Interactive Computer-Assisted Instruction on Cancer Screening Guidelines

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The American Cancer Society (ACS) assists physicians in acquiring up-to-date information on cancer. A portion of the society's Professional Education Program is directed to primary care physicians, as they are in the best position to use those guidelines that deal with cancer prevention and early detection.[1] Recently the California division of the ACS studied the effectiveness of the ACS education programs in California. It was discovered that to a large extent the programs of the ACS have been ineffective in disseminating the intended information. The major reasons cited for such findings are related to the society's tendency to tailor its educational programs to the cancer specialist rather than to the primary care physician.[1] The project described herein arose from a joint interest of the authors and the ACS to determine whether (1) a course developed by primary care physicians would more successfully teach the generalist, (2) the computer could be used to teach cancer topics effectively and efficiently, and (3) a scientific exhibit utilizing a number of microcomputers could be used to teach large groups of physicians, such as at a medical conference.

CAI AND PILOT

Attempts to provide a teaching method that offers personal attention tailored to the individual student's needs and abilities led to the development of computer-assisted instruction (CAI). CAI has been used successfully for years in many facets of medical education, primarily patient education and student teaching in medical schools,[2-5] but little research has been conducted in the use of the computer as a tool for continuing medical education.[6,7] With the advent of the microcomputer's popularity, it is quite likely that CAI courses will serve as a valuable addition to the available CME options.

In the early 1970s PILOT was developed as a CAI-authoring language. Since its origin it has been improved many times to take advantage of the superior graphics and sound capabilities available in today's microcomputers. For this project an enhanced PILOT program (Apple SuperPILOT) was used with the Apple IIe microcomputer.

THE PROGRAM

It is important to consider content, learning techniques, and technical characteristics when developing educational software. In terms of content, because a major self-criticism of the American Cancer Society included the paucity of primary care physicians involved in the educational programs,[1] all questions and initial testing of this CAI program were by family physicians and residents. To ensure the accuracy of the program content, the published ACS guidelines of 1980 (as later modified to increase the frequency of mammography) were used as the sole reference.[8] The program's scope was limited to management questions related to cancer prevention and screening, with practical cases presented for the physician's consideration. For example, the program allows the physician to evaluate a breast mass, decide on the necessity of a Papanicolaou smear in an elderly patient, or opt for the appropriate screening examination for colon cancer. To facilitate learning (and possibly compliance), the rationale for the guidelines are also reviewed.

Multiple learning techniques were employed in the program, and these are closely tied to the flexibility of the technical characteristics of the language. The physician's attention is first captured by an animated introduction accompanied by the first 15 notes of Beethoven's "Ode to Joy." After a brief introduction the physician is given the option of a short tutorial on the use of the computer's keyboard. Lesson questions are then presented in a multiple-choice, true-false, or

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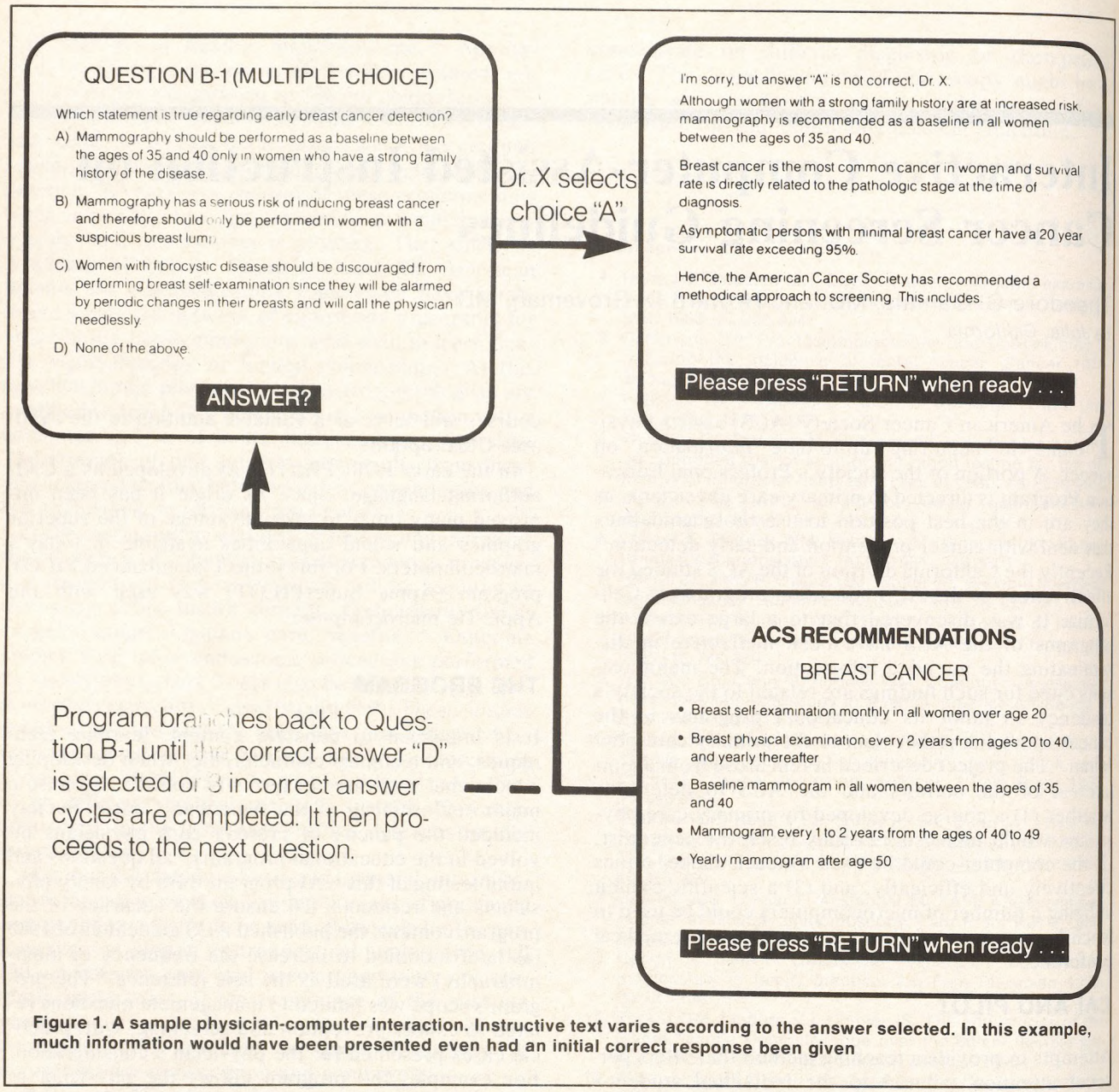

Figure 1. A sample physician-computer interaction. Instructive text varies according to the answer selected. In this example, much information would have been presented even had an initial correct response been given

fill-in-the-blank format. Many questions build on material previously presented, and the physician is asked to integrate multiple principles. A correct response is rewarded with instant positive feedback (a pleasant beep and a congratulatory statement of praise from the computer), and additional information is given in the answer's explanation. Incorrect responses are met with a dull tone and an explanation of why that answer is incorrect. Additional learning points are then added, and the program loops back to give the person a second (or third) chance at the same question.

SuperPILOT facilitated the emphasis of important concepts by allowing the easy formatting of single- or double-spaced text, bold and large print, changing colors, and graphics. To keep the physician's interest, animation and music were added where appropriate. SuperPILOT also provided for complex lesson structure with feedback loops, music, animation, bold and large text, and the saving of answers, all with single-letter commands. For the program, backward loops for incorrect answers were limited to two, so that on the third incorrect answer the person is given the correct response with an explanation. Figure 1 presents a sample interaction.

The program is menu driven to allow the physician to select freely from any of the lesson's four sections

(breast, cervix, colon, and lung) and to repeat any section desired. Because the program waits for a response before continuing, the respondent is allowed to proceed at his own pace, taking notes when appropriate.

Another valuable SuperPILOT feature allowed all of the participants' answers to be saved on disks. Thus large numbers of physicians were able to interact with the program and the responses analyzed at a later date. As the language is based on a Pascal editor, text formatting with "word wrap around" is automatic. This editor also has such word-processing features as "find," "replace," and "move."

EVALUATION AND OBSERVATIONS

To date over 800 physicians have interacted with the lesson at ACS scientific exhibits. Assessment of family physician knowledge using this program is described elsewhere.[9] Written evaluations demonstrated that the vast majority have considered the program an educational, enjoyable, and worthwhile method of learning and review. Most felt that graphics, animation, and music added to the learning experience, but a few (less than 5 percent) considered that these were merely unnecessary distractions.

The authors were present while most of the physicians were interacting with the program. Of special note is the degree to which many of the participants became "involved" with the tutorial, manifested by occasional displays of emotion that ranged from outright laughter to desk pounding in apparent anger or disagreement. It is quite possible that the ability of an educational technique to generate this much emotion will add to its effectiveness.

Some interesting findings were determined from the data collected. Age was directly related to whether a participant requested a tutorial on the computer keyboard. The request for such review, however, was unrelated to the final score. Thus the program was easy to use even for the computer novice. Overall test performance was considered suboptimal with under one half the participants scoring better than 65 percent correct responses. The program was an effective teaching tool nevertheless, with over 90 percent of the repeated questions answered correctly.

CONCLUSIONS

The computer was shown to be a powerful resource to help teach primary care physicians many of the essentials of cancer screening. Personalized teaching for a large group was readily accomplished by utilizing several microcomputers at scientific exhibits sponsored by the American Cancer Society. In addition, the SuperPILOT program was found to be an authoring language that can be used to write educational and entertaining lessons for physicians. Developed programs allow for the recording of respondents' answers for later analysis, thus making it ideal for many research and educational purposes such as continuing medical education and resident evaluation.

Acknowledgment

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