Continuing Medical Education Software:

A Comparative Review

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Personal microcomputers can be used by physicians for continuing medical education (CME). Advantages of computerized CME include local control over the topic, time, place, and pace of instruction. Computers can be interactive, providing selected information that depends on the desires and needs of the physician. Learners have different preferred styles of receiving information, and computer programs can be written to appeal to a particular style of learning.

Three examples of commercial software programs available for CME are reviewed. CYBERLOG should appeal to those who like to learn from reading text-

books but also desire simple computer graphics and case simulations to reinforce key concepts. PATIENT SIMULATOR II is a detailed patient simulation for those who learn best by doing. A subscription to DISCOTEST provides patient management problems, and multiple choice questions (no graphics) based on information in *Scientific American Medicine*. No one program is suitable for all family physicians.

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With medical knowledge growing at an increasing rate, the need for continuing medical education (CME) has never been greater.[1] Keeping up with current information is vital to maintaining competency as a physician. The specialty of family practice recognizes the importance of CME by requiring documentation of educational activities to obtain recertification by the American Board of Family Practice. Many states now require similar documentation of CME for medical relicensure.[2]

The purpose of this article is to examine three computerized commercial CME programs and suggest factors to consider when evaluating a software product for CME. Other computerized CME products are available that are not reviewed here.

Why Computerized CME?

Traditional modes of instruction continue to provide the bulk of CME. Attending lectures and conferences, consulting with colleagues, and reading books or journals are

the predominant learning modalities.[3] The business of providing CME that meets prescribed guidelines for receiving credit is now a multimillion dollar activity. Computers can provide CME locally at less cost per credit hour than traditional lecture courses, especially if the traditional courses involve travel.

The widespread availability of microcomputers now makes the advantages of computer-assisted education feasible. More than half of active family physicians own, rent, or lease a computer for their office.[4] Many practices use microcomputers for administrative purposes, such as billing and appointment scheduling. Other physicians invest in a microcomputer for clinically related tasks such as word processing and medical record keeping. These computers may also be used for CME. Purchase of a microcomputer solely for CME is expensive, but should be a consideration for those unable or unwilling to earn CME credits by other methods.

Computers offer many advantages over customary methods of CME.[5] The physician with an office computer does not have to travel to an off-site location. The time of day, length of the session, and pace of instruction can all be controlled by the learner. The content of instruction is also under much more control, and can be directed toward specific patient care problems when needed.

Furthermore, the computer is an interactive medium of learning. This means that the computer can individualize its response depending on input from the user. By requiring responses from the user, the computer keeps the learner alert, and the learner can focus the program on information most wanted or needed. With well-written software, computerized CME can be almost as interactive as a conversation with a consultant who has all the data at his or her fingertips.

Computers can also track the progress of the learner for documentation to external reviewers. A summary of the history of the use of computers in medical education suggests that ". . . the computer in certification and licensure could, within a decade, transform the way competence is assessed."[6] Surveys of physicians have shown a growing interest in computer-assisted education over the past decade.[7]

Studies have shown that people have definite preferences as to how they learn. One theory distinguishes types of learning styles determined by one's strengths in four modes of learning: concrete experience (from feeling), reflective observation (by watching and listening), abstract conceptualization (by thinking), or active experimentation (by doing).[8] Based on these learning categories, a person is identified as being one of four learning-style types: accommodator, diverger, assimilator, or converger. Accommodators learn primarily from hands-on experience. Divergers view concrete situations from different points of view and generate multiple solutions. Assimilators are most interested in abstract ideas and concepts that are logical. Convergers find solutions using ideas and theories.

Computer software can sometimes be written to transmit information in different ways. For example, a relationship between two variables may be presented in one or more of the following ways: written text, table, graph, static image, or animated series of images. Accommodators and divergers tend to learn better from more concrete presentations, while convergers and assimilators tend to learn better from more abstract presentations. Current CME software is generally limited to one or two different methods of presenting information. Physicians should try to acquire information in the mode that best suits their individual learning style.

Given the advantages of computerized CME, one might wonder why it is not more widespread. Developing high-quality software is very labor intensive.[9] High costs have hindered the development of advanced programs aimed at the practicing clinician. There are many programs now available to medical students that cover a variety of topics in the basic sciences and some clinical areas. The advent of software used to produce computerized instructional programs ("authoring courseware")

has decreased the amount of labor required to produce good computer-assisted instructional materials. Even using this authoring courseware, however, software development requires considerable time and effort. There is also a lack of knowledge of the availability of already developed software.

Is CME by computer effective? Studies have shown that computer-assisted learning reduces the time required to complete a course on a specific nonmedical job skill or task, or on a high school or college subject.[6] Studies at the medical school level have shown comparable learning and even enhanced learning when computers rather than standard lectures are used to present material.[10-12] Although there have been no conclusive studies on the effectiveness of computers in postgraduate medical education, there are no inherent reasons why computerized instruction should be less effective in this setting.

What Software to Buy?

There are several factors to consider after making the decision to pursue computerized CME. One factor is the physician's preferred method of instruction based on his or her learning style. Current computerized CME programs employ various combinations of multiple choice questions, case scenarios or patient simulations, didactic text, and interactive text and graphics. Some programs offer more than one way of presenting information to accommodate different preferences.

Another factor to consider is the subject matter of the CME. Some packages have a selection of topics or cases from which to choose, whereas others cover only one specific area. Alternatively, one can subscribe to an ongoing series that eventually covers a broad area, such as internal medicine. The target audience of the software should be identified; this is often obvious from the title or other information provided by the publisher. For family physicians, software written for medical students is generally too basic, while some software written for subspecialists may contain needless detail or trivia.

Other factors that should be considered in choosing software for CME include ease of use, cost, and any special hardware or software requirements. The degree of support from the publisher may be important, especially for computer novices. Some programs may offer additional benefits, such as a database of information for later quick access during actual patient care, or information in a format suitable for patient education. The date of the software should be noted, as information on disks can become outdated, just as information in textbooks does. Software must be revised to keep up with current medical developments.

Table 1. Three Continuing Medical Education (CME) Software Programs for Microcomputers

	DISCOTEST	CYBERLOG—The Journal of Applied Medical Software	PATIENT SIMULATOR II
Version reviewed	Issues 95,96,97,98; IBM version	Congestive Heart Failure, Issue 17, 1990; IBM version	Joanna Fox and Marcel Rosen; IBM version 1.08
Distributor	Scientific American Medicine 415 Madison Ave New York, NY 10017 (800) 545-0554 212-754-0550	Cardinal Health Systems, Inc 4600 W 77th St, Suite 150 Edina, MN 55435-4923 (800) 328-0180 (612) 835-6941	Knowledge House 3845 Dutch Village Rd, Suite 201 Halifax, NS, Canada B3L 4H9 (800) 565-0702 (in Canada) (902) 455-1962
Price	US$152/year	Individual program—US$189 Discount for subscription or multiple issues	Individual program—US$84 Discount for multiple cases
Frequency of issue	Two cases issued quarterly	Usually three programs per year	11 cases currently available
How supplied	Disk, manual	Disk, manual, and printed text	Disks, manual
Documentation	Good	Good	Fair
Hardware requirements	IBM PC, XT, AT, PS/2 or compatible with a minimum of 256K (3.5" or 5¼"); Apple II+ with 80 column card/IIc/IIc/ GS (5¼" disk only); Macintosh with a minimum of 512K	IBM PC or compatible with a minimum of 192K, MS DOS 2.1, with graphics display adaptor	IBM PC or 100% compatible with a minimum of 640K, with mouse, 2 floppy drives or 1 floppy and 1 hard drive, and graphics card; Macintosh with a minimum of 1 MB (available early 1992)
Customer support	Good; toll-free	Good; toll-free	Good; toll-free in Canada
Demonstration disk	Review disk available at initial subscription	Yes; institutional review copy also available	Two types of demonstration disks available
Money-back guarantee	May cancel subscription after trying review disk	Not advertised	Yes
AAFP-approved CME	4 credits per case (32 credits per year)	12 credits per program	3 credits per case

Owners of IBM-compatible microcomputers should have few problems obtaining software because most of the CME programs available are written for these computers. A graphics card is usually needed. Some software may be available for other computer systems. Besides a basic microcomputer with sufficient memory, extra hardware is sometimes highly recommended or required. The most common of these are a hard drive, EGA or VGA monitor, printer, mouse, and modem.

Specific Product Reviews

DISCOTEST

DISCOTEST (Scientific American Medicine, New York, NY), a series of computer-assisted CME programs written for practicing clinicians, has been published for more than 5 years (Table 1). There are two parts to each program: an initial patient management problem and multiple choice questions. The patient management problem begins with a short description of the patient, then allows for the selection of additional history from a list of possibilities (Figure 1). After further historical information and examination findings are presented, the user is given a choice of laboratory tests or other diagnostic studies. Laboratory results are usually presented immediately. Based on the information acquired, the user then chooses from the therapeutic options presented. The progress of the patient is reported, and further options are offered. After the case is finished, a critique of the user is provided (Figure 2). References are provided, which are primarily to *Scientific American Medicine*, the three-volume binder text that is basic to the program.

The program proceeds to multiple choice questions covering the clinical issues brought up by the case. Because the questions are generally based on information contained in *Scientific American Medicine*, the relevant sections of the book may be read before taking the examination. Immediate feedback is given after each question is answered. The answers to these questions are
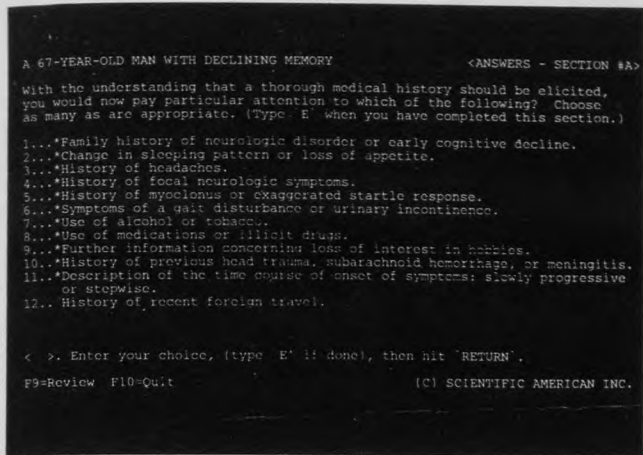
Figure 1. Printout of DISCOTEST patient management problem screen. Items are marked with an asterisk as they are chosen.

recorded and are the basis for granting CME credits, which are acceptable for 4 prescribed hours by the American Academy of Family Physicians. To get CME credit, a special scoring code number is generated when the program is completed; this number is mailed back to receive credit.

The user can rerun case simulations, changing the management and receiving a new score and critique. The questions can also be reviewed at a later time. The multiple choice test, however, counts for credit only the first time the program is used.

This review was done using an IBM-PC compatible computer with a monochrome monitor. The specific DISCOTEST simulations reviewed include a 28-year-old woman with palpitations and chest pain; a 64-year-old man with postoperative fever, diarrhea, and dyspnea; a
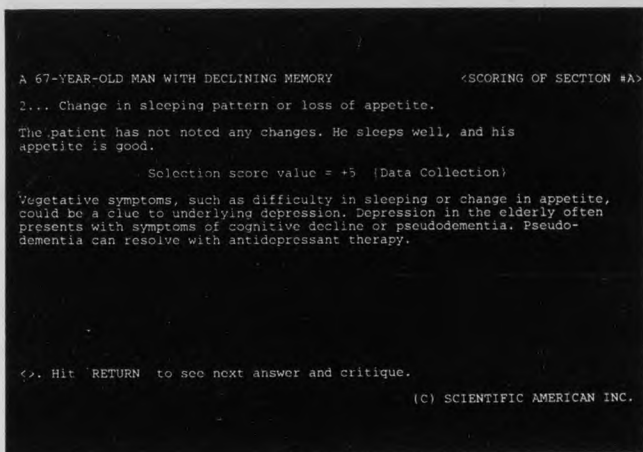

Figure 2. Printout of DISCOTEST patient management critique screen. A score for each item selected is displayed along with a short commentary.
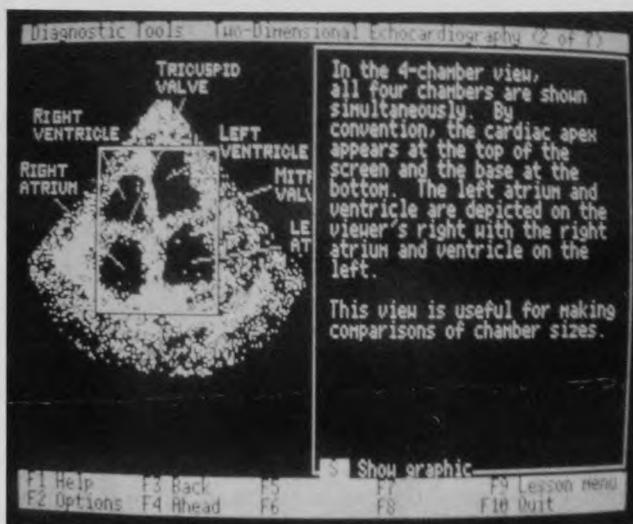

Figure 3. CYBERLOG tutorial screen. The entire graphic image of the echocardiogram can be viewed by pressing the S key.

67-year-old man with declining memory; and an 18-year-old man with rectal bleeding. The patient management problems are structured, so that history taking, examination, testing, and treatment are in sequential order. Options for additional history or examination findings are designed to focus on specific points that are pertinent to the problem at hand. The cases are concise, providing a thumbnail sketch of an illustrative patient rather than an in-depth examination of the patient.

DISCOTEST is supplied as a series by subscription, so there is no control by the subscriber over the topics covered each quarter. The program is text-based, and does not use graphics to illustrate concepts or findings. The feedback critique in the patient management section is occasionally redundant, with the same information repeated on successive screens.

CYBERLOG

CYBERLOG (Cardinal Health Systems, Inc, Edina, Minn), a computer-assisted CME program written for advanced medical students, residents, and practicing clinicians, has been published since 1985. Each issue covers in depth a different clinical topic. An extensive printed text, which usually exceeds 40 pages, is intended to be read first. It outlines the logic and reasoning behind the clinical decision-making processes in the topic's subject area.

The computer software portion has three integrated parts that are used with the printed text for education: tutorials, case studies, and tools. The tutorials use computer graphics to help clarify principles as they are presented in the text (Figure 3). The case studies, based on

Figure 4. Printout of CYBERLOG case study screen. A number of options are presented to the user to choose from. Help screens are available with function keys.

actual patients, demonstrate the authors' suggested approach to actual clinical problems (Figure 4). The tools are a collection of formulas, tables, diagrams, and other clinical aids that can be used in daily practice as well. CME credit is obtained by answering a series of multiple choice questions on paper and sending a form back to the publisher.

In the specific CYBERLOG program reviewed, congestive heart failure, the printed text is quite complete, covering the pathophysiology of congestive heart failure. The software tutorial provides computer graphics (some animated) to illustrate concepts from the printed material. The tools section highlights abnormal findings on seven modalities of testing commonly used in the evaluation of congestive heart failure. This tools section can easily be accessed later during a clinical session to assist with the interpretation of a test from an actual patient. The graphics add a good visual reinforcement to the material under discussion in the tutorial and tools sections. Although acceptable on a monochrome monitor, the graphics appeared much better when viewed using a color monitor.

Five case studies provide brief patient simulations to illustrate key points. Feedback for incorrect responses is usually immediate. Incorrect sequences of actions, however, are not always detected. The program did not provide feedback when I failed to obtain any further history or to perform a physical examination, and instead jumped directly to ordering laboratory tests and guessing a diagnosis.

To obtain CME credit, an additional fee of $15 is required. Including the program I reviewed, 18 topics are now available (Table 2).

Table 2. CYBERLOG Topics

Fluid, electrolyte, and acid-base balance

Management of type II diabetes

Hypertension

Acute respiratory failure

Selected environmental emergencies

Coronary artery disease

Major gastrointestinal disorders

Inflammatory arthritis

Thyroid diseases

Preventive methods in coronary heart disease

Inpatient infectious diseases

Clinical pharmacology

Outpatient infectious diseases

Sports medicine: injury and treatment

Sports medicine: rehabilitation and prevention

Arrhythmias

Anxiety disorders

Congestive heart failure

PATIENT SIMULATOR II

PATIENT SIMULATOR II (Knowledge House, Halifax, Nova Scotia), written for practicing primary care physicians, is a patient simulation with feedback at the end of the case on the user's performance. The simulation is extensive, providing multiple menus of options for history taking, physical examination, laboratory testing, and therapies (Figure 5). An example of the level of detail of
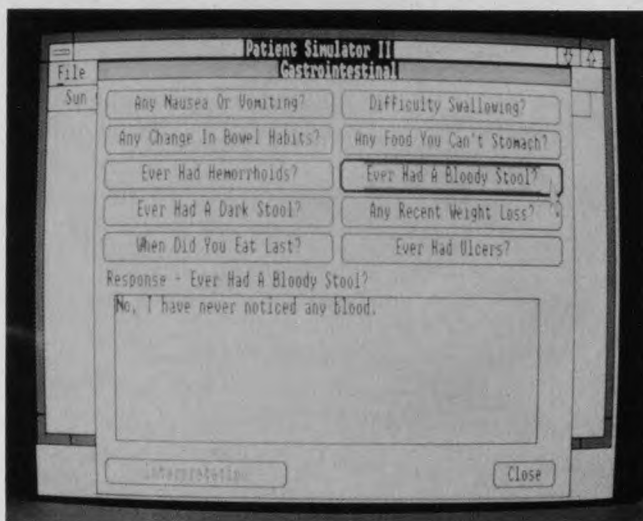

Figure 5. PATIENT SIMULATOR II history-taking screen. The mouse is used to select questions to ask the patient. The response is displayed in the rectangle below.
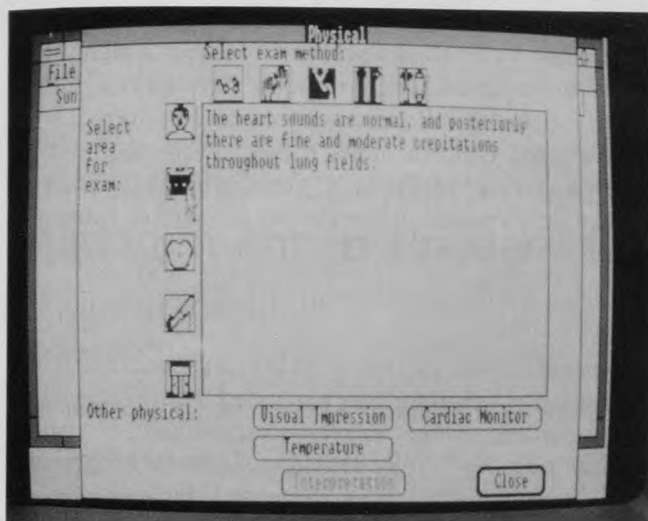
Figure 6. PATIENT SIMULATOR II physical examination screen. Findings are obtained by clicking on an examination method in the top row (inspection, palpation, auscultation, special instruments, neurologic) and an area for examination in the vertical column (head, chest, abdomen, upper extremities, lower extremities).

the program is the way the physical examination is conducted. The user must choose the part of the body to examine and the type of examination to be conducted (inspection, palpation, auscultation, or other) (Figure 6). After treatment is prescribed, the user specifies when the patient should be seen again for follow-up. Time can be advanced, and the patient is seen again. The program also asks the user to make a list of possible diagnoses at various times during the simulation. Alternatively, the user may choose to enter diagnostic possibilities at other times by using the appropriate window.

The program uses pull-down menus, making selection from the variety of options easier. On the IBM, Microsoft Windows is supplied on disk for the graphics interface. A mouse is strongly recommended, and Knowledge House is currently offering a free mouse to purchasers of the program. Although the program uses a graphics interface, information is provided as text except for the patient's vital signs, which may be viewed in a graphic format.

Extensive help is available as "expert advice" in a pull-down menu. When the case is over, an evaluation of performance is provided. The user's list of choices is compared with the expert's list, accompanied by the reasoning behind the expert's decisions. A review of questionable management decisions made by the user is also available. Evaluation of diagnostic reasoning compares the user's list of diagnostic hypotheses with the expert's list. A list of literature references for further

Table 3. PATIENT SIMULATOR II Topics

Abdominal pain in the emergency room
Malaise and fatigue
Obstetrics
Tachypnea in the newborn
Weakness and incontinence
Fatigue and headaches
Acute epigastric pain
Infant growth and development
Hypertension
Shortness of breath and edema
Cough, headache, and fever

reading is available in another menu. Health care costs are available with some simulations.

The program was reviewed on an IBM PS/2 model 30 with a hard drive. There was some initial difficulty in setting up the program to work with a mouse, but this was easily solved with a telephone call to the publisher. Setup for users without a hard drive requires creating two disks to be used as start-up disks. Creating these start-up disks may be confusing for novice computer users. Setup for hard drive owners is much simpler.

The two PATIENT SIMULATOR II cases I reviewed were fairly realistic: a 22-year-old woman who presents to the physician's office with abdominal pain, and a 38-year-old man who comes to the emergency room with epigastric pain. Nine other cases are available (Table 3). This program is more advanced than other patient simulation programs I have seen. Other programs designed for medical students stop after the initial laboratory workup, rather than continuing on to include therapy and follow-up.

There were a few minor drawbacks to the program. Because the program is Canadian, some medication names may not be familiar to US physicians, especially if the generic name is not provided on the menu. Each case provides a good list of references, but it should not be available until the end of the case to prevent prematurely learning the final diagnosis. Several options, including a save function to record the current status of the patient for later retrieval to continue the simulation, have not been implemented. A new version scheduled for completion in early 1992 should correct some of these problems.

Summary and Recommendations

Each program reviewed has its own strengths and weaknesses. CYBERLOG should appeal to those who like to

learn by reading textbooks but also want simple computer graphics and case simulations to reinforce key ideas. The program is designed for the user first to learn about the topic, and then to apply it to the case studies. A growing collection of topics is available, with three new topics planned each year. An added bonus is a tools section that can be called up for reference during patient care.

In contrast to CYBERLOG, DISCOTEST is designed for the user to try the patient management problems first, then do some reading on the topic before proceeding to the multiple choice questions. The multiple choice questions are best used in conjunction with the published text, *Scientific American Medicine*. The contents of the patient management portion of DISCOTEST are the same as the paper *Discotest*, available free to subscribers to *Scientific American Medicine*. Over 100 cases are now available and new cases are created quarterly.

PATIENT SIMULATOR II is for those who like to learn by doing. The cases provide the most detailed simulation of patient care of any commercial computer CME available. Currently there are 11 cases available.

Computer CME is not for every physician, but the increasing variety and quality of programs available makes them more attractive for physicians. There is no one perfect computer CME program for all family physicians. Depending on the needs of the physician and the style of learning, a program can usually be found to meet the educational needs of the physician. Prospective buyers should be aware that other computer CME programs are available as well, with varying degrees of quality.

The future holds even more promise as technology continues to advance. All three programs reviewed here, including PATIENT SIMULATOR II, provide text in response to an inquiry for information about the patient. Interactive video allows portions of actual patient interviews to be played back in response to questions, including the patient's inflections of tone and nonverbal communication. Unfortunately, the hardware required for interactive video is expensive, limiting home use, and the cost of development of worthwhile interactive video programs is very high.

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