

## THE USE OF COMPUTERS IN NURSING EDUCATION, PRACTICE AND ADMINISTRATION

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Computers are increasingly being used in an ever wider variety of educational settings. Their use is particularly applicable in nursing education for a number of reasons. One is the capability of provided clinical simulations, which closely approximate the clinical experience, yet provide a controlled environment. The learner has the opportunity to become a primary care provider who can incorporate previously learned concepts, procedures and principles in a unique situation where error can occur without harm to clients.

Another strength of computer-based instruction in nursing becomes apparent when one considers the variety of students in nursing. Currently, nurses are prepared on three different levels; diploma, associate and baccalaureate. The majority are prepared below the baccalaureate level, but many wish to continue their education. In addition, many Licensed Practical Nurses and Nurses Aides return to school to become Registered Nurses. Therefore, students in baccalaureate programs usually enter with a variety of behaviors, knowledge and backgrounds. Computer-based instruction can be used to individualize instruction, making education more meaningful and efficient for these students.

A third reason that computers are enjoying increasing acceptance in nursing education is to prepare the student for future use of the computer as a tool in nursing. Increasing numbers of health care facilities are utilizing computers in patient care management and in record keeping. It is, therefore, becoming imperative for the future nurse to be computer literate to function effectively in tomorrow's health care system.

The purpose of this paper is to review and summarize how computers are currently being used in nursing education, practice and administration.

### NURSING EDUCATION

Computers as a basic tool for education have been available for about 35 years. Health education, however, has made very little use of this tool. In a survey by Gold and Duncan [1] questionnaires were sent to 179 schools with health education programs. Of the 95 responses, 61% made no use of computers, 6.3% used CAI and only 4.2% used computer simulations.

The potential applications of computers in health education is unlimited, both as a motivational device and as a device for allowing the student to apply knowledge to hypothetical problems (simulations).

The first use of computer-based education in nursing reported in the literature, began in 1963 [2]. Using PLATO as a simulated laboratory, a learning situation was created that was almost completely self-directed. At that time, only a few lessons were developed which allowed the student to control both the rate and direction of her learning. The students in the experimental group (using the computer) did as well as or better than those in the control group. In addition, the more active a student had been in the learning process, the more she learned.

In 1966 Bitzer and Boudreaux [3] adapted a complete maternity nursing course for use on PLATO. For the purpose of this study, students were divided into two groups matched according to ability. One group took the PLATO course and the other group was given the course in the conventional classroom manner. A comparison of final examination grades of both groups did not indicate a significant difference, but the total time students took to complete the PLATO course

ranged from 28 to 40 h, in comparison to the 84 h that each of the control students spent in the classroom. It appears, then, that PLATO students learned the same amount of material in 1/3 to 1/2 the time required by the regular classroom instruction. Although some of this difference may be attributable to the professional instructional design of the instruction on PLATO, it seems likely that much of the difference is due to the individualization and interactive capabilities of CAI. With medical knowledge increasing so rapidly, this may be a major benefit of CAI.

Another CAI program in post-operative nursing care was developed by Kirchoff and Holzemer [4]. Evidence again demonstrated that students did learn the material on the computer system. However, in this study there was no control group for comparison.

Taylor [5] reported on a project designed at John Abbott College in Montreal, Canada. In this project, clinical simulations were developed to enhance the clinical experience of nursing students. Given that the number of clinical hours available for student practice is minimal and the variety of experiences is limited, computer simulation seems to provide the best alternative to conventional instruction. Since it most closely approaches the clinical experience and yet provides a controlled environment, the learner has the opportunity to practice decision-making skills with immediate feed-back and without harm to clients.

Computers may also be used to extend the classroom to rural areas. Estes [6] described a program designed for the RN who is seeking a BS degree. A specially designed van transports a computer and computer-based courses to distant/rural sites in Pennsylvania. These courses provide the same content as those offered on campus at the University of Pennsylvania, but they facilitate the efforts of nurses already in practice to earn a BS degree. This system utilizes both CAI, where all instruction is on computer, and CMI, in which pre- and post-tests are on the computer and instruction is presented "off-line" in the form of printed materials, slides, audio tapes, etc. The computer is able to store and analyze student performance and adapt instruction to each student's needs. Through Computer Managed Review and Examination (CMRE), a diagnostic test is administered, and the student is routed around course content in which she has demonstrated competence. This system sounds ideal in its ability to individualize instruction for students with varied knowledge and experience.

Computerized instruction can also make a contribution to continuing education in the health field. Computers can provide training 24 h a day, 7 days a week, so that health care providers can have access to educational programs at their own convenience. The MERIT project [7] was designed to determine the feasibility of using CBE as a means of continuing education in the health sciences. Case simulations are offered in courseware from Massachusetts General Hospital and Ohio State University College of Medicine to medical schools, nursing schools, dental schools, hospitals and health care institutions. This is the only project identified by our literature review that specifically used computers to up-date present-day nurses or nurses returning to the field.

Computers have also been used in educational settings to manage evaluation in the form of individualized testing. In the system in effect in the College of Nursing at the University of Florida [8], students make an appointment to take a test in the Individualized Learning Center within a specified time in the instructional unit sequence. Students are provided with immediate performance feedback and two opportunities to retake the test if mastery (set at 90%) is not achieved. This approach has had several benefits: tests are developed in accordance with a table of specifications for each goal, expectations for student performance are more clearly defined, students have greater flexibility in learning rates and testing intervals than in the traditional setting and this external evaluation approach frees instructor time for special enrichment activities.

In addition to courses being taught and managed by computers, courses are being taught about the use of computers in the health field. Senior students at SUNY Buffalo School of Nursing have the opportunity to take a course entitled "Implications of Computer Technology for Nursing" [9]. The course gives a general overview of basic concepts of computerized information processing, describes major applications in areas of client care, administration, health science education and health care research and provides a chance for students to interact with a computer through a remote terminal using a CAI program in nursing. This direct interaction with the computer has proven to be one of the most valuable experiences of the course for many students. Students expressed a change in attitude toward using a computer. They felt the hands on experience had demystified the process for communicating with a computer. The computer lost many of its

“monster” qualities and became more of a “friend” and “tool”, one which they could manage and which could be helpful to them.

Similar courses have been offered elsewhere with similar results [10, 11]. So it seems that there are many nursing programs which are making use of computers to provide or assist instruction and to manage or evaluate instruction and many are recognizing the valuable contribution computers can make to health care and are offering elective courses expounding on this.

#### NURSING PRACTICE AND ADMINISTRATION

The use of computers in health care settings generally falls into one of two categories: those used in nursing practice to direct and/or record data regarding patient care, and those used for administrative purposes. McNeill [12] described a system entitled PROMIS in use at the Medical Center Hospital in Burlington, Vermont. This system assists the practitioner with four functions:

- (1) gathering a data base where the computer has resource information such as techniques, drugs, patient preparation and patient education;
- (2) formulating a problem list whereby the practitioner selects patient problem(s) based on assessment data;
- (3) formulating initial plans for each problem in which the practitioner selects from a repertoire of interventions related to each problem; and
- (4) recording progress notes on the problem.

This system is composed of terminals with touch-sensitive screens that are placed on patient care units and linked to other key departments (X-ray, laboratory, pharmacy, kitchen). By inputting information regarding patient medication orders into the terminal on the patient care unit, for example, the order is transmitted directly to the pharmacy. This saves time previously required for filling out requisitions and making phone calls, leaving the nurse more time for planning and implementing quality patient care. Johnson *et al.* [13] described a computerized system in use at a 570 bed hospital in Salt Lake City. This is a system with a central data base and decision making capabilities. This system extends the expertise of clinical specialists to cover 24 h per day. It detects, analyzes and generates diagnostic interpretations for selected life-threatening lab abnormalities. It then generates specific treatment protocols. While this system is limited in its data base at present, it has the potential to be expanded to cover a greater range of acute and chronic clinical problems.

At the Harvard Community Health Plan a system is used to record, store and retrieve patient information quickly [14]. On readmission, information about past medical history and previous contacts is readily accessible.

Systems such as these facilitate record keeping and transmission of patient information among departments, thereby reducing nursing hours spent in non-nursing functions. In addition, these systems have the potential for facilitating research in patient care by keeping records of responses to therapy.

Computers are also being used in nursing administration to keep employee records. Scheduling of nursing staff has long been problematic and tedious in agencies that require 24 h a day, 7 days a week, unit coverage. A computerized system has been developed and implemented in Fairview General Hospital in Ohio to schedule the hours of their 1050 full-time and part-time nursing staff [15]. This has not only relieved the professional nurse from this time-consuming task, but has produced more precise staffing, has facilitated budgetary control via computerized management reports and has increased employee satisfaction. The system is flexible enough to handle requests for days off, orientation of new employees and holidays. Reportedly, its implementation has resulted in a considerable monetary saving.

Another system, called Nursing Education Record computer system (NER), performs administrative functions by keeping individual education records for 701 nursing personnel within one agency [16]. This method relieves administrators of tedious tasks by providing a complete profile of all educational activities performed by nursing personnel. This is useful for hospital accreditation purposes as well as for keeping track of Continuing Education Units (CEU's) earned by individual staff. (CEU's are necessary for relicensure in many states.)

## CONCLUSION

These are just some of the ways that computers are being used in nursing education, practice, and administration today. One can readily see that the potential is great.

In consideration of the increasing use of computers in health care settings, it behooves educational facilities to prepare their students to use computers. Familiarity with computers, either by CAI, CMI and/or courses about computers, would do much to help future nurses overcome "computer-phobia" and prepare them to function in the health care field of today.

## REFERENCES

1. Gold S. and Duncan F., Computers and health education. *J. School Hlth* **30**, 503-505 (1980).
2. Bitzer M. D., Clinical nursing instruction via the PLATO simulated laboratory. *Nurs. Res.* **15**, 144-150 (1966).
3. Bitzer D. and Boudreaux M. C., Using a computer to teach nursing. *Nurs. Forum* **8**, 234-254 (1969).
4. Kirchhoff T. and Holzemer L., Student learning and a computer assisted instructional program. *J. Nurs. Educ.* **18**, 22-30 (1979).
5. Taylor A. P., Clinical simulations in nursing. *Nurs. Times* **76**, 1217-1218 (1980).
6. Estes A., The use of computer based instruction in an extended degree program for nurses leading to the Bachelor of Science degree. Paper presented at the *Annual Meeting of the American Educational Research Association* (1976).
7. Held H. and Kappelman M., Continuing health education through computer technology. Paper presented at the *Health Education Medical Conference* (1976).
8. Davis J. H. and Williams D., Learning for mastery: individualized testing through computer-managed evaluation. *Nurs. Educ.* **5**, 9-13 (1980).
9. Ronald J. S., Computers and undergraduate nursing education: a report on an experimental introductory course. *J. Nurs. Educ.* **18**, 4-9 (1979).
10. Ellis L. B. M. and Gatewood L. C., A training program in health computer sciences. *Proceedings of National Education Computing Conference*, pp. 311-315. Iowa (1979).
11. Erat K. and McGrath S., Developing a teaching/learning experience for nurses in fundamentals of computer programming preliminary to nursing research. *Proceedings of National Education Computing Conference*, pp. 316-325. Iowa (1979).
12. McNeill G., Developing the complete computer-based information system. *J. Nurs. Admin.* **9**, 34-57 (1979).
13. Johnson D. S., Ranzenberger J., Herbert R. D., Gardner R. M. and Clemmer T. P., A computerized alert program for acutely ill patients. *J. Nurs. Admin.* **10**, 26-35.
14. Gluck J., The computerized medical record system: meeting the challenge for nursing. *J. Nurs. Admin.* **9**, 17-31 (1979).
15. Ballantyne J., A computerized scheduling system with centralized staffing. *J. Nurs. Admin.* **9**, 17-39 (1979).
16. Marks J., Is the computer the answer? *J. Contin. Educ. Nurs.* **12**, 25-27 (1981).