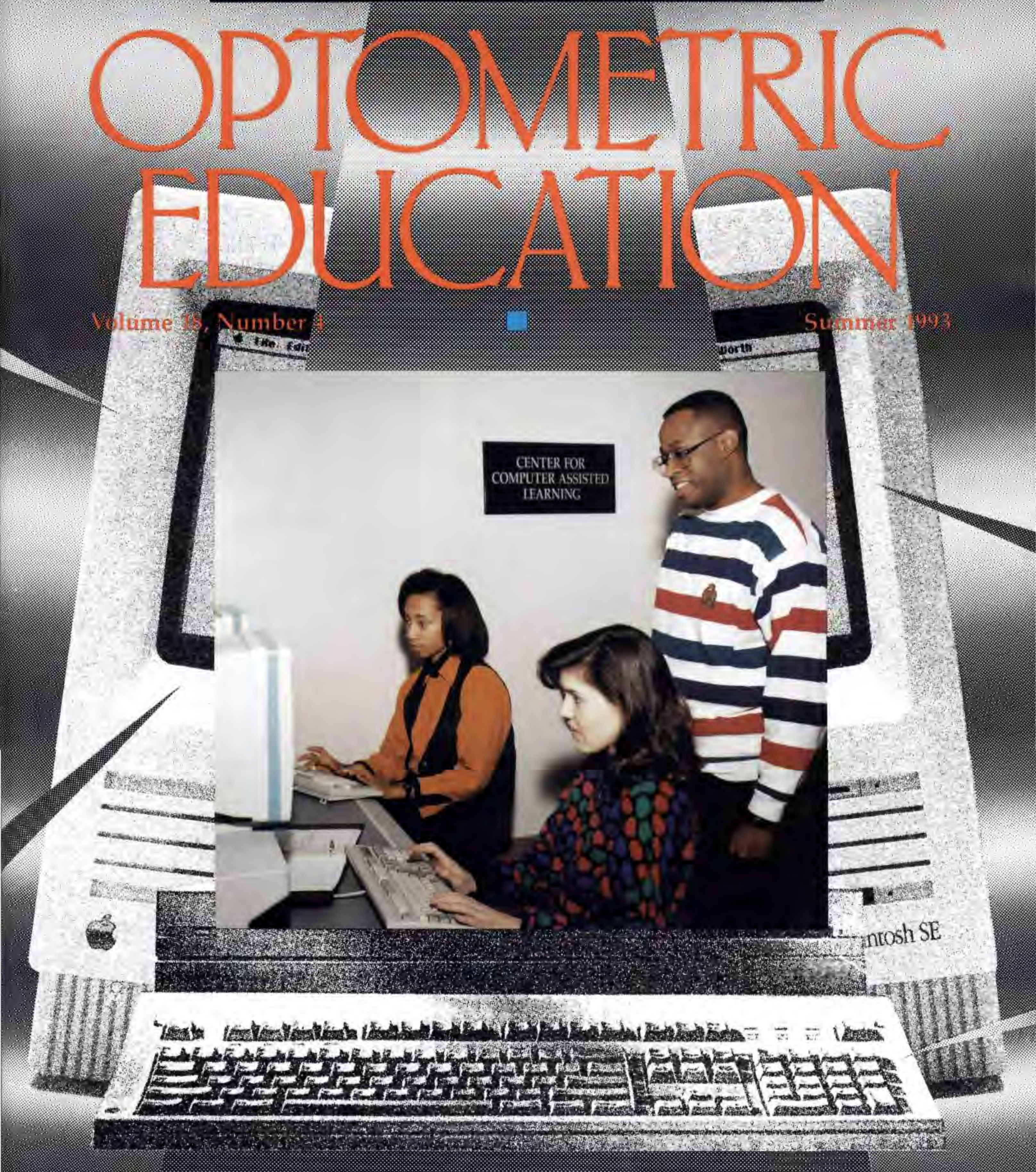
The Journal of the Association of Schools and Colleges of Optometry

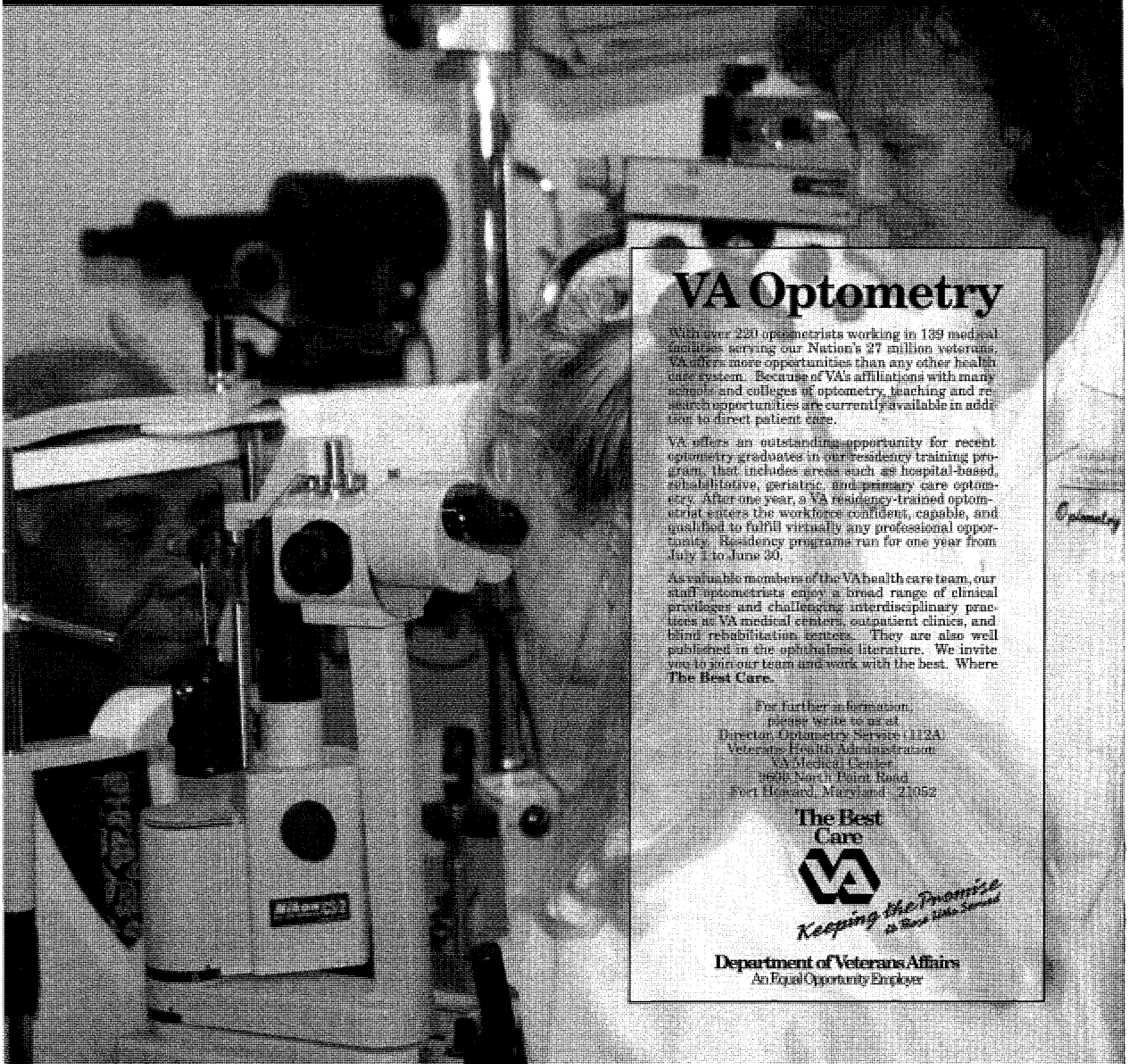
OPTOMETRIC EDUCATION

Volume 18, Number 4 Summer 1993



Enhancing Teaching with Computers

Looking Toward the Future...



Keeping an Eye On Our Past.

OPTOMETRIC EDUCATION

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GUEST

EDITORIAL

The Impact of Computer and Video Technologies on Optometric Education

Pierrette Dayhaw-Barker, Ph.D.

Today's rapidly developing technology brings continual evolution to our society. Networked personal computers as well as satellite and cable videographic technology are part of the burgeoning change in our access to information. This affects not only how we view and perform our work, but it has become a basic part of what work is to each of us.

In education, technological change occurs so quickly that we often find ourselves failing to complete the normal cycle of human adjustment to new ideas, instruments and techniques before the next wave of change washes over us. For example, while most of us are just getting comfortable with computers and video technologies as our constant companions, our students often anticipate and toy with the most recent innovative applications. Many students understand "expert systems," interactive video, simulations technology, and virtual reality. These systems are just beginning to be incorporated into teaching.

For faculty educators, this creates opportunity and stress. We must not only stay current with content area, but we must acquire and continually update computer and video technology skills. We must monitor the host of applications that are marketed as teaching tools.

The use of high technology in health professions education is no longer a simple matter of innovative instructional style. Computer and video technology are so interwoven with basic educational and delivery missions that they are rapidly becoming a significant component of content themselves. For example, "slice of life"- type programs enable students of anatomy to have standardized, in-depth human dissection experiences without the need for a specimen for each student. Similarly, we now expect students to be "med-line" literate.

Current information processing capability has painted the realistic scenario that modern patient care management will include use of "expert systems" as an aid in clinical decision making. Image enhancement, non-invasive imaging and other video/computer combinations will be used on an increasing basis, thus providing us exciting diagnostic windows into the human body.

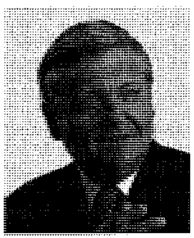
What is most compelling for optometric education is that although past technology produced advances mainly in the specialty care areas, future development of advanced computer and imaging technologies will be increasingly directed toward primary care applications. Primary care will be reshaped substantially by advancing info-technology in health care and in society in general. As a result, more and more specialty care issues will be handled within the realm of primary care. To stay current, our faculty, practitioners and students must learn effective use of developing patient-management software, on-line literature searches and the like.

Perhaps the biggest challenge facing the optometric educator is how to adjust to new technologies in the face of their rapid change. We need to deal with our time commitment and re-orientation to new technologies. We must also make very basic, yet highly significant, decisions about which hardware and software are best for our current applications with the hope that our choice will stand us in good stead as future developments occur. Costs are high and costs of wrong decisions are potentially enormous.

While no one formula is right for every school, we can more quickly advance in technology application with assistance of unbiased technology experts. They can help identify the needed basic tools and then plan for their acquisition and application. We should acknowledge the equally significant need for faculty growth and development that is essential to make new technology work. Paying for all of this will be difficult, but forces of change are already at our doorstep. We must rise to the challenge!

Dr. Dayhaw-Barker is assistant dean for basic sciences at the Pennsylvania College of Optometry.

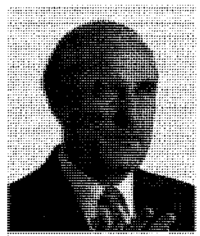
Why Daily Wear Two-Week Replacement?



• Better Compliance

"My daily wear two-week patients simply comply better than my conventional lens patients. Better compliance gives me greater control of my contact lens patients."

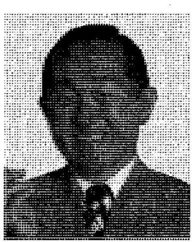
— Kirk Smick, O.D., F.A.A.O. Atlanta, GA



• Practitioner Satisfaction

"I believe 90% of contact lens complications I see involve dirty lenses. Replace lenses every two weeks, and I believe you eliminate 90% of the problems."

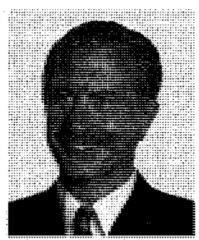
— John Herman, O.D., F.A.A.O. Pittsfield, MA



• Patient Satisfaction

"My patients get the comfort and convenience they want with daily wear two-week replacement. In my opinion, it's the best way to prescribe daily wear today."

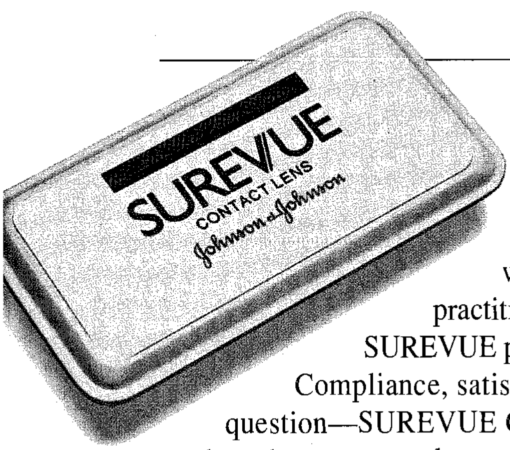
— Rodger Kame, O.D., F.A.A.O. Los Angeles, CA



• Practice Growth

"My daily wear two-week patients are so happy, they tell their friends. Furthermore, my practice enjoys a 94% renewal with these patients, ensuring continued practice growth."

— Lee Rigel, O.D., F.A.A.O. East Lansing, MI



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[1]Data on file.
*Recommended wear schedule.

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INDUSTRY NEWS

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Vistakon Offers Expert Advice On Patient Management

Practitioners interested in improving their patient management and communication skills can take advantage of a new peer-to-peer educational program offered by Vistakon, a division of Johnson & Johnson Vision Products, Inc.

"We had been getting a lot of requests from doctors for some kind of professional program that would help them to communicate with their patients better and thus manage them more effectively," said Stanley Yamane, O.D., vice president of professional affairs at Vistakon. "Although many programs teach staff people how to manage patients, there are very few programs to improve doctor-patient interaction with the overall goal of gaining patient acceptance of a treatment plan in his or her own best interest. Our Patient Management Program developed as a direct result of this oversight."

The Patient Management Program's pilot year was 1992, with Sheldon Wechsler, O.D., past vice president of professional affairs and founder of the program, conducting seven seminars around the country. Several more are already scheduled for this year, and will be conducted by a number of guest speakers, including Wechsler.

"In preparation for this program, we asked a couple dozen practitioners to tape record an afternoon of patients' examinations," said Yamane. "Transcriptions of these tapes revealed that there was a definite difference in communication techniques between more and less successful doctors. "The seminar that we give consists largely of the pearls and gems extracted from those tapes," he continued.

Also included in the seminar is a discussion of four models of the doctor-patient relationship. Additionally, the seminar provides tips on how to gain patient acceptance of the treatment plan and how to make the most of the case history interview, the diagnostic test communication and the diagnosis. "The verbal interaction between doctor and patient in the examination room is one of the keys to gaining acceptance by the patient of the optimal treatment plan that's in the patient's best interest," Yamane said. "The Patient Management Program is designed to provide practitioners with the skills necessary for accomplishing that end."

Varilux Sponsors 2nd Annual Optometry Super Bowl

On January 8, 1993, Varilux Corporation held the Second Annual Optometry Super Bowl at the unique Hyatt Regency Union Station in St. Louis, MO. Shane Laster, a 3rd year student at Northeastern State University College of Optometry claimed victory over 17 other colleges and universities.

Rod Tahran, O.D., director of professional services at Varilux Corporation, began the competition by welcoming the 600 attendees, reading the rules, and introducing the distinguished panel of judges. The six finalists, after three rounds of questions, placed as follows: 1st place Shane Laster, Northeastern State University College of Optometry - Tahlequah, OK; 2nd place Lois Mecham, Pacific University College of Optometry - Forest Grove, OR; 3rd place William Pope, University of Houston College of Optometry - Houston, TX; 4th place David Reed, Pennsylvania College of Optometry - Philadelphia, PA; 5th place Mona Sara, University of Montreal School of Optometry - Montreal, Canada; 6th place Todd Oates, The Ohio State University College of Optometry - Columbus, OH. Questions were asked from all areas of optometric curriculum. The first student to "ring in," and answer correctly scored points.

Michael Ness, vice-president of marketing, in presenting the awards, said "Varilux values this opportunity to support optometric education. We enjoy the students' spirit of competition and are impressed with their extensive knowledge." Shane Laster was awarded $1000.00 for first place, and a crystal bowl will be placed at Northeastern State University College of Optometry for one year until the next winner is crowned in 1994. The Third Annual Optometry Super Bowl will take place January 7, 1994, in Newport Beach, California, during the American Optometric Student Association Conference.

Ciba Provides Students Complimentary Subscriptions

Fourth year optometry students at the 17 schools and colleges of optometry across the United States and Puerto Rico are receiving complimentary one-year subscriptions to Contact Lens Update, a newsletter published by Anadem, Inc., courtesy of CIBA Vision Corporation. Contact Lens Update provides abstracts of contact lens related articles from almost 40 journals.

The subscriptions, which are valued at more than $100,000, began in January 1993. They were sponsored by CIBA Vision to help encourage students to stay current with literature related to the profession and to stimulate interest in research. "This is just one example of CIBA Vision's continuing commitment to education and fostering a better understanding of contact lens knowledge," said Sally Dillehay, O.D., M.S., manager of professional services at CIBA Vision.

CIBA Vision Corporation offers a wide-range of vision care products and services, including soft contact lenses, lens care products, and ophthalmic pharmaceuticals. CIBA Vision products are marketed in 70 countries.

Bausch & Lomb Announces Research Program Winners

Bausch & Lomb has awarded 20 research grants totaling $100,000 through its International Research Program. The International Research Program was established in 1991 by Bausch & Lomb to initiate and support contact lens related research worldwide. This year's program attracted 58 applicants from 15 different countries. Applications were reviewed by a selection committee comprised of a group of leading eyecare authorities.

"We are very pleased to award twenty $5,000 grants to individuals in 11 different countries spread throughout Europe, Asia, North America, and Latin America," said Gary Orsborn, O.D., director of Bausch & Lomb's professional and clinical services. "We realize the importance of supporting independent clinical research and are pleased to have the opportunity to sponsor these excellent projects."

The deadline for applications for the 1994 International Research Program is January 15, 1994. For more information, or to receive application guidelines and forms, contact Dr. Gary Orsborn at Bausch & Lomb, 42 East Avenue, Rochester, New York 14603.

In other news, Bausch & Lomb recently appointed Jack Solomon, O.D. as manager of professional services for the Contact Lens Division. Dr. Solomon has been the senior partner in a large contact lens practice in Fort Lauderdale, Florida, for the past 25 years, and he is a professor on the faculty of the College of Optometry at the Southeastern University of the Health Sciences in Florida. Dr. Solomon will act as an advisor and consultant for Bausch & Lomb professional programs. This includes visiting optometry schools and advising contact lens department faculty on managing their clinics and acting as an optometric consultant for the Practice Management Consulting and Training Group — The Dream Team — a group of Bausch & Lomb exerts who help practitioners manage the transition from standard contact lens wear to planned replacement programs for their patients.

"Dr. Solomon's hands-on experience and knowledge of the profession will help us to strengthen our existing relationships with and support of the eye care community," said Harold O. Johnson, corporate senior vice president of Bausch & Lomb and president of the Contact Lens Division. "We are very pleased to have Dr. Solomon join the Bausch & Lomb team," he added.

Wesley-Jessen Reports Practitioners Increase Toric Prescriptions

Practitioners are prescribing soft toric contact lenses for record numbers of low astigmats. "For all of 1992, nearly one in four Dura-Soft OptiFit torics sold was 0.75D cylinder," according to Dwight H. Akerman, O.D., F.A.A.O., Wesley-Jessen's director of professional services. "That's up from just 10% of OptiFit prescriptions two years ago — a dramatic increase. It's apparent that doctors are now prescribing soft torics to low astigmatic patients who used to wear spherical lenses but are no longer willing to accept vision compromise."

The reliability, comfort and technological improvements of OpTiFit soft toric lenses is responsible for the trend of prescribing soft torics to correct low levels of astigmatism, said Dr. Akerman. "In the past, the success rate for toric lenses was less than for spheres. But that difference has disappeared as toric lens technology has improved," he said.

Wesley-Jessen also reported that it has added additional options to its widely used Optibank program for volume purchasers of its OptiFit toric lenses. The OptiBank program allows practitioners to lock in favorable pricing with a commitment to purchase OptiFit lenses over a 12-month period. Four bank levels are now available.

For the practitioner who has little experience with OptiFit, there is a "Trial Bank." This option, priced at $240, allows trial of OptiFit on up to five patients at attractive pricing. There are three other levels of Optibank. With "Optibank 15," free overnight or two-day shipping is available for all OptiFit orders. For its highest volume users, "Value Optibank" is now available. It locks in the lowest pricing on the entire OptiFit line through March 31, 1994, and offers free overnight or two-day shipping for all OptiFit orders.

Corning Launches Consumer Public Relations Program

Corning's first entry into consumer publicity for its photochromic lenses has proved to be an outstanding success. A story based on presbyopia and the 39 million Americans over 40 who suffer from it was sent to over 8,000 local newspapers across the United States in the special 1993 Health and Fitness Section of a major syndicated service. Corning chose a very topical subject on which to base its first move into consumer public relations — presbyopia — since today's baby boomers are not only parents, but also middle aged.

The story, "Have reading glasses become a necessity?" discusses the drawbacks of drugstore reading glasses which come with plastic lenses, against the benefits of glass lenses. Corning's glass photochromic lenses are described as an even better option for reading glasses due to their adjustment to different levels of light indoors and outdoors.

(Continued on page 118)

SYMPOSIUM

Enhancing Teaching with Computers

Design and Pedagogical Issues in the Development of the InSight Series of Instructional Software

John A. Baro, Ph.D., and Stephen Lehmkuhle, Ph.D.

Abstract

A number of design-oriented and pedagogical concerns are discussed in the context of planning and developing instructional software. Design issues include the choice of a hardware platform, identifying the audience, defining the scope and limitations of the subject matter to be presented, designing an appropriate user interface, selecting a programming environment, obtaining user feedback, and distribution of the software. Pedagogical issues include evaluation of the practical advantages associated with instructional software, improving upon traditional techniques, and developing novel applications not possible with other media. These considerations are illustrated with examples from our ongoing software development efforts at the University of Missouri - St. Louis School of Optometry.

Keywords: *Macintosh™ Computer, Educational Software, Computer-Aided Instructions, CAI, Instructional Design*

Introduction

The Macintosh™ computer, with its built-in color, sound, multimedia, and networking capabilities, provides an ideal platform for the development of easy-to-use, interactive instructional software. However, in order to take full advantage of these capabilities, a number of issues must be considered when developing software to be used by students for instructional purposes. In this article we outline some of the theoretical and practical considerations that were important and guided us in the development of the InSight series of instructional software. These issues can be very broadly divided into two categories, software design and pedagogical issues. Software design issues primarily include the more mechanical aspects of developing software of any kind (e.g., the choice of a hardware platform, the designation of a target audience, and the design of a user interface). Pedagogical issues concern how the software contributes to and enhances a curriculum or achieves instructional objectives.

Dr. Baro is an instructional designer at the NASA Classroom of the Future, Wheeling Jesuit College, Wheeling, West Virginia. Dr. Lehmkuhle is an associate professor at the University of Missouri - St. Louis School of Optometry.

Design Issues

The Hardware Platform. We have used the Macintosh computer in our research for several years. When the platform evolved sufficiently (i.e., the advent of HyperCard software, color capabilities), we decided that the Macintosh computer was best suited for the development of our instructional software. One important factor in this decision was the Macintosh's user interface. Although some training is required in order to use any computer, the time devoted to such training is minimal on the Macintosh as compared to other platforms. Once the basics are mastered, the user can operate virtually all applications with little or no additional training. This is due to the consistency of the interface across applications, which permits a high transfer of skills from one program to another.

Consistency of hardware is also an important consideration. All Macintosh computers are equipped with the core operating system, sound output capabilities, networking hardware and software, and all current Macintosh models have built-in video and sound input capabilities. As a developer, you need not be concerned with the type of printer used, whether or not the user has added a sound card, or the type of video card they will be using (some older models do not have color display capabilities). This means that, with minimal effort, you can create software that can be used on virtually any Macintosh computer.

The Target Audience. Before embarking on the development of software of any kind, you must decide who the typical user will be. In defining your audience, age, educational level, and previous computer experience are obvious considerations. A less obvious factor is the context in which the software will be used. For example, less experienced users can take full advantage of fairly sophisticated software if the appropriate training and supervision is provided. If students will be using the software with little or no supervision (e.g., when software is provided and used in public computing facilities), then the software should be as intuitive as possible and a vehicle must be provided to deal with problems or questions that arise. If a certain level of computer literacy is required, then students must receive the necessary training before working on exercises on the computer. Otherwise, the student is overwhelmed by the operation of the software and does not glean any educational benefit from completing the exercise.

We have designed the InSight series for use by undergraduate, graduate, and professional students with little or no previous computer experience. Prior to using the software, students need only to have mastered some basic terminology (e.g., terms such a "clicking" or "button") and the basic operation of the computer (e.g., using a mouse to point and click, making selections from pull-down menus and on-screen buttons, using scroll bars in a scrolling text field). In order to insure this minimum level of proficiency, in-class demonstrations are provided prior to exposure to the software and the completion of on-line tutorials is strongly recommended. Exercises are then assigned on a regular basis, which students complete on their own time. A teaching assistant is available to answer students' questions and provide supplemental instruction as necessary.

Subject Matter. A fairly precise description of the intended subject matter, its scope and limitations, must be formulated before development begins. It is overly ambitious to attempt to develop software that will entirely replace all the information and functionality of previously used teaching techniques. Since many students prefer to browse and skim textual information, printed material is generally preferred by students to on-screen text display. Textual information should be provided only as a supplement or review of information provided elsewhere (i.e., the textbook). A more realistic approach is to design software with the purpose of supplementing and enhancing the teaching of specific topics in a course. The software should provide experiences not available elsewhere, for example, animations, interactive demonstrations, and exercises with immediate feedback.

When designing InSight, we concentrated on the demonstration or experiment portions of the programs; background information, references, and other supplemental materials were provided, but have only an auxiliary role in the exercises. Our goal was to provide students with hands-on experience in experimental design and data collection/analysis techniques within the areas of vision/visual perception. Our intent was never to replace the lecture, but to enhance the students' experience of particular topics covered in lecture in a laboratory format.

User Interface Design. As important as defining the subject matter is deciding on how to present it to the students. The user interface is what determines how the software looks and how it will be used. Although many aspects of a Macintosh program should adhere to Apple's Human Interface Guidelines (e.g., see *Human Interface Guidelines* or *HyperCard Stack Design Guidelines)*, there remains a great deal of flexibility in how the user interface is designed. The following are just a few of the things that should be considered:

Program structure — Should the program have a linear design in which students proceed from topic to topic in a specified order, or will the students be able to browse and move freely from topic to topic?

Navigation and selecting options — The program should utilize standard items such as pull-down and pop-up menus, buttons, and dialog boxes, but can also implement less common, but useful items such as program "maps," textual reminders, or progress indicators where appropriate. HyperCard in particular has a number of standard objects used for navigation within stacks.

Layout and graphics — All components of a program should have a consistent layout and visual style, unless there are some specific reasons to do it otherwise. In general, the function of on-screen buttons should be clear and consistent (icons are only useful if the user knows what the picture means), the layout of screen elements should be organized and uncluttered, and fonts should be legible and different types used sparingly. Graphics, in particular scanned and/or color images or animations should be used as appropriate to enhance or simplify the presentation of information. For example, in an anatomy lesson, a graphic image with minimal text can create an uncluttered visual display in which students can click on different portions of the image to present additional information in a "pop-up" format.

Sound — Sound, especially digitized recordings of speech or music, can greatly enhance the impact of virtually any instructional software. However, sound should be used sparingly and only when it serves a specific function; the repetitive use of an unnecessary sound can quickly become annoying.

Help — In addition to, or instead of, printed documentation, on-line help/instructions should be readily available. This is especially important if the software will be used with little or no supervision from the instructor.

One other factor which determines how the software will be used is the overall organization of the program. In general, a division into individual exercises, each of which can be completed in 30 minutes or less, is most desirable. Each exercise should be a stand-alone, self-contained lesson that focuses on a single topic. This type of organization permits the student to complete an exercise in a single session.

Programming Environment. The selection of a programming environment depends on the programmer's level of expertise as well as on the subject matter of the program. Apple's HyperCard™ environment, and the associated HyperTalk™ programming language, are ideal for a wide variety of instructional software. HyperTalk™ is a relatively easy language to learn and to develop programs in because many of the complexities of Macintosh software development are hidden from the programmer. The creation of standard menus, buttons, text fields, and many other interface or navigational components is considerably more straightforward than doing so in a traditional language. The same is true for the inclusion of graphics, digitized sound and music, and simple animated sequences.

There are, however, some limitations to using HyperCard, including a non-standard Macintosh interface, slow execution times, inadequate support for color, and difficulty in creating certain non-standard interface elements (e.g., complex dialog boxes). If your design specifications call for functionality not supported by HyperCard, then the use of a more traditional programming language is required. If your additional requirements are modest, the HyperTalk™ language can be extended with the creation of external commands (XCMDs), programmed in another language then added to the HyperCard environment. However, if a stand-alone Macintosh program is required, a *substantial* increase in development time should be anticipated. The creation of standard Macintosh programs can be quite complex and time consuming and is not suggested for the programming neophyte.

The first InSight package was developed almost entirely in HyperCard. We did however supplement HyperCard with a small number of XCMDs, some of which were general-purpose XCMDs obtained from third-party sources and others were created specifically for our software. The demonstrations included in InSight 2, on the other hand, could not be implemented in HyperCard. Our requirements for speed, the use of color, and the inclusion of real-time animations dictated that we use a more traditional approach to programming. To speed development, we decided to take advantage of HyperCard's unique strengths where appropriate and to create stand-alone programs where necessary. The result is a set of demonstrations that have a HyperCard "front end" that launches and controls standard Macintosh programs. HyperCard was used for navigation between demonstrations, the presentation of textual materials (i.e., instructions, background, study questions), and the presentation of experimental results. The actual demonstrations themselves were standard, stand-alone Macintosh programs, developed in the Think Pascal environment, that were launched from HyperCard and returned control to HyperCard when completed. This combination of programming environments has proven to be an excellent compromise, taking advantage of the strengths and avoiding the weaknesses inherent in each approach. Keep in mind however, that this was our *second* major development project; much was learned in the development of our first, HyperCard-based package.

Program Testing. Review and testing is necessary in order to develop a stable and usable program. It is nearly impossible to anticipate all the problems and inconveniences of a program without receiving feedback from novice users. Colleagues and others familiar with the subject matter of the program can provide feedback with respect to content (i.e., accuracy, scope, appropriateness for intended use) and functionality (the inclusion of necessary and appropriate capabilities). However, testing by students typical of those in the target audience will provide useful feedback with respect to ease of use, ability to hold attention, adequacy of instructions or help, and the presence of bugs (if bugs exist, students will uncover them). Feedback can be provided via informal debriefings as well as written questionnaires or formal interviews. Both types of review are important and should be used to guide the development and evolution of the software. The final program is rarely the same as, and often quite different from, the original implementation.

Program Distribution. If you would like your software to be used by others, there are two alternatives: distribute it yourself or have it published. Many developers of instructional software would like to make their products readily available for little or no cost. Releasing the program into the public domain (i.e., giving up all control and rights) or releasing it as shareware (i.e., retaining copyrights, but asking users to pay a fee) are two avenues for open distribution of the program. This approach can potentially make the software available to a large number of users; however publicizing, advertising, and distributing the software are the responsibility of the author. Mail-order shareware distributors and local bulletin board services may also be willing to advertise and distribute your program for a nominal fee to users. This avenue for distribution will necessarily involve an investment of both time and money, sometimes substantial amounts of each; however all remuneration will be retained (i.e., there is no publisher to take a percentage of the proceeds).

If you would like to make your software available to others, but do not want to devote the time necessary to distribute the software yourself, then commercial publication is a good alternative. The type of software will typically determine the most appropriate publisher. Many software publishers specialize in instructional products, sometimes for a particular hardware platform. Another popular trend is bundling software with a textbook. If the software can accompany a particular textbook, a book publisher might be interested in distributing it. The major advantage to this approach is that virtually every aspect of distribution (e.g., advertising, publicizing, record keeping) is done by the publisher. The only real disadvantage is monetary — the author typically receives a royalty, a small percentage of the sale price, much as the author of a textbook would. As compared to distributing the software yourself, the amount received per unit sold is considerably less, however it is likely that a larger number of units will be sold. Unless you are fairly ambitious with respect to publicizing your own product, commercial distribution will enable the software to reach a much wider audience than if you distribute it yourself.

Pedagogical Issues

Practical Advantages. The kind of instructional software discussed here to be used for simulations and demonstrations offers a number of practical advantages that should not be overlooked. One major advantage is in terms of cost savings. In a laboratory course in which experiments and demonstrations are performed by students, a variety of equipment is typically required. This specialized equipment can be costly, and is often dedicated to a single function. In addition, special-purpose hardware requires an instructor or assistant familiar with setup, operation, and maintenance, which can involve a substantial amount of time. Implementing demonstrations and experiments on the computer can save a significant investment in both time and money. A single piece of equipment can be used for a variety of lessons. Compared to the equipment used in some perception experiments, savings in cost can be substantial. Being involved in the teaching of vision/perception, we are especially fortunate in that the kind of laboratory exercises we require (e.g., that involve the presentation of visual stimuli, recording or tabulation of responses, summary of results) are particularly well-suited to the computer. Setup and breakdown time is reduced or eliminated; at most, programs need to be copied or deleted. Operation, if the software is well-designed, will require little or no instructor intervention. In general, instructor/student interactions can concentrate more on the *content* of exercises than on their *implementation*.

For example, a demonstration of spatial contrast sensitivity can require the use of special-purpose and often costly hardware. Because of limited budgets, demonstration of and student interaction with this very basic perceptual metric is either avoided or poorly simulated at best. With the use of our software however, spatial contrast sensitivity functions can be obtained using either or both of two different psychophysical methods; no special hardware is required. In addition, by completing the exercises in the assessment of spatial contrast sensitivity, students are exposed to and interact with psychophysical techniques, experimental design, and various strategies for data collection and analyses.

Versus Traditional Methods. In developing the InSight software our main objective was to enhance the students' experiences in the laboratory portion of a class. This objective was implemented by making the experiments and demonstrations *interactive.* The degree of interactivity built into the software is not possible with traditional methods or dedicated equipment. By interactive, we mean that students can directly manipulate many aspects of the demonstration and have an immediate and observable effect on the outcome. In other words, "what if?" experimentation by students is facilitated and encouraged, and feedback is immediate.

As an example, our Form and Motion demonstration provides both classic and novel examples of the "structure from motion" phenomenon, in which vivid, three-dimensional structures can be perceived from the motion of randomly-positioned dots. Traditionally, classroom demonstration of this phenomenon has been limited to the presentation of a movie or video tape, or even more often, a verbal description. In our software implementation however, students can directly manipulate a number of parameters, generate a new animated sequence based on their parameter settings, and then see the perceptual consequences of their manipulations. Because students are free to manipulate all relevant parameters, the learning situation becomes very flexible and promotes creativity. With a "canned" videotape demonstration, the learning situation is more rigid and precludes the kind of exploration and experimentation possible with a more interactive medium.

Novel Techniques. In addition to supplementing and enhancing existing methods, novel applications are possible with instructional software. One can design instructional software that will provide experiences unique to the medium. This is especially true in the area of multimedia presentations. The computer is particularly well suited to the storage and retrieval of vast amounts of data in a variety of formats, including digitized, still images, compact discs, video tapes, animations, and sounds.

An example of a novel learning experience made possible by InSight is the Spatial Vision demonstration, which illustrates the contribution of the spatial components of an image to our perception of the image in a way that was not possible before. The program permits students to load any image stored in a standard format and manipulate the Fourier components of the image. By directly manipulating a representation of a human contrast sensitivity function, spatial components can be reduced or eliminated from an image (i.e., digital filtering) and the result displayed. This enables the simulation of the perceptual consequences of a variety of visual pathologies, permitting the student to experience what the image would look like to an individual with, for example, a cataract or glaucoma.

Equipment Setup and Availability. One of the more practical of the pedagogical issues involves the computer laboratory itself. In order for students to take full advantage of instructional software, an appropriate environment must be provided. It might appear at first that setting up a student computer laboratory can be a very costly venture, and not necessarily more efficient or cost-effective than setting up a more traditional laboratory. We have found however that if the software is easy to use, students can complete the exercises independently. As a result, it is not necessary to schedule laboratory periods when a large number of students meet to complete exercises under direct supervision. Instead, students have access to a computer facility in which they can complete exercises on their own time. This type of arrangement permits a relatively large number of students to be adequately served by a relatively small number of computers. For example, in our school a typical class consists of 40 students, who are required to complete one exercise per week on average; each exercise takes no more than 30 minutes to complete. To accommodate these students, we have two computers in our library used exclusively for class-related exercises. Students have access to these computers during normal library hours, and there are sign-up sheets available for reserving computer time if necessary. We have found this arrangement to be quite satisfactory.

System Requirements and Availability

InSight will run on any Macintosh with at least 2 MBytes of memory, a hard disk (1.5 MBytes free), and HyperCard™ software version 2.0 or later (HyperCard™ is currently provided with all new computers). InSight 2 — InColor requires a Macintosh with color capabilities (currently an LC, SE/30, II series, Performa, Centris, or Quadra). Additional requirements include System 6.05 or later, 2 MBytes of memory (4 MBytes if System 7 is used), a hard disk (3.5 MBytes free), HyperCard™ software version 2.1 or later, 8-bit color (256 colors), a minimum display size of 640 x 480 pixels, and a math coprocessor (required by only one of the demonstrations). If you would like to be able to produce hardcopy output, a printer is also needed. Both products are distributed by Intellimation, *Intellimation Library™ for the Macintosh.* Lab packages and site licenses are available.

Summary and Conclusions

We have outlined some factors, with respect to both design and pedagogy, that should be considered when planning and developing instructional software. Design issues that we have discussed include choice of a hardware platform, identifying your audience, defining the scope and limitations of the subject matter to be presented, designing an appropriate user interface, selecting a programming environment, obtaining user feedback, and distribution of the software. Pedagogical issues include evaluation of the practical advantages associated with instructional software, improving upon traditional techniques, and developing novel applications not possible with other media. These considerations have been discussed within the context of examples taken from our on-going software development efforts.

Our goal was to illustrate not only the issues involved in instructional software design, but also how these principles can be put into practice in an actual product. Although it is not always possible to implement all original design goals, we believe that we have shown that it is possible to develop a viable and useful product that enhances students' experience beyond that possible with more traditional media.

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Innovations in Pedagogy: Curriculum Considerations

David A. Heath, O.D., Ed.M.

Abstract

In an effort to meet increasing demands upon the curriculum and increased expectations for student learning, educators are turning towards technology and alternative instructional strategies. Decisions to use innovative teaching methods or new technologies must be carefully considered with pre-implementation strategies for measuring the effect of the decision. This paper will discuss the process of curriculum reform, the role of pedagogy and technology in that process and the use of outcomes assessment to monitor change.

Key Words: *Outcomes assessment, curriculum, computer assisted instruction, pedagogy, curriculum reform.*

The expansion of the scope of practice in optometry has created pressures never before experienced by colleges and schools of optometry to continually modify their curricula. The seriousness of the challenge is no better evidenced than by the occurrence of three major conferences on optometric education during 1992 with more planned for 1993.

New demands for curricular time and an increasing emphasis on cognitive skills have created a climate in which content reviews are no longer sufficient. It is imperative that pedagogy be explored as well as content with the goal of maximizing the learning and analytical skills obtained by our students within the time constraints of a four-year curriculum.

The purpose of this discussion is to consider the incorporation of alternative approaches to teaching, of which computer assisted instruction (CAI) is one, as an integral part of curriculum review and reform. Each stage in the curriculum development process will be discussed, but there will be an emphasis upon outcomes assessment as an important step in curriculum development, particularly when fundamental changes in pedagogy are considered.

Behavioral Goals & Objectives

The use of behavioral goals and objectives is well established as a means of defining the outcome of the educational process. These may be established for learning modules, courses, a specific track or program, or the curriculum as a whole. Prior to defining curriculum content and the process by which a student will learn, it is critical that the behaviors to be obtained are clearly defined.

It is important to recognize that for today's graduate, there is a greater emphasis upon clinical problem solving skills and critical thinking than in the past.[1,2] If the goals and objectives are properly designed, all requisite skills may be identified and reflected throughout subsequent stages of curriculum development and assessment.

Defining Requisite Knowledge and Skills

Once we establish the educational goals and objectives, the requisite knowledge and analytical, technical and social skills required for entry level competency into the profession must be defined in more detail. Many curriculum reviews stop once the content has been defined, and it is simply left to the predilection of a single faculty member to decide how the information is best presented.

Unfortunately, the teaching method selected usually reflects the history and tradition of the instructor, rather than the needs of the learner. If properly performed, the formal process of curriculum review should consider pedagogical approaches which are most likely to result in the effective and efficient achievement of the objective by the student.

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Figure 1

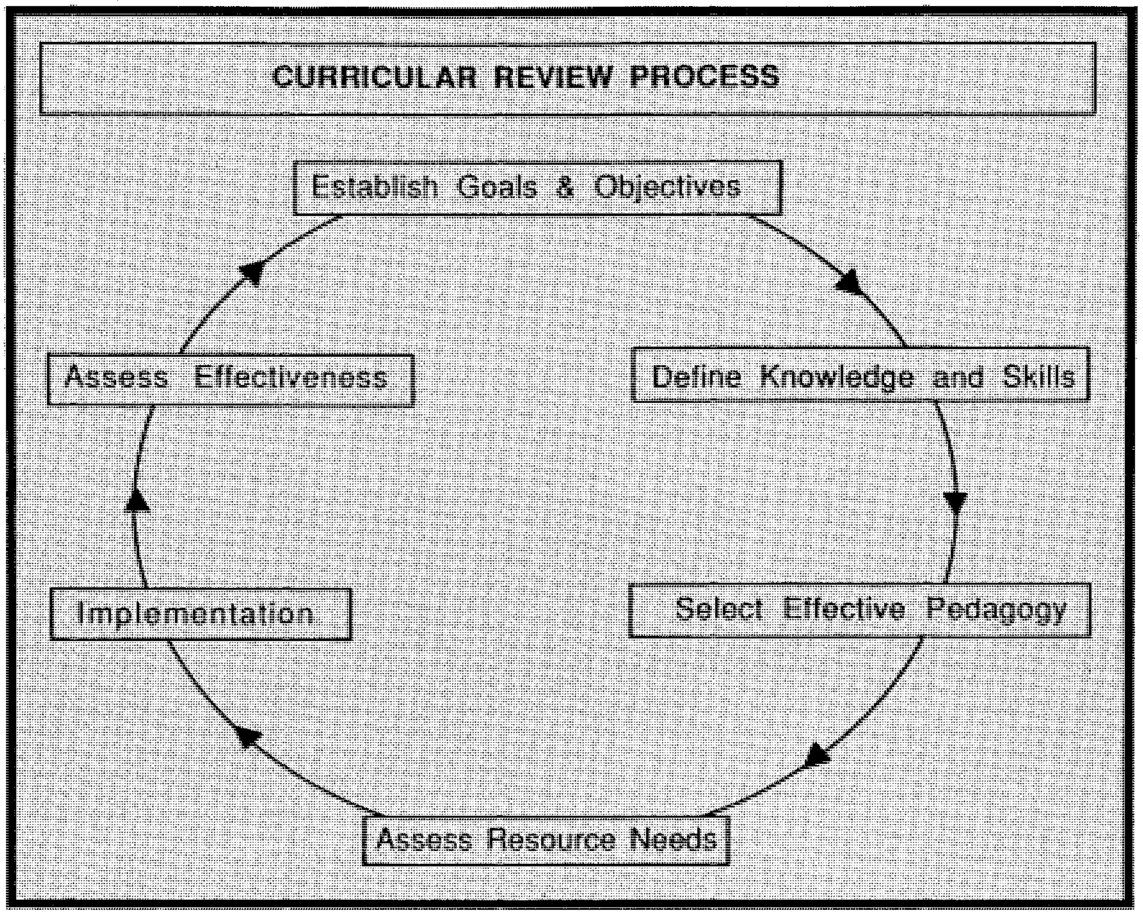
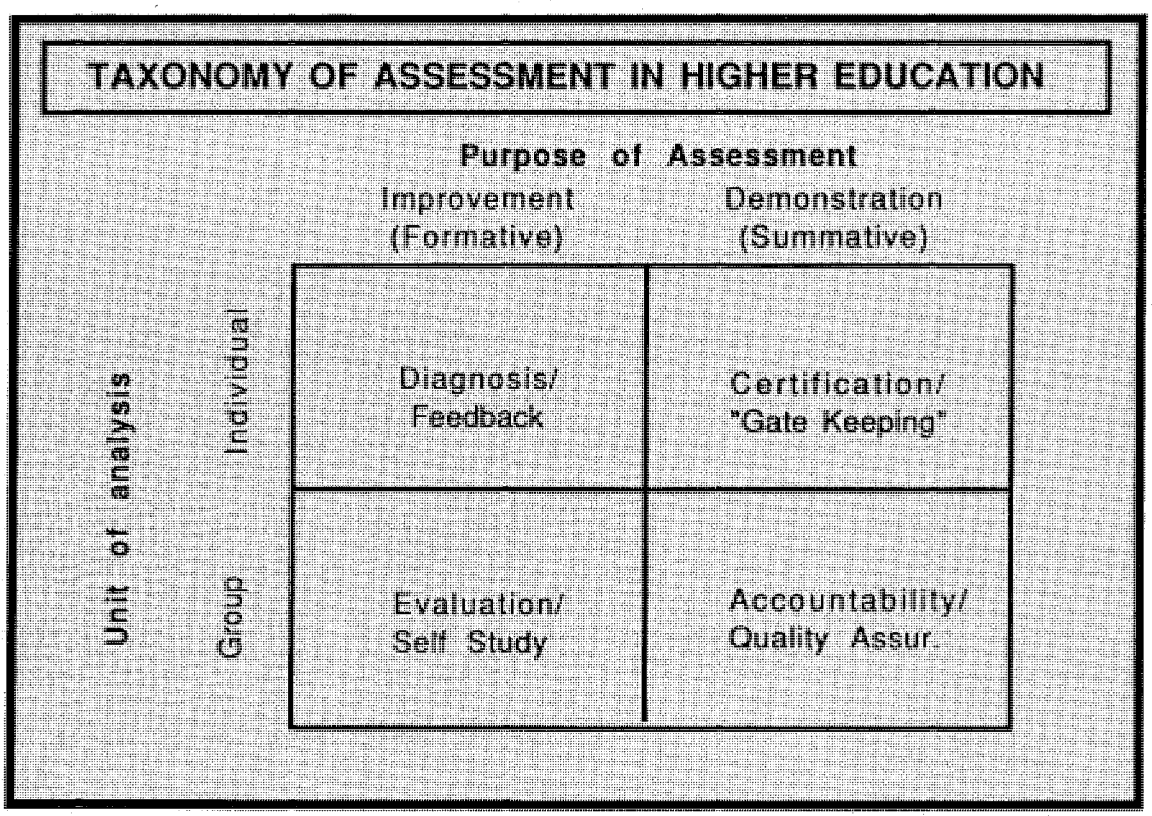


Figure 2



Pre-implementation Assessment of Pedagogy

The instructional process employed in optometric education is frequently grouped into three broad categories: lecture, lab and clinic. While noting the learning environment, these labels lack specific information regarding teaching methods.

For example, in lecture, is the faculty member simply presenting the material without student dialogue, or is he or she engaging the class in discussion? Are there ten students or a hundred students? Does the instructor employ the Socratic method? Does he or she use overheads, videos, slides, or computer projection? Have the materials used been developed to emphasize factual knowledge, the development of conceptual understanding, the application of principles or the development of problem solving skills? Teaching methods which fall under the general concept of lecture are numerous, but they are not equally applicable. Rather, they depend upon the course objectives.

Hannifin and Peck[3] note that "wise educators select the appropriate [instructional method], based upon the learning task, the learner profile, external constraints and the specific objectives they are trying to achieve." This comment underscores the need for faculty to consider their teaching methods from the perspective of the learner, rather than as the conveyor of knowledge or skills.

Regardless of which method of instruction we are considering, it is useful to reflect on some general characteristics of instruction which facilitate effective learning. An initial listing, which is by no means comprehensive, may include:

1. Clear communication of learning goals and objectives
2. Active learning that engages the student
3. Accessible to different learning styles
4. Sensitive to individual differences
5. Motivates the student to learn
6. Develops intellectual independence
7. Provides timely feedback
8. Provides accurate evaluation
9. Facilitates achievement of course goals and objectives effectively and efficiently

When considering the use of a given teaching method, it is helpful to consider the relative strengths of each of the above characteristics and the degree to which they support what is being taught.

Using CAI as an example, a comparison of these nine points with the characteristics of effective CAI packages as noted in the literature reveals expected similarities.[3] In particular, a well designed CAI module is quite sensitive to individual differences in learners, provides frequent feedback and accurate evaluations and by its interactive design, actively engages the student. On the other hand, modules designed externally may not be precisely what is needed; the time investment required on the part of some students may exceed that required by other methods. In a crowded curriculum, time demands are quite critical and need to be carefully considered.

Let us continue to use CAI as an example. If a CAI module were content appropriate and well designed, the question then becomes, under which curricular conditions and to what extent does computer-based instruction reflect characteristics for effective teaching of the material at a level higher than more traditional methodologies?

Depending upon the nature of the program, CAI programs may be useful in lectures, laboratories, clinical settings or as adjunct tutorials. It is important that a decision to use computer assisted instruction as an integral feature of the curriculum be judicious and well informed. Even a decision to retain a traditional lecture approach should be conscious and rationally based rather than presumed due to historical precedent. Similarly, a decision to use technology for technology's sake would be as likely to affect adversely our efforts to educate for optometry tomorrow as to support them.

Institutional Resources

Moving away from traditional teaching methods requires not only careful consideration of the effectiveness of the "teaching tool," but also a consideration of institutional resources.

Again using the CAI as our pedagogical example, implementation of CAI involves the purchase of computer hardware if it is not already available. It is also important to remember that if computer-based instruction is becoming a part of a course, students need access outside of the instructional period to work with the programs. This often necessitates increased access either to a teaching laboratory or a computer center. Increasing access may require capital outlay of equipment and personnel.

It should also be anticipated that considerable faculty time will be necessary for implementation of any change in teaching methods. For CAI, this is especially true if the instructional module is being created in-house. While simple programs are becoming easier to develop, more advanced multimedia presentations require a tremendous investment of time. Time estimates for the development of CAI modules range from a few hours for simple programs to hundreds of hours for multimedia presentations.

Regardless of whether the pedagogy selected is CAI or another variation from traditional methods, such as problem based learning, faculty training must be considered as an institutional investment in addition to facility or capital equipment requirements.

Outcomes Assessment

As curricular reform occurs and decisions to integrate new forms of pedagogy into the curriculum are made, it is critical that these changes are assessed for effectiveness and the answers to a variety of questions.

Is the method of instruction effective? Is the quality of teaching and the student learning being improved? Are the students achieving the established goals and objectives? Are our students demonstrating entry level skills for the profession upon graduation? These are just a few of many questions that may be asked.

The field of *outcomes assessment* has grown rapidly and changed dramatically over the past decade. Spurred on by a perceived need for educational improvement, a higher quality of education (internal to the academy), and enhanced accountability (external), a wide range of assessment measures have been tried.[4,5,6]

While much of the work done to date has been at the under-graduate level, the current demands for reform of the optometric curriculum establish outcomes assessment as not only desirable but necessary. Beyond an internal recognition of the value of assessment, it is evident that optometry schools will be affected in the future by an external mandate.

Current estimates suggest that up to seventy percent of American colleges and universities are establishing assessment programs. Approximately forty states are either considering the implementation of assessment plans or now mandate assessment programs in public universities.[4] Similar pressures are being exerted by accrediting agencies.

The Council on Optometric Education's (COE)[7] accreditation standards have become quite explicit, stating that schools and colleges must have programs to assess curriculum, clinic management and patient care. Within the area of curriculum assessment, specific mention is made of outcomes assessment relative to student mastery of curricular objectives and the ongoing review of the curriculum. The establishment of a strong assessment plan provides the opportunity for examining not only student performance, but also teaching effectiveness.

As colleges of optometry begin to establish programs of assessment, it is reasonable to reap the benefits of experimentation at the undergraduate level over the past decade. Most notable in the literature is the lack of similarity in the approaches used by different institutions.[6] It has become clear that methods of assessment must reflect the mission and the nature of the institution and address questions which are of the greatest interest to the college community.

One example of the institutionally unique nature of assessment strategies may be found in the Harvard Assessment Seminars[8]. In 1986, Derek Bok, then president of Harvard, simply requested that the faculty "study the learning process and the effects of its programs."[8] This broad challenge left the Harvard community to ask and explore what it felt were the questions which needed to be answered. The result was heavy participation in the Seminars, including more than one hundred faculty and students, and an array of questions generated, from which developed several educational research studies.

As colleges and schools of optometry select their own outcomes assessment strategies, it may be helpful to consider a taxonomy of assessment practices offered in the educational research literature.[4] Under this organizational scheme, assessment is defined by the two variables: unit of analysis and unit of purpose.

The unit of analysis is defined as at the individual level or the group level. In effect, are we as a faculty interested in measuring the effects of curricular reform upon the individual student or the class as a whole?

The unit of purpose is divided into formative versus summative. The formative is directed towards self-study and program improvement while the summative is more concerned with accountability and quality assurance. Many assessment tools may be used towards either end, however, the emphasis may have a significant impact on the success of assessment implementation. A heavy emphasis on accountability, rather than formative feedback, may be quite threatening to those involved in the delivery of the curriculum and result in an undermining of efforts to improve curriculum.

In an era where curricular change must be rapid and effective, faculty and administration need to cooperate rather than compete on educational issues. To encourage this, assessment tools need to focus upon a community interest in self-study and improvement.

Assessment Measures for Optometry

While there appear to be as many approaches to assessment as there are institutions, several trends in outcomes assessment in higher education have been identified.[4]

Over the past decade assessment in higher education has become increasingly oriented towards group performance. For optometry this is particularly appropriate as the focus is upon the overall progress of the profession and curriculum development, rather than the capability of the individual student.

Most measures for assessing the quality of education have used longitudinal research designs with the emphasis on complex integrative abilities, rather than simple value added concepts. Towards this end, *performance measures* are being more heavily used. As a health care profession, optometry is fortunate to have a strong foundation in performance based measures.[5,9,10,11] With an educational system which is criterion based, many performance based measures for assessment already exist or are easily created. These include proficiencies, standardized testing, clinical performance measures, and patient management problems (PMPs).

Experience at the undergraduate level has also demonstrated the practicality of using several measures to monitor academic programs. It is readily acknowledged that many measures in educational research are suspect due to the lack of research controls in the educational setting. To overcome this deficiency, it is helpful to use a portfolio approach where trends are identified and corroborated through multiple measures.

Whether a given institution selects existing measures or creates new ones as a part of their outcomes assessment program, it is imperative that the measures are linked to the curricular goals and objectives. Only by comparing outcomes measurements with the established goals and objectives can we be confident our curriculum, in terms of both content and process, is effective.

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Creating Effective Computer-assisted Instruction

Daniel L. Schwarz, M.D.

Producing Successful Computer Software

The most important considerations in producing successful computer software are related to understanding the needs of the intended market or audience. Who will be using the product and for what purpose? Careful consideration of the targeted user group during all stages of development will ensure a result that meets the needs and gains the appreciation of the user. This concept applies to the development of educational computer-assisted instruction as well as to any other software program, and it is equally important whether the application is for in-house use or for commercial distribution.

Paying attention to the intended uses of the program extends to the academic content as well as to the technical aspects of the project including designing of the user interface, choosing a software authoring system, and selecting an appropriate delivery system.

For this reason, you should write a statement of purpose before the start of any significant development work. This document will direct the expenditure of time and resources used in collecting or in creating components of the program. This step will help to avoid confusing users with information not directly supporting the intended goal. It is important to be specific while creating the blueprint.

Finally, before embarking on any computer-assisted instruction (CAI) development project, determine if it is genuinely worth the effort. Will the learning process be significantly enhanced? Will it be made more enjoyable? Once instituted, will the new teaching method save students and faculty time or in reality add to their burdens? Creating effective CAI requires a major investment of time and other resources. The final product must provide a much needed service or significantly enhance an existing activity. Otherwise, it will not be a worthwhile undertaking, and it will not be appreciated.

Abstract

Nearly all educators agree that microcomputer technology has exciting potential in the medical school classroom and teaching laboratory. Recent software development aids make it possible for individuals with limited knowledge of computers to create teaching applications. However, the goal is not only to present facts on a computer screen; the computer must be used to enhance the learning process. It can save time, add variety, provide ready access to multiple resources, offer immediate feedback, and increase knowledge retention.

KEY WORDS: *computer-assisted instruction, medical education, multimedia, hypertext, computer graphics*

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The Creative Process

Many CAI applications develop gradually through the efforts of a single person working on a project in his or her specific area of interest. A few of these projects become important parts of a teaching curriculum. More often though, such individual efforts get sidetracked somewhere in the developmental process. Reasons for these difficulties usually involve a lack of resources, insufficient technical expertise or both.

Effective CAI does not just happen. It is the result of careful planning, long-term vision and lots of work. This creative process can be organized into a cycle comprised of four essential steps or phases: planning, design, execution, and distribution. The entire process must be guided by constant reference to the two imperative considerations presented above: the targeted user group and the primary goal of the application. These two considerations provide essential direction for every aspect of the project from solidifying the initial concept to getting the application into the hands of the users.

Finally, frequent internal review assures that the coordinated efforts involved in the project result in an effective application. Carefully directed evaluation and reevaluation is necessary during all phases of the project.

The Planning Phase

All complex enterprises must have direction, and software development is no exception. By following a few simple steps at the outset, the entire process will progress more smoothly.

Begin by forming a project committee. This group will draft the statement of purpose to formalize the goals and scope of the project. It will also periodically review the progressing work. As the number of people on a committee is often inversely proportional to the amount of effective work that gets accomplished, limit this main group to essential personnel.

A formal committee may be difficult to arrange in some situations. In that case a more loosely organized team will suffice. This group should include one or two individuals who have a good grasp of the overall concept of the project, an individual with a firm understanding of the technology involved, and someone who is expert in the academic subject to be covered by the application. Some of these roles may overlap. Also, it is important at this early stage to have input from a member of the target user group. A core project committee of only four or five members can work very efficiently.

The first task of the main project group is to produce a statement of purpose. This document will serve as a road map or pattern for the duration of the project. It needs to define the exact target user group and list the specific goals for the application. The more precisely you define these two items, the more smoothly the project will progress. Record sufficient detail regarding the group's decisions to be clear to those working on all aspects of your project.

After the specific goals are defined, the scope of the project needs to be determined. Maintaining careful focus on a particular topic area during the planning phase of the project avoids the risk of having the project expand to impossible proportions. This step completes the statement of purpose.

Next, the members of the planning team should be assigned tasks in their respective areas of expertise. They may in turn need to form working groups of their own to accomplish the goals of each aspect of the project.

Most of the development work will fall into three distinct areas: content, interface, and programming. The content group will be responsible for collecting and organizing the academic material which will be presented. The interface group will determine the hardware platform and design the software user interface. The programming group will incorporate the content material, program design, and hardware platform into a working learning environment.

The Design Phase

Commercial software companies spend much time and money developing interesting and intuitive user interfaces for their software applications. They have discovered that it is this aspect of their product that wins customers. A well designed user interface will make your program more effective by making it easier for the student to use. A strong effort in this regard will also make your CAI project more professional in appearance and more likely to meet the expectations of your users.

Details which should be considered include: hardware platform (PC, MAC, NeXT, Sun, etc.), type of user input device (keyboard, mouse, touchscreen, etc.), interface style (text entry, menu driven, point and click, etc.), interface look and feel (character vs. graphics-based, windowed, etc.), organization (top down, hierarchical, directed, user controlled, etc.), interactivity (pick list, free text, instant feedback, delayed feedback, etc.), and clinical correlation (retrieval cues, clinical cases, etc.)

A software environment will need to be selected in which to develop the application. If there are professional programmers available, a high level programming language might be used (C, Pascal, BASIC, etc.) In the majority of educator produced CAI projects, it is more common that an existing authoring system is selected. These software construction aids have their own scripting languages and are easier to master than traditional programming. These programming environments are marketed primarily for use by the non-computer programmer and offer developers many tools for constructing an original application. While not exactly simple to use, software construction aids can yield impressive results. Examples of such authoring systems include Guide (Owl International), KnowledgePro (Knowledge Garden), ToolBook (Asymetrix), and HyperCard (Apple Computer). The choice of programming environment will determine the text and graphics formats to be used by the application.

Some of these issues are technical in nature and may warrant further reading. A short reading list is given at the end of this article. Some choices may be predetermined by the resources that are already available in your situation. Even so, explore all the options. Exciting and helpful new products appear almost monthly.

A few books have recently been released that cover multimedia programming in some detail. Much of the information they provide applies to instructional program development. Computer industry magazines (PC Computing, Compute!, Byte, etc.) are filled with reviews, examples, ideas, and tips. Obtain samples and demonstration copies of commercially produced software as well as instructional programs developed by other educators. Attend conferences and conventions offered by schools, computer vendors and national organizations such as AMIA (American Medical Informatics Association). You can get many good ideas by seeing what others have accomplished. You will also gain an appreciation for what your users will expect of your application as a result of their prior exposure. For example, certain interface standards have been established, and it is a good idea to follow their lead.

Most new CAI applications take advantage of the computing power of the latest generation of microcomputers. The multimedia capabilities of these systems are truly marvelous. Colorful point-and-click interfaces, high quality sound effects, animated images, and digital video are now readily available. While most educational institutions have not yet installed a large number of these systems, it may still be worthwhile to develop your application for one of them. The value potentially added to the learning process by incorporating some multimedia is very significant. People have been conditioned by television, film, and video games to expect a lot from interactive computer applications. It is better to require students to schedule time to use a great program on one multimedia capable system than to have your program sit unused on every monochrome terminal in the university. Fortunately, prices of multimedia PC's have been reduced 30-40% in the past year.

The Execution Phase

Progress on different aspects of program development will occur at the same time. While some members of the project are involved with planning and design, others will be collecting the information comprising the application database. Data for use in your application can come from any number of sources including on-line computer information services, textbooks, radiological teaching files, microscope slides, lecture transparencies, original text, original art, etc.

Most of your material will be captured or "digitized" using a digital scanner or video camera attached to a computer. As the data is collected it will need to be converted into a format compatible with the hardware and software you have elected to use. Numerous software programs are available for converting graphic images between common image file formats. Examples of such utilities include Hijaak (Inset Systems) and PictureEze (Application Techniques).

Be creative when selecting and preparing your material. The computer can and should be used to enhance both text and graphics. Text can be reformatted, indexed, and filled with automatic links (hypertext) to definitions, related topics, and illustrations. Graphic images from multiple sources can be edited, colorized, labeled, combined, and linked (hypermedia). Three-dimensional models, animations and simulations can be created. It helps to have a graphic artist available who is familiar with these techniques and who can help you build them into your application.

While the educational material is being prepared, the programming group can be working as well. They can begin implementing the user interface in the development environment selected for the project. It is not necessary to have a completed database to begin this work. The full knowledge base and any hypermedia links can be inserted during the final stages of the project.

The technical team should have a clear and precise set of specifications from which to work. Most computer programmers expertly solve programming challenges, but relying on programmers to make design decisions or to create an intuitive interface is unwise. There must be almost constant communication between representatives of the interface working group and the programmers. The main project committee also should review the progress frequently while the programming is being done. This review is crucial in case something must be changed. A change which seems minor may entail hours or days of reprogramming and rewriting hundreds of lines of program code.

Program Distribution

Consider early in the planning stage the method by which the application will be delivered to your end users. Even if you plan to use your application only at your institution, there are numerous issues that will impact the course of the project from beginning to end. Most applications for local use will reside on magnetic media (hard disk) or videodisc. For larger applications, some institutions are using optical storage devices. Since in-house production of CD-ROM disks is now available for less than $10,000, CD-ROM is becoming more feasible for institutional use.

If you have thought about using a videodisc in your application, I suggest you consider the alternative fully digital system. Videodisc requires additional dedicated equipment to marry two different technologies. Its use limits the distribution of your application to non-networked video capable systems. Fully digital systems are becoming the technology of choice.

Be careful of settling for equipment already available to you if it is more than two or three years old. Too often university-based CAI projects are developed on older non-standard computer hardware that is uncommon, obsolete, impossible or expensive to upgrade and hard to support. This practice is short-sighted and unfortunate as good applications should be available for wider distribution and future expansion.

If your application is to be used on many different hardware platforms, you will have additional challenges. It may be necessary to supply separate hardware drivers for each platform. This requires more programming. The other alternative is to develop the application to operate on the "least common denominator" system. This last option will probably limit your application to using a simple text format.

Other considerations include accessibility and support. Does your institution have a computer learning laboratory with computer systems already in place capable of running the software? Will systems need to be purchased or upgraded? Are there full or part-time staff available for training new users? Will there be on-line help available within the application or will the developers be available for telephone consultation? It is never too early to consider these issues.

Review - a Continual Process

To attain your goal of producing an effective CAI program, all aspects and phases of the project need to undergo frequent review. The project committee will need to check and recheck the statement of purpose to make certain that the goals are being achieved and that the scope remains focused on the chosen topic area. The members of each working group will need to meet occasionally to review progress and share ideas.

Members of the target user group must be involved in the review process. A CAI application designed for a specific group but never seen by a member of that group prior to its completion may fail to meet the group's needs or gain the group's support. It will not be effective.

Mistakes will be confusing to users and should be detected and corrected as early as possible. Careful evaluation for internal consistency is also important. This includes everything from the wording of the menu choices to the color or font coding of hypertext link words, program or function icons, and window borders.

Do not be afraid to change your statement of purpose. During the review process your team may come up with a way to improve your application. Possibly a new technology will become available to improve image quality or an additional source of text or images may be obtained. If this happens, consider whether making the change (which may involve considerable time and effort) is going to add substantially to the value of your program. If so, by all means make the change.

A good CAI application can always get better. After the program has been in use for several months, take a poll or do a study to determine how well the program is being accepted. Are there suggestions for improvement or program errors to be corrected? Begin a new development cycle to implement the fixes and upgrades.

Conclusion

Computer-aided instruction may prove to be the greatest medium available to educators since the printed book. However, this will only be the case if the effort is made to create maximally effective applications. By following a thoughtfully developed plan and paying careful attention to necessary detail, truly effective enhancements to the learning process will result. Learning will be faster, better, and more fun.

NOTE: For further information on this article, contact Dr. Schwarz at da Vinci Enterprises Inc., 4805 Arkansas Ave., N.W., Washington, D.C. 20011 (202) 726-0780. Da Vinci Enterprises contracts with individuals and institutions to help them create and market medically oriented multimedia applications for use in educational and clinical settings.

Appendix A — Reading List

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Industry News

(continued from page 105)

Vistakon Launches Ad Campaign For Acuvue Lenses

Convenience, combined with the free trial pair offer, is the key message in a major new advertising campaign for the ACUVUE Disposable Contact Lens. Launched by Vistakon, a division of Johnson & Johnson Vision Products, Inc., the campaign was developed based on what best motivates consumers to try ACUVUE.

"The commercial compares the conventional way to wear contact lenses — tedious and repetitive cleaning routines — to the ACUVUE way to wear contact lenses — no cleaning, simple and convenient," said Craig H. Scott, Vistakon's vice president, product management. "We tested this commercial with consumers and it scored an all-time high for patient recall. It is the highest scoring commercial that we have produced since the introduction of ACUVUE."

"By creatively illustrating the convenience associated with the ACUVUE regimen, we effectively communicate why ACUVUE provides a better, more convenient way to wear contact lenses," explained Scott. "Plus, we've incorporated the free trial pair offer in our ads to drive consumers into their doctor's offices."

Varilux Symposium On Presbyopia

Varilux Corporation announced the Varilux Symposium on Presbyopia will be held October 1 and 2, 1993, at the Queen Elizabeth Hotel in Montreal, Quebec, Canada.

"Varilux Corporation is proud to continue our tradition as world leaders in Progressive Addition Lens (PAL) technology, presbyopia research and education," said R. Michael Daley, president of Varilux Corporation. "We are looking forward to a truly sensational event." Symposium curriculum will include a review of lens design and development of aspheric and progressive addition lenses, clinical studies presentations, recent presbyopia research, round table and panel discussions.

A call for posters has also been announced. Topic areas include: Presbyopia (physiology, testing methods, correction, demographics, practice management) and Lens Design (progressive addition lenses, aspheric single vision lenses, lens materials, clinical applications). For information contact Danne Ventura, manager, professional services, Varilux Corporation 1-800-237-8725, ext 169 or Dr. Rod Tahran, consultant, Varilux Corporation, ext 385.

Effecting Changes in the Teaching of Practice Management

Robert Conway, B.Sc., M.Phil., M.B.C.O., and David Kember, Ph.D.

Abstract

This paper details changes in learning and teaching that have been effected in the subject "Practice Management." The subject had previously been taught largely through a conventional lecture approach. The new approach involved elements of the project method, peer tutoring and the seminar technique. The students were formed into project groups to prepare and present specified topics. The students used a variety of presentation methods including a management game, a survey, a panel of graduates and a mock court-room. These changes were intended to better fulfill the teaching aims of the subject in the short time available. The students preferred the project/seminar/peer tutoring approach to the conventional lecture approach for information content, enjoyment and relevance to their future career. Suggestions for further improvements are made, in the light of the experience gained during this initial study.

Keywords: Optometric Education, Practice Management, Group Projects, Peer Tutoring

Introduction

The scope of work of an optometrist includes case history taking and the investigation of symptoms, assessment of refractive status by objective and subjective measures, investigation and evaluation of binocular coordination and the evaluation of ocular health and its relationship to systemic health[1]. The optometrist's health care function is well established and expanding in many communities. This is underpinned by a teaching curriculum which frequently, and justifiably, lays emphasis on the development of clinical skills[2]. The teaching of Practice Management, however, has been a cause for concern among optometric educators in recent years[3].

There have been radical changes in the delivery of optometric services over the past decade. For example, increasing competition has changed the nature of the marketing of optical appliances and the business management aspects of optometric practice. The commercially competitive nature of modern optometric practice has heightened the potential conflict between "business" and "professional" ethics. To be successful, it is essential that the practitioner is able to adapt to cope with this changing environment. This is of significance to optometric educators for after graduating, most optometrists will work in private practice where managerial skills are frequently as important as clinical expertise. In many cases the graduates will need to adopt a commercial, as well as a health care role. It behooves us as educators to prepare students for a world in which their management skills and commercial awareness are often as indispensable as clinical expertise.

Mr. Conway is a senior lecturer in optometry at the Hong Kong Polytechnic, Hung Hom, Kowloon, Hong Kong. Dr. Kember is a programme development officer at the Hong Kong Polytechnic.

Teaching Practice Management

Management is, by definition, about "doing." The teaching of Practice Management in the undergraduate situation suffers institutional restraints on time and facilities. This limits the students' exposure to the "real life" experiences which are so important an element of management education[4]. There have been attempts in the field of optometry at designing curricula to make practice management education more experiential[5]. However, in the optometry course at the Hong Kong Polytechnic the subject has previously been taught largely through a conventional lecture approach. One of the main limitations in the teaching of Practice Management to optometry students at the Hong Kong Polytechnic is the lack of time allocated to the subject (15 hours).

The aims of the subject are both affective and cognitive:

1. To develop an understanding of the concept of professionalism and ethics as applied to the practice of optometry.
2. To provide the student with the foundation knowledge for efficient professional management of an optometric practice.

Modification to Curriculum

It was perceived that the affective aims were likely to be the most difficult to fulfill in the institutionalized setting — particularly with the limited amount of teaching time available. The changes in teaching approach were made largely in view of this difficulty. It was decided to include teaching and learning methods which incorporated elements of the project approach, the seminar method and peer tutoring.

The first part of the subject consisted of a series of presentations given by full-time staff members and visiting practitioners who were invited to give an introduction to their subject. These were in the form of a lecture or a discussion group, according to the preference of the lecturer. A senior member of staff, with several years of recent experience in private optometric practice, was appointed as subject co-ordinator.

The titles of the introductory lectures were as follows:

- The development of optometry as a science and profession.
- Starting and running an optometric practice in Hong Kong.
- Intra- and inter-professional referrals and responsibilities.
- Optometry in Hong Kong — development, regulation and promotion.
- Optometric associations.
- Codes of ethics in optometric practice.
- Recordkeeping and computerization in optometric practice.

Projects

For the second part of the course the students were divided arbitrarily into groups of five students each. Working in their groups, the students were required to integrate and develop the themes introduced in the lectures in order to produce a presentation and report on an assigned topic. Group rather than individual projects were chosen because, in practice management, communication skills and the ability to work in a team are important. Yet for a large part of their tertiary and pre-tertiary education, Hong Kong students are required to work as individuals, and communication skills, other than writing ability, are rarely required or assessed.

Each group was given an outline description of the project to be undertaken. The groups had between four and seven weeks to develop the theme into a group project. Further advice and guidance, help with sources of information etc. was available upon request from the subject coordinator. Each group was required to give a 30-minute presentation on the outcome of their project, which was followed by a 20-minute question and answer session. A report was produced by each group for distribution to the class on the day of the presentation.

The assigned projects are described below. For each project the outline given to the group is followed by a short description of the way in which the group interpreted the brief and the presentation method employed.

Group 1. The optometric practice management game

Devise a gaming simulation which exposes the players to some common problems faced by managers of optometric practices in Hong Kong. Some possible areas are:

- decision making
- patient relations
- employee relations
- setting priorities
- handling of written correspondence
- other basic supervisory and management skills

A board game was devised. Groups competed against each other, with the organizing group acting as "gamemaster." Groups had to make initial decisions on practice location, levels of stock to be held, investment in equipment etc. "Hazards" and "chances" were introduced throughout the game. These took the form of questions of a clinical nature. The winner was calculated on the basis of final profit and accumulated "professional reputation." Throughout the three-hour course of the game, groups were exposed to simulations which required decisions of a clinical, managerial and ethical nature.

Group 2. Professional ethics: Reality or fantasy?

Using as many "real-life" situations as possible, bring to the class an immediate awareness of the relevance of professional ethics to the routine practice of optometry. This should lead into a class discussion on ethics.

A video was made by the group using a local optometrist's premises as a backdrop. A number of situations were devised through which the application of professional ethics could be demonstrated. During the showing of the video the class was required to act as observers. Using a check-list they were required to comment on the conduct and outcome of the role-plays.

Group 3. The beginner's guide to optometric practice

- Practice location
- Sources of finance
- Projected cost of start-up
- Record keeping
- Computerization
- Personnel management
- Functions of ancillary staff
- Practice literature

The group gave the first part of its presentation as information on overhead transparencies. The merits of two eye care products were then expounded using a mock-up of a courtroom situation. The group formed the prosecution, defense and the judge. The jury was appointed by the group from among the other class members. The debate was well structured and enlivened by the theatrical element.

Group 4. Communication with the public at large and patients in particular. Inter- and intra-professional referrals

- By the optometrist before, during and after the eye examination
- By the receptionist
- By the practice
- Complaints: justified, unjustified ("awkward customers")
- Complaints about retail services
- Complaints about professional services
- Referrals

Three short films were shown to the class. These were standard films on interpersonal communication in the business setting. A series of live role-plays was conducted by the group in front of the class. These depicted all of the situations listed in the project description and all related to optometric practice. Each situation was illustrated by two role-plays in which the class was shown the "correct" and the "incorrect" way of communicating.

Group 5. Promoting Optometry in Hong Kong - how much does the layperson know about optometry and health care?

Conduct a survey of students in the polytechnic

- Design a questionnaire.
- Use the data to formulate ways of promoting optometry in the polytechnic.
- How could these be applied to the promotion of optometry in Hong Kong?

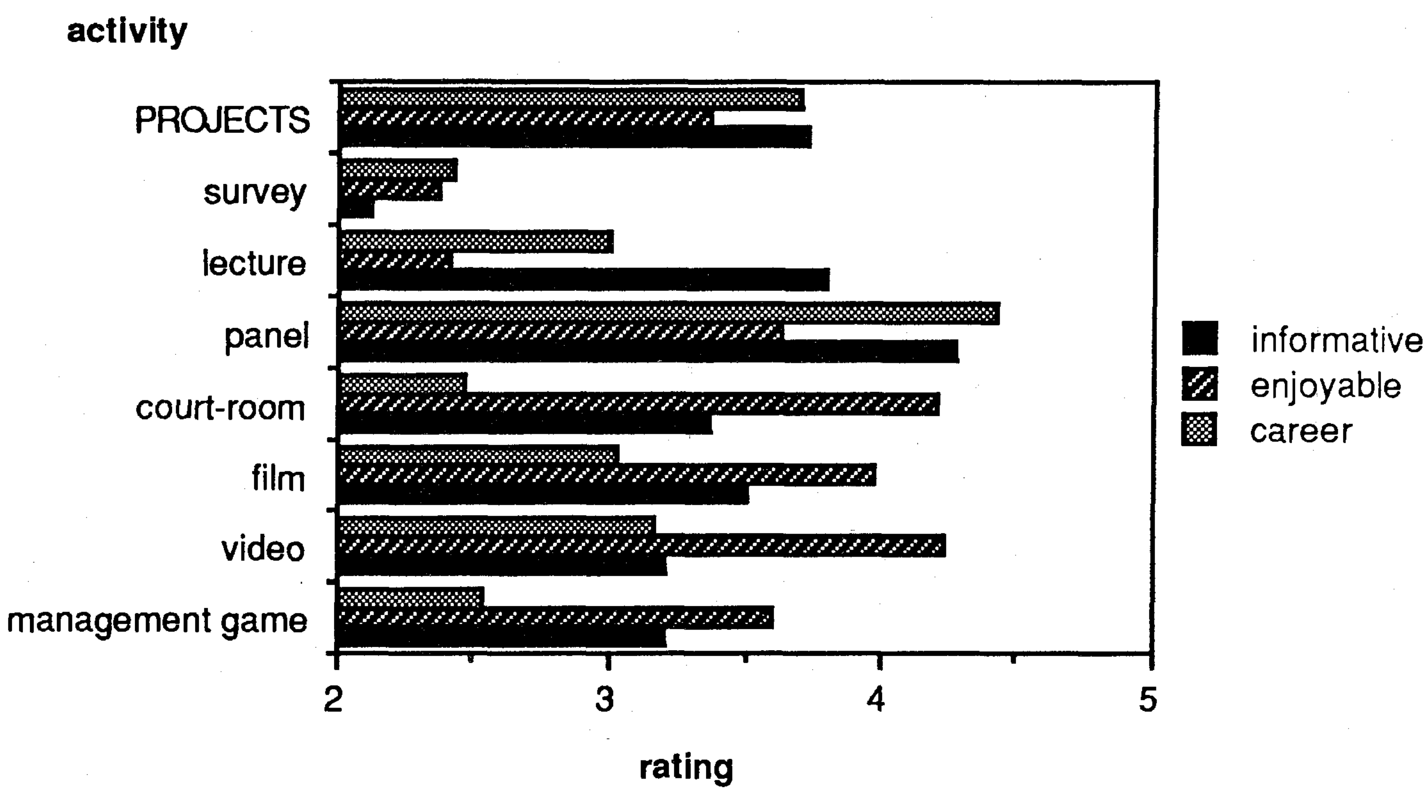
Five hundred staff and students in the polytechnic were surveyed. Knowledge of and attitudes towards optometry were investigated. The results were presented to the class using overhead transparencies.

Group 6. Opportunities, experiences and difficulties encountered as a newly qualified optometrist

A panel consisting of Professional Diploma Optometry Graduates would help in the presentation of this section of the seminar.

Three former graduates were invited

Figure 1
Comparison of Activities



to speak to the class for approximately twenty minutes each. The speakers were chosen to represent different modes of practice. They were respectively an employee of a large optical chain, an owner of a small optometric practice and a clinician at a local institute for the blind. A lively discussion followed each of the presentations. A full transcript was produced as a permanent record of the discussions.

Method

A questionnaire was ued to evaluate the project presentation approach to teaching in comparison to the lecturing used in the firest half of the course. The various methods of presentation were also compared for:

- information content
- enjoyment
- anticipated relevance to future career

Students were asked to rate the effectiveness of each activity by the three criteria on a five point Likert-type scale. The students were also asked to rank the six activities, plus the lectures in the first part of the course, in terms of learning effectiveness.

The questionnaire was administered to students one week after the end of the course. As the questionnaire was handed to students for completion in class, the return was 30 usable questionnaires out of a total enrollment of 30. A copy of the questionnaire is available on request.

The final item on the questionnaire was an open-ended question which asked "Do you prefer conventional lectures or learning through group projects? Why?" The responses to this question were analysed by sorting into categories of similar responses, following well established procedures for the analysis of qualitative data[6]. Quotations typical of the resulting categories are used to illustrate the findings presented and discussed in this paper.

Results

Comparison of Activities

The questionnaire data were analysed with SPSS-X[7]. A mean rating between 1 and 5 (corresponding to the five point scale) was computed for the three criteria for each of the seven activities. The results are presented in Figure 1.

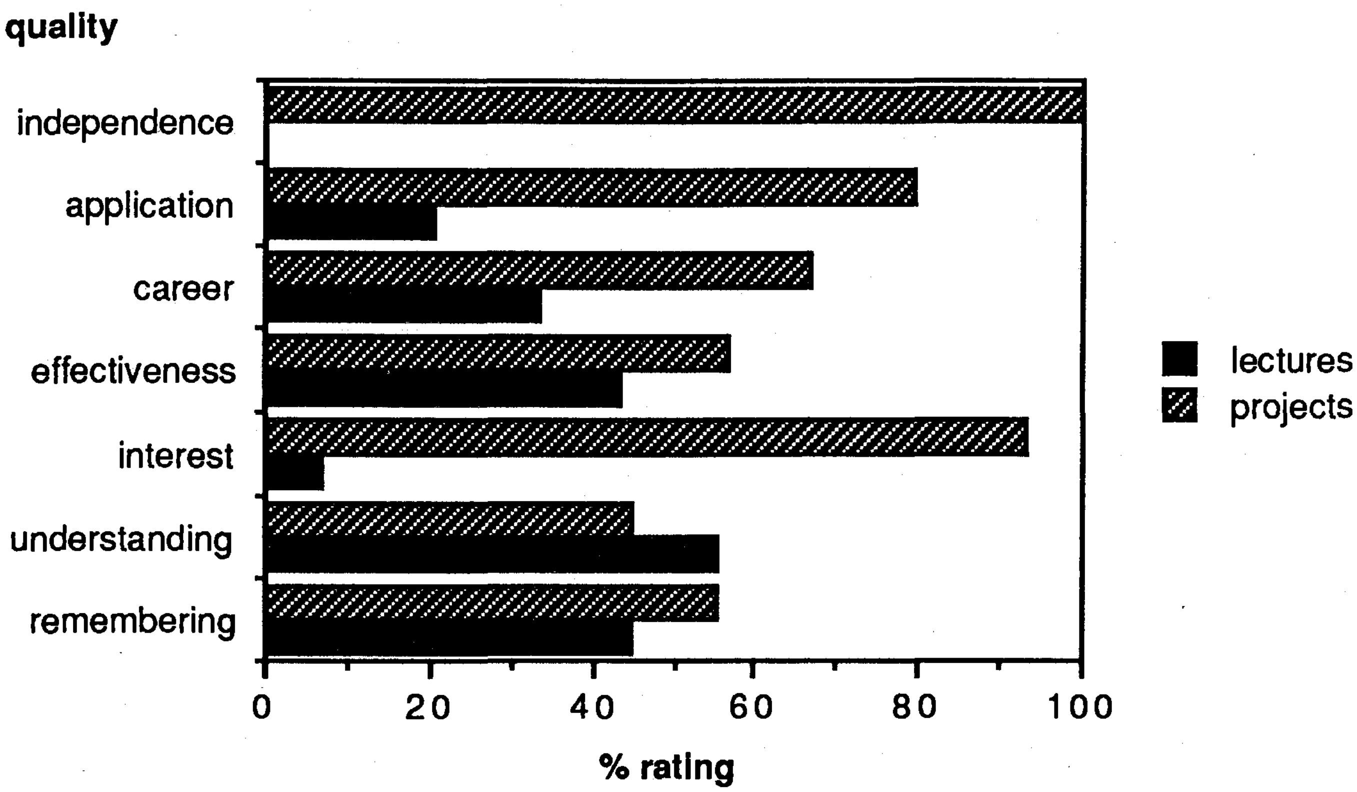
Further comparison of the seven

Table 1
Ranking of Activities

Activity	Mean Rank	
Panel of former graduates	2.55	highest mean ranking
Film show plus live role play	3.23	
Videoed role play	3.60	
Court room situation	3.97	
Lecture/OHP presentation	4.30	
Management game	4.43	
Survey of students	5.92	lowest mean ranking

X^2 for Friedman test = 43.7 (degrees of freedom = 6) p <0.0001

Figure 2
Comparison of Lectures and Projects



activities was provided by the question which asked students to rank the seven activities in terms of learning effectiveness. This question was analysed with a Friedman test which computes a mean ranking for each activity and then tests whether the differences between the mean rankings are significant. The mean rankings are given in Table 1. The Friedman test indicates that overall the rankings are significantly different at the 0.0001 level.

The Panel of Former Graduates scored highest among the activities for information content and relevance to future career. On the other hand the students felt that the Survey provided the least information, was the least enjoyable and was least relevant to their future careers.

The Court Room mock-up was used as vehicle for the comparison of two products commonly used by optometrists. The students considered it to be the most enjoyable activity, although they felt that it had little relevance to their future careers. The medium of Film was used in conjunction with Live Role Play to teach communication in optometric practice. This was found to be very enjoyable and informative although it scored below average in relevance to future career. The Videoed Role Play was used to illustrate the theme "professional ethics: reality or fantasy." This approach was considered highly enjoyable, although only moderately informative and of little relevance to future careers.

The Optometric Practice Management Game was given an above average score for enjoyment and informativeness, although it was considered to have limited relevance to the students' future careers.

Overall Comparison between Lectures and Projects

The students were asked to compare the lectures they were given at the start of the course with the projects they subsequently undertook. They were asked whether they thought projects or lectures were better for the following aspects of teaching and learning.

- Developing independent learning skills
- Learning how to apply knowledge
- Career preparation
- Learning effectively
- Creating interest
- Understanding the subject matter
- Remembering information

The results of the students' preferences for lectures or projects for various aspects of teaching and learning are shown in Figure 2. The bars represent the percentages of students indicating a preference for lectures and projects respectively for each educational attribute.

Quotations from the "open comments" section of the questionnaire provide a more graphic insight into these responses. All class members thought that projects were better for developing independent learning skills.

> "I prefer learning through group projects because, when we do our project, we can decide how we like to present. Also, we will have more opportunity to communicate amongst all group members."

> "I prefer learning through group projects because we can develop the potential of independent learning and the communication techniques."

Eighty-five percent of the students considered projects to be better at creating interest than lectures.

> "For conventional lectures, we do not have much work to do but it may be boring just 'receiving information . With projects, finding information may lead to

interest in other aspects of the subject. Therefore, I prefer the latter method."

Seventy percent of the students felt that projects were better than lectures for learning how to apply knowledge and relate it to their future careers.

"It [projects] can be applied to subjects that cannot simply be learnt from books, such as ethics. In addition, it can improve discussion and communication with the groupmates."

About half the class thought that projects were better than lectures for learning effectively and understanding.

"I prefer the mode of part conventional lectures and part of learning through group projects. Though group projects are a more effective way of learning, they seem to be less systematic. So, some conventional lectures are needed to increase the organization."

"When learning through the project, I find that I learn the subject more deeply. It is easier to memorize the information as it is found and analyzed by myself."

"Conventional lectures can provide more clear information and more material to learn. It can give the students a clearer background knowledge. Group projects can then be added between the lectures to make the students memorize the information firmly."

Discussion

It is clear that the students prefer learning the subject of "Practice Management" using group projects with elements of peer teaching and seminar approaches, as compared to the conventional lecture approach. It is not feasible, nor even desirable, to attempt to isolate the components (project, peer teaching, seminar) of the teaching approaches adopted. The terms project, seminar and peer tutoring are used in this context as external reference points which help describe the varying approaches used in the teaching of this subject. In most cases the groups adopted a very imaginative approach to the design of the project and it was evident that a lot of hard work was put into the task. In the main the presentations were well received by the class which found them to be enjoyable and informative. The students felt that the project approach better prepared them for their future careers than the conventional lecture approach.

The questions concerning relevance to the future career obviously require a considerable degree of speculation on behalf of the respondents. It was assumed that the students responded with the intention of a career in optometry in mind. It is not universally the case that graduates in optometry go into a career in optometry. A survey of 150 graduates from 1987 to 1991 showed that approximately 20% were not practicing optometry[8]. As a follow-up exercise it is planned to circulate to graduates an additional questionnaire one year after graduation re-testing the aspect of "relevance of the course to the future career."

The presentation of the survey results to the class received the lowest score for information content, enjoyment and career relevance. There is thus a strong argument for discontinuing, or at least substantially modifying, this teaching activity.

Several of the respondents commented that they felt that the workload distribution among members of the group was not even. This led to an iniquitous distribution of marks for a single group report. A possible solution to the problem is to use peer evaluation and review as part of the course assessment. As well as contributing towards the summative marks for the subject, peer assessment could contribute to the student's learning experience[9]. Goldfinch and Reaside[10] suggest a method of peer assessment which combines the group mark given by the subject co-ordinator with a "peer assessment factor" generated by the group members. This approach to peer evaluation will be incorporated into the assessment of Practice Management in the coming year.

The feedback method will be slightly modified in the coming year with the introduction of semi-structured interviews, conducted by an experienced interviewer. The intention is to investigate in greater depth the student's attitude to the teaching and learning approach adopted in this subject.

Conclusions

The feedback from the end-of-subject questionnaire was very positive. It is clear that the students prefer learning the subject of "Practice Management" using group projects with elements of peer teaching and seminar approaches, as compared to the conventional lecture approach. The students felt that the project approach encouraged independent learning and an ability to apply knowledge to new situations. The class found the project approach to be more enjoyable, although there was some concern over the high level of work required by the project approach. It is significant though that the project method was preferred in spite of the extra work entailed. The students felt that the project approach better prepared them for their future career than the conventional lecture approach. The approach to teaching the subject "Practice Management" will continue to evolve year by year, building on the positive developments so far achieved.

Acknowledgement

We would like to thank Peter Hendicott for helpful comments on an earlier version of this paper.

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ASCO

ABSTRACTS

A Survey of Instructional Technology in Dental Education.

Cohen PA, Forde EB. J. Dental Education 56(2), 1992.

This article describes the results of a survey of the use of instructional technology, both computer-based and non-computer based, at 59 dental schools. It is interesting that the authors view the profession of dentistry similarly to the way we view the profession of optometry. In most places, the word optometry could be substituted for dentistry and the statements would still be true. The results of the survey might be similar if conducted at optometry schools. All dental schools use slide materials and most use pencil and paper patient simulations. Only about half use standardized patients or computer-based instruction for things other than grading exams and keeping records. Most felt that the administration was supportive of the development of innovative instructional technology and that the students reacted favorably to it. However, most felt that faculty enthusiasm and faculty rewards for developing these technologies were lacking in their schools. It would seem that dental schools have the same difficulty as optometry schools in balancing a faculty member's responsibilities.

Reviewer: Roger L. Boltz, O.D., Ph.D.
University of Houston
College of Optometry

The Use of the Objective Structured Clinical Examination as an Audit of Teaching and Student Performance.

Cater JI, Forsyth JS, Frost GJ. Medical Teacher 13(3): 253-257, 1991.

How does the level of expectation of teachers compare to the actual performance of students in objective examinations? Not too well, according to this study, where 40% of all students performed poorer than expected by faculty. The authors suggest that such information indicates areas where faculty must improve their teaching. It also provides information on students' strengths and weaknesses. The authors did not discuss the technical issue of determining a reasonable passing score. For example, in a multiple-choice criterion-referenced question, some options are better distractors than others. Questions with more effective distractors are more difficult, and therefore less likely to be answered correctly — the expected passing score is lower. The general difficulty of the exam is a reflection of the individual difficulty of the items. This process provides a more realistic required "passing score" for the exam. The authors correctly emphasize that examination results provide useful information to faculty on their own teaching effectiveness.

Reviewer: Hector C. Santiago, O.D., Ph.D.
Inter American University
School of Optometry

Assessment Programs and their Implications for Health Professions Training.

Gordon MJ. Acad Med 67:672-679, 1992.

One method of getting health professions students more involved in their own education is to bring them into the evaluation process. Numerous attempts to do so have been presented in the literature, yet most involve anecdotal information about the outcomes. The author made an extensive search for those studies which documented effective methods to improve validity and accuracy of the self-assessment programs. He concludes that effective programs share at least two common characteristics: first, that the students systematically gather and interpret data about their performance; and second, that there be some attempt to reconcile the self-assessment with faculty observations. The article describes 11 different programs exhibiting these characteristics.

Of particular note is a theme about which the author makes frequent mention: while it is assumed that self-assessment techniques learned as a student will transfer to a postgraduate practice, there is no data to support this contention. There have been no studies that follow graduates who have participated in such a program to determine what, if any, long-term effects there may be.

Reviewer: Dennis W. Siemsen, O.D., M.H.P.E.
Illinois College of Optometry

A Model for Clinical Teaching and Learning.

Price D, Mitchell C. Medical Education 27: 62-68, 1993.

Very few clinical teachers in medical or optometry schools have received formal training in teaching. In this paper, the authors discuss a program designed to instruct clinical teachers (tutors) in a medical school on the prevailing models for clinical teaching and then evaluate their performance as clinical teachers.

The six basic dimensions of teaching/learning discussed in the paper were: the teaching/learning environment, the degree of intellectual challenge, the degree of interaction, the logical structure of teaching sessions, the quality of teaching skills, and the modeling of professional skills and attitudes.

The authors found the tutors to be supportive of the program and positive about the feedback they received. Two additional studies will be conducted to determine how or if the feedback the tutors received has changed their teaching skills and what impact this has on student learning. The ultimate goal of the authors is to develop a viable model of clinical teaching and learning.

Reviewer: James E. Paramore, O.D.
Ferris State University
College of Optometry

Problem-based Learning: A Review of Literature on its Outcomes and Implementation Issues. Albanese M, Mitchell S. Acad Med 68(1), 1993.

This paper describes an extensive analysis of problem-based learning (PBL) by means of meta-analysis of historical literature from 1972-92. PBL is an instructional option that incorporates specific patient problems organized into thematic blocks (e.g., ischemia, inflammation, anemia, etc.) as a means for students to create problem solving skills and knowledge in both basic and clinical sciences. The faculty role in such a model is "To guide, probe, and support the students' initiatives, not to lecture, direct or provide solutions."

The authors suggested that institutions select their own criteria to determine whether or not to incorporate PBL into their programs. The five research questions asked by the authors were: 1) What does PBL cost compared with conventional lecture-based instruction? 2) Do PBL students develop the cognitive scaffolding necessary to easily assimilate new basic sciences information? 3) To what extent are PBL students exposed to an adequate range of content? 4) Do PBL students become overly dependent on a small-group environment? 5) Do faculty dislike PBL because of the concentrated time commitment required?

The results indicated that there was merit in implementing PBL based on the first four hypotheses; however, they cautioned that additional research was needed to confirm their findings. While PBL has produced positive results in some programs, there is concern that students trained by this method seem to perform poorer than expected on national basic science examinations; further, these students appeared to have gaps in cognitive knowledge and ability to engage in forward reasoning typically used in clinical settings.

It is, therefore, concluded that global curriculum conversion of PBL should not be implemented by other institutions until more data are available concerning: faculty roles and levels of participation, cost of implementing PBL, the extent and level of cognitive-processing weaknesses expressed by the students, and the level of resource utilization that can be expected by PBL graduates.

Reviewer: William A. Monaco, O.D., Ph.D.
Northeastern State University
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Using Workshops to Teach Residents Primary Care Procedures. Powers LR, Draeger SK. Acad Med 67(11), 1992.

The authors point out that the tradition of "see one, do one, teach one" for teaching medical procedures allows for the passing on of inaccurate information and methods; this random system of education cannot insure that infrequently performed procedures are even taught.

To remedy these problems, a system of formal instruction and supervised practice in procedures training was established in 1991 for internal medicine residents at the University of Wisconsin. A workshop format was used to provide comprehensive information about specific procedures, and to offer experience designed to enhance the level of clinician confidence when performing procedures on an actual patient. The goal of these sessions was to introduce the various procedures in a consistent, controlled manner and to provide accurate, comprehensive information to residents. The procedures were presented at 14 different procedure stations. Workshop participants rotated among stations where they were instructed in specific techniques and given an opportunity to practice specific procedures utilizing paid volunteers, models and cadavers.

The authors conclude that a workshop approach of teaching primary care procedures is feasible, affordable, and successful.

Reviewer: Richard D. Hazlett, O.D., Ph.D.
Southern College of Optometry

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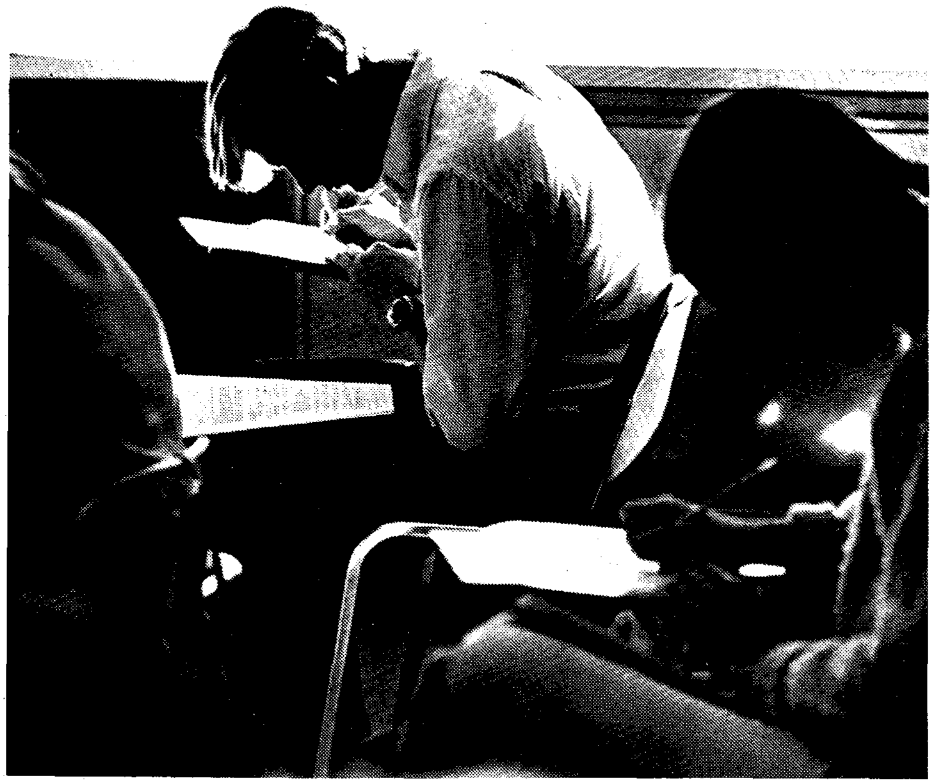

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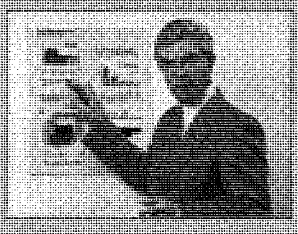

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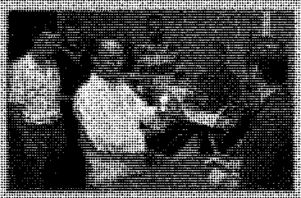

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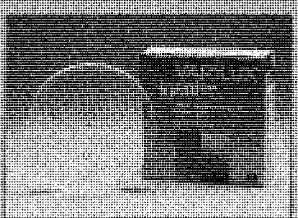

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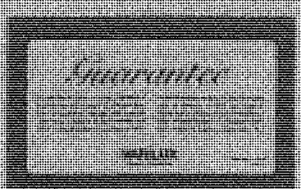

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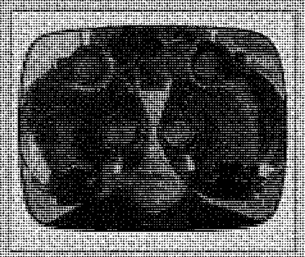

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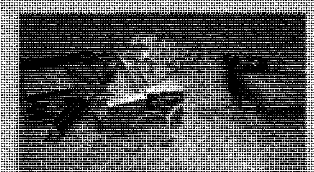

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