results may be available immediately, and it supports a variety of different reports (Latu & Chapman 2002; Van Horn 2003). NCLEX-RN preparation programs vary in quality, ranging from simple drill and practice to those that provide rationale for answers. An example of an NCLEX-RN educational endeavor is the weekly NCLEX question that is available to students online

BOX 16–4   Features to Look for in NCLEX-RN Preparation Programs

- Clearly defined system requirements such as types of computer, operating system, memory requirements, and any special software needed such as a media player
- Ease of use
- Feedback for answers. For example, does it provide rationale for answers and scores?
- Screen design and keyboard use that simulates the NCLEX-RN
- High quality and clear questions
- Random generation of questions similar to the NCLEX-RN
- A match between the preparation program content and NCLEX-RN examination content
- A bookmark feature that allows students to exit the program and return to the same spot later
- Clear instructions
- Adequate technical support
- System requirements such as type of computer and memory requirements

(Kaplan Nursing 2007). Educators and nursing students need to be discriminating consumers. One question to consider is the approach and intended purpose of the program. For example, some provide a means to decrease anxiety over the NCLEX-RN examination through practice under similar conditions. They may also attempt to simulate the examination experience. Other programs claim to predict student success on the NCLEX-RN examination. Box 16–4 lists some criteria to consider when selecting NCLEX-RN preparation software.

The benefits associated with computer-supported learning have led to an increased availability of courses and educational software related to nursing and healthcare topics. It is important to evaluate the quality of these applications and to use them in an effective manner. The nurse educator is responsible for evaluating the merits of available tools prior to their implementation. It is not necessary to be a software expert to do this. Faculty should use the same criteria to evaluate computer uses in education that they apply to any other instructional medium. Box 16–5 lists criteria that may be used to evaluate the quality of instructional software.

Administrative computer applications improve record keeping for program attendance, performance, and evaluation and can save time for the construction,

BOX 16–5   Evaluation Criteria for Instructional Software

- Does it support the overall course objectives?
- Is the material presented clearly?
- Is content accurate?
- What is the quality of the design? Does it maintain learner interest and provide the ability to customize learning to individual needs?
- Is information presented in a logical order?
- Does it provide appropriate and immediate feedback?
- Does it make good use of graphics, design, and multimedia?

administration, and scoring and statistical analysis of test results. Although most evaluative tools focus on testing, computers and PDAs lend themselves nicely to notes and anecdotal accounts of clinical learning, which can be used to evaluate individuals and the quality of specific learning experiences as well as support curriculum changes (Meyer, Sedlmeyer, Carlson, & Modlin 2003). An increasing number of faculty are turning toward software applications and technology to make the clinical evaluation process less arduous. In some cases, Web-based tools accept input from both faculty and students, tabulating results and providing information for curriculum decisions.

Hospital Information Systems (HIS) Connectivity with real hospital information systems (HIS) is another important use of computers in nursing education. The incorporation of hospital and nursing information systems into nursing school curricula promotes professional socialization, helps students see the effects of their decision making with care plans or maps, and decreases orientation time for new graduates. Computer-generated care plans or maps allow students to devote more time to the analysis of data, rather than to the writing of care plans, and allow staff more time to mentor students. This use of information systems ensures that graduates have exposure to computers and that they possess marketable job skills, and helps students to see the whole clinical picture. Students may receive live training sessions in system use by faculty or by hospital-based trainers or use computer-based training (CBT). Training may occur at the school or healthcare facility. Students can retrieve information for use in preparing for client assignments, but should not be able to make changes or add information to the actual client record from remote sites.

Access to hospital information systems as a learning tool in schools of nursing offers the following benefits (Doorley, Renner, & Corron 1994; Kennedy 2003; Poirrier, Wills, Broussard, & Payne 1996):

- Provides time to analyze clinical information
- Provides the student with adequate time to compose care plans or review critical pathways
- Allows students to review their plans with faculty or hospital nursing staff prior to entry into the system
- Increases students' knowledge and proficiency when they enter the actual clinical setting

HIS connectivity may be provided at schools of nursing. This requires negotiation with the vendor for permission. Other considerations include increased demands upon the information system and concerns related to confidentiality of client information. HIS connectivity allows students to be more familiar with their assigned clients and poses fewer interruptions for staff from students requesting information. HIS connectivity provides students with the opportunity to retrieve diagnostic results, vital signs, admission assessment data, and nursing documentation for review prior to their assigned clinical hours. Incorporation of hospital and nursing information systems at schools

of nursing also facilitates role transition from student to graduate nurse, makes graduates more attractive to prospective employers, and allows hospitals to cut orientation time for graduates with prior HIS training.

Continuing Education

Nationwide budget cuts caused many institutions and employers to reduce or eliminate continuing education program offerings provided by traditional classes, conferences, and workshops. There is now an increased reliance on outside agencies and technology to meet this need. The traditional approach to this problem has been home study offered through professional journals and organizations. Readers review articles, answer related questions, send in their test form and fee, and wait to find out whether they received credit. The journal approach offers little, if any, interaction with peers. Mandatory education requirements such as fire safety were often met through the review of video or paper self-learning modules. Another approach is the use of the Internet for continuing education courses. This approach offers several benefits. It is available without a subscription 24 hours a day to a large population. Furthermore, it can provide instant feedback and highly individualized instruction, since the incorporation of links allows users to skip familiar content or seek additional information as required. It allows staff to attend mandatory programs at convenient times without interruption to client services and decreases expenses for travel between sites and instructor hours (Harrington & Walker 2003). Internet continuing education programs may be found through professional publications and organizations, as well as Web searches. Unfortunately, this option requires access to a computer.

Computers can also be used for administrative support of continuing education (Cragg et al. 2004). For example, computerized records can be searched rapidly to determine if and when a particular student attended a program, such as fire safety or cardiopulmonary resuscitation (CPR). It is also possible to administer and score proficiency examinations and evaluation tools. Other tracking features can show individuals who started, but did not complete, an educational unit or the number of attempts needed to achieve successful completion. Improved records also help to determine program costs and demonstrate staff development or continuing education staff productivity.

E-learning has been suggested as an alternative delivery method for mandatory educational programs as well as other programs that provide employees with opportunities to improve or maintain skill sets (Hequet 2004; Hirumi 2002; Joch 2003). The rationale for this approach is that e-learning allows employees to learn at their own pace and skip material that they already know. There are no costs associated with travel, lodging, or meals. It also helps to meet deadlines for mandatory education programs. Training is available upon demand, and course materials and tests are online. Institutions using e-learning to meet mandatory educational programs should choose a product that easily allows customization, as regulations change and programs need to be revised. In addition, e-learning can support synchronous or asynchronous communications, but asynchronous

communications are more common and are often mediated by technology. Appraisal of the effectiveness of e-learning may be done through participant evaluation as well as a review of technical support logs.

Client Education

Although many computer applications directly benefit nurses and other healthcare professionals, consumers derive much of their healthcare information from the Internet, educational software, and e-mail. Some sites allow consumers to pose questions and then provide an answer within 24 hours. Home pages on the World Wide Web provide information on a variety of topics, including preparation for diagnostic tests. They may even show video clips of medical-surgical procedures. Web-based client education materials must be designed with the following factors in mind: purpose, target population, expected clinical and learning outcomes, educational framework, design principles, and ongoing site evaluation for readability and ease of navigation (Smith, Cha, Puno, Magee, Bingham, & Van Gorp 2002). Effective instructional Websites should also incorporate different learning modalities (Vogt et al. 2001). Client education materials and discharge instructions can be generated by hospital information systems as well.

An example of this application may be seen with a client who had heart bypass surgery. Instructions should include the following: when to schedule a follow-up visit with the cardiac surgeon and the primary physician, wound care, signs or symptoms that should be reported to the physician, and discharge medications. Computer generation of discharge instructions can tailor instructions to the individual client and the physician authorizing the discharge, and offers the following advantages:

- Consistent instruction despite the fact that different nurses provide teaching
- Improved quality and detail
- Speed
- Clarity and legibility
- Eliminates repetition so nurses no longer need to write the same instructions over and over again.
- Compliance with physician recommendations.
- Provides individualized, printed discharge teaching instructions with the capability to incorporate evidence-based guidelines

ISSUES RELATED TO COMPUTER-ENHANCED EDUCATION

The mere presence and use of computers for education do not ensure successful learning. Consideration of the following factors and guidelines will enhance the effectiveness of using computers for education:

- *Institutional planning.* Computer-enhanced education must be a part of an overall plan that makes provisions for infrastructure, as well as financial and technical support.

- *Hardware and software must be accessible.* This includes technical support, servers, and all software that the learner is expected to use. Problems with access and poor service immediately set a negative tone.
- *User comfort with the technology.* Not all learners are familiar with computers or know how to use them. This lack of knowledge and skills may lead to anxiety. For this reason, computer literacy should be a prerequisite, and a basic introduction to computers should be provided to faculty and students before the introduction of any new technology. Short, highly interactive training sessions that cover small amounts of information at one time are recommended. Once the learner is comfortable with the technology, other learning needs can be met (Chen 2003; Scollin 2001).
- *Opportunities to ask about material not understood.* Although the computer is an invaluable instructional aid, the ability to question and discuss information presented must also be available.
- *Instruction is well designed and well matched to course objectives.* High-quality Web-based instruction and computer programs for education must maintain learner interest and provide the appropriate information (Bloom & Hough 2003).
- *Evaluation criteria are identified to monitor the effectiveness of the computer as a tool.* These may include increased use of e-mail, increased job satisfaction, and improved student achievement. Online course evaluations may also be used.

There are a number of issues that must be addressed for faculty who are either interested in developing online courses and other means of computer-enhanced instruction, or who feel that they are under pressure from their respective institutions to teach online courses. These issues include:

- *Faculty workload, or hours, for the development and presentation of computer-enhanced instruction.* Administrative support of faculty who develop and present online courses, computer tutorials, and other applications that support education should include release time and/or financial rewards.
- *Promotion and tenure policies.* The design, development, and ongoing support of computer-enhanced or online instruction are time-consuming and labor-intensive. However, this time-intensive work is recognized by today's students, who expect technology to be woven throughout their educational experiences. Therefore, students will evaluate faculty accordingly, and perhaps positive teaching evaluations will have a direct effect on promotion in rank and tenure. As more institutions adopt computer-enhanced instruction this area is being considered by peer-review committees.
- *Intellectual ownership.* Many faculty remain unclear on questions of intellectual ownership for computer-enhanced learning activities and online courses that they develop or materials that they post online as part of a course. Institutional policy needs to address this. Most faculty feel that they "own" a course that they developed and that no one else should be given that course to teach without their permission. Typically, however, this attitude conflicts with the policies of the organization.

EDUCATIONAL OPPORTUNITIES IN NURSING INFORMATICS

Until recent years, the opportunities for nurses and other healthcare professionals to learn more about informatics were largely limited to programs sponsored by special-interest groups. Only a handful of undergraduate and graduate nursing programs offered introductory nursing informatics courses. This situation is changing rapidly now as nursing informatics has become a popular topic. An increasing number of schools offer a graduate degree or a certificate with a nursing informatics focus. Some of these programs use distance or Web-based education, while others use the traditional classroom setting. Doctoral programs are still limited. There are also a number of programs with a focus on health information management or health informatics.

FUTURE DIRECTIONS

All forms of education will continue to evolve as more is understood about individual learners, their learning styles, and desired outcome behaviors. Technology will continue to support and enhance learning in ways that can scarcely be imagined at the present time, making learning more convenient anywhere, anytime. Simulation provides the means to foster learning in an environment that is safe for the student as well as the healthcare consumer. It is particularly useful for experiences that are difficult to provide for all students. As technology continues to become more pervasive throughout society it will also become more available and easier to use, affording yet more educational opportunities.

CASE STUDY EXERCISES

16.1 Locate and evaluate at least one online continuing education offering.
16.2 You are on the education committee at your small community hospital. Your staff development department was eliminated several years ago. You and your colleagues are charged with developing strategies to meet the educational needs of agency registered and licensed practical nurses. Limited capital and the isolated location of your community make this a difficult assignment. Your institution does have Internet and World Wide Web access in the medical library, as well as teleconferencing capability. Develop a proposal to meet your charge using available resources. Be prepared to defend your proposal to an administration loathe to part with monies beyond those already budgeted.
16.3 You are the client educator at a medical center in the Pacific Northwest. Your clientele are drawn from a 150-mile radius and beyond. It is difficult to have clients complete diabetic education or other classes. You have been told to improve client completion of classes or face elimination of your department. The medical center has both teleconferencing capability, presently used for consults, and an established Web page that

provides basic information about the institution. How might you use these resources to develop alternative strategies for client education? Address budget considerations, necessary resources, target populations that might be better served, and how you propose to link distant clients with instructional offerings.

16.4   You recently joined the faculty at a small, private rural college. Because you express an interest in computers and are slightly more knowledgeable about computers than are your faculty colleagues, you have been asked to establish online sites for all of the traditionally taught courses to post the course syllabi, announcements, handouts, and other relevant course materials as a mechanism to facilitate learning. Your institution already owns a course management system. How would you proceed? What, if any, additional applications might you consider when working on this project?

MediaLink

Additional resources for this content can be found on the Companion Website at www.prenhall.com/hebda. Click on "Chapter 16" to select the activities for this chapter.

- Glossary
- Multiple Choice
- Discussion Points
- Case Studies
- MediaLink Application
- MediaLink

SUMMARY

- Computer technology can help revolutionize education in formal health-care programs, continuing education, and consumer education. It also provides informal opportunities for networking among professionals via e-mail, and social networking systems, such as wikis, blogs, and podcasts.
- Successful use of computers for education requires careful planning, specific learning objectives, orientation to the technology, convenient access, opportunities to question what is not understood, instructional design, and sound evaluation of learning outcomes.
- Formal nursing education is a logical place to introduce or expand basic computer skills, such as word processing, Internet access, e-mail, online literature searches, and use of Web 2.0 applications.
- Educational software should be subject to the same review criteria applied to other instructional materials before their adoption and following student use.
- Computer instruction should clearly match curriculum level and objectives.
- NCLEX-RN preparation programs and HESI exit exams are a popular use of computerized test programs in basic nursing programs.
- Connectivity to hospital information systems from schools of nursing allows students more opportunity to analyze client information before scheduled clinical experiences and facilitates professional socialization.

- Computers provide invaluable assistance in the preparation of educational materials and presentations, the delivery of instruction, examinations and evaluations, and the maintenance of educational records.
- Virtual Learning Environments are examples of the use of a computer to teach a subject other than computing. A VLE offers the following advantages: convenience, decreased learning time, and increased retention.
- Teleconferencing is the use of computers, audio and video equipment, and high-grade dedicated telephone lines, cable, or satellite connections to provide interactive communication between 2 or more persons at 2 or more sites. It may occur via desktop computers or via larger systems with multiple persons participating at one time.
- Distance education is the use of print, audio, video, computer, or teleconferencing ability to connect faculty and students located at a minimum of 2 different sites. Distance education may take place in real time or on a delayed basis. It expands educational opportunities without the need for a long commute.
- Web-based instruction uses the attributes and resources of the Internet to deliver and support education. It may be used as a stand-alone course or to supplement traditional classes.
- E-learning uses electronic media to present instruction. It is often suggested for corporate training because it is considered to be efficient. It allows users to skip material that they already know.
- Multimedia refers to the ability to deliver presentations that combine text, voice or sound, images, and video. Multimedia presentations tend to improve learning by actively engaging the senses.
- Educational opportunities in nursing informatics range from the informal to the formal. There are numerous introductory courses on undergraduate and graduate levels. Some institutions offer areas of specialization within a degree on the graduate level or certificate programs. Opportunities for doctoral work in nursing informatics are limited.

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Personal Digital Assistants 💬

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INTRODUCTION

Personal digital assistants, or PDAs, have gained appeal due to their small size. Usually designed to fit in a pocket, PDAs are easily portable and have impressive performance capabilities that allow you to store, access, and organize information such as calendar entries, documents, spreadsheets, databases, notes, and to-do lists. Your capabilities and access are limited by the processing speed and memory; the faster and more robust the memory capabilities are, the bigger the price tag. If you are considering purchasing a PDA, it is important that you reflect on your current and future needs. You want to be able to expand your capabilities as needed without having to replace your PDA. Therefore, it is important to review all of the PDAs available (c|net 2008a; c|net 2008b; Softpedia 2007a; Softpedia 2007b).

Most of today's PDAs use Linux, PocketPC (Windows), or PalmOS (Palm) operating systems. Since PDAs can be used in networked environments, including wireless configurations, they can theoretically give the clinician constant access to patient information, colleagues, and other necessary resources.

The applications provide a wide range of functionality, from simple to highly complicated software tools. You can take dictation, practice telenursing, and access dosage calculators, drug and specialty databases, educational applications, and clinical forecasting tools—all from your PDA. Since the PDA is compact and you use a stylus or scroll bars to manage your information, there are many add-ons available to enhance functionality as well as ease of use in inputting, accessing, and output.

HOW TO USE A PDA

The PDA could have the following equipment: a display/touch screen, IR (infrared) port, USB connector, SD slot (secure digital memory), clock icon, menu icon, sync icon, find icon, web browser button, navigator button or pad, calendar icon, home icon, contacts icon, scroll button/bar, headphone jack, internal Bluetooth, internal Wi-Fi, speaker, multi-connector, reset button, stylus, microphone, and/or cell phone capabilities. Examine a PDA at a vendor or online at Softpedia (2007c). The configuration of the PDA will affect its performance and your ability to use it. The navigation buttons and scroll functions allow you to see, access, and open applications, files, and documents. Depending on the PDA you choose, how you input your data and commands will vary. There are handwriting and voice recognition capabilities available but typically you will use a blending of a plastic

stylus, touch screen, and handwriting recognition software. The handwriting software that recognizes the characters you write and transfers them to letters and numbers is Graffiti on Palms and Block Recognizer for Pocket PCs. The Transcriber software used on the Pocket PC will recognize legible normal handwriting, printing, or a combination of both; thus, you do not have to remember the character codes for the letters and numbers. You can also type in your input using the soft keyboard, a small keyboard on the screen, or add-ons such as a small or full size peripheral keyboard using a Bluetooth or USB connection.

Almost all of the current PDAs come with an expansion slot enabling you to increase your memory or storage space. Secure Digital (SD) is a common type of card that provides inexpensive additional memory. If you are thinking about purchasing a PDA, an expansion slot is a must-have item in today's environment.

Most PDAs come with office applications, sync software, Bluetooth, cables, and an IR port. The office applications could include word processing, spreadsheets, database, and/or presentation software. The sync software is short for "synchronize" and functions to match and update information on both your computer and PDA. Bluetooth is a form of wireless connection that is commonly used in cell phones; although it usually does not provide Internet access, it does facilitate file transfer between your PDA and a computer. You can purchase an adaptor if you have a PDA without Bluetooth. Cables are an inexpensive way to connect to a computer. You essentially plug the PDA into your computer. The downside is that you must be near the computer in order to connect. The IR beams of light are used as a unidirectional means to wirelessly transfer select data or entire programs to other PDAs. The data and information are not exchanged or traded but rather transferred in one direction. If you had something that was needed in hard copy, you could also beam a document to an IR enabled printer. People most commonly beam their business cards. For example, if you are at a career fair or conference visiting exhibitor booths, you could beam your business card into a vendor's PDA. The quest to beam across platforms would require additional software.

As PDAs continue to evolve, so do their capabilities and connectivity. The Internet connectivity (Web browser and e-mail) provides the clinician with communication capabilities and constant access to real time online data and information. Since the PDA is portable, your connectivity must be ready whenever and wherever you need it. One way to establish connectivity is through the use of Wi-Fi. The Wi-Fi compatibility provides for use at hotspots throughout the country, such as coffee shops, hotels, restaurants, universities, and other sites. It can also use your existing wireless network in your agency or office. You can add this feature to a PDA by purchasing a Wi-Fi adaptor.

Some cell phones, called smartphones, have limited PDA capabilities, and some PDAs are phone enabled. Smartphones have limited PC functionality; they have an operating system and facilitate the use of e-mail and other applications. The addition of the phone features could be an important consideration based on your practice setting.

APPLICATIONS

As nurses, there are tremendous advantages to using a PDA. They can be used to track patients, as Point of Care (POC) devices, or as calculators. The PDA could take your dictation at the bedside or on the go as you travel between patients. As reference tools, PDAs can provide ready access to clinical and/or drug databases; electronic textbooks and reference materials; online journals in real-time, such as the Online Journal of Nursing Informatics (OJNI) and MEDLINE; educational tools such as study guides; and care planning documents (Skyscape, n.d.; Dykes Library, 2008: PDA Cortex, n.d.). You can transfer information within your network even when you are in the field, such as sending a note to a case manager, updating a physician on the status of a patient you visited in her home, or sending a prescription to the pharmacy. The PDA allows you to maintain your calendar or schedule and receive reminder alarms. You can even use your PDA for professional development such as continuing education offerings or furthering your academic education online. Get involved and participate in the online group that discusses PDA use in nursing at http://www.rnpalm.com/nursing_pdas_listserv.htm.

As a nursing student, the reference materials and podcasts available for your coursework could be stored on your PDA for easy access. You could upload and download clinical documents and information with your instructor and clinical setting staff.

The PDA can enhance the healthcare for patients as well. We can monitor our patients and send surveys and questionnaires; patients can submit their responses to us as their healthcare provider or to the healthcare institution. The PDA can enhance their access to their clinicians, especially if the patient is mobile; the PDA can go where the patients go and they can keep in touch via e-mail, phone, Fax, and instant or text messaging. Patients can maintain their appointment and medication schedule as well as receive patient education materials and access clinician-recommended Websites/Listservs.

We have certainly not included an exhaustive list of PDA applications or equipment, and the current will be the past by the time this is in print. PDAs continue to evolve and become smaller and more robust (About.com n.d.; Seko 2005; Softpedia 2007a; Softpedia 2007b). As this future continues to unfold, so will our uses for PDAs in nursing.

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