FOCUSING ON
LEARNING DISABILITIES

Winter 1986
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JOURNAL OF OPTOMETRIC EDUCATION

Association of Schools and Colleges of Optometry

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JOURNAL OF OPTOMETRIC EDUCATION

DEPARTMENTS

Cover photo: At State University of New York College of Optometry, sequencing, directionality, auditory-visual integration, and visual conceptualization are some of the skills developed using the Electro Therapist.

The **JOURNAL OF OPTOMETRIC EDUCATION** is published by the Association of Schools and Colleges of Optometry (ASCO). **Managing Editor:** Patricia Coe O'Rourke. **Art Director:** Dan Hildt, Graphics in General. Business and editorial offices are located at 600 Maryland Ave., S.W., Suite 410, Washington, D.C. 20024 (202) 484-9406. **Subscriptions: JOE** is published quarterly and distributed at no charge to dues-paying members of ASCO. Individual subscriptions are available at $15.00 per year, $20.00 per year to foreign subscribers. Postage paid for a non-profit, tax-exempt organization at Washington, D.C. Advertising rates are available upon request.

Ocular Disease Competency—Teaching and Testing

In this issue of the *Journal of Optometric Education*, Dr. Gary A. Lesher discusses a timely issue for optometry. As the definition of optometry changes from state to state, how can we manage our curricula to prepare students for state board examinations?

Optometry graduates may take board examinations in states that have defined optometry to include the diagnosis and therapeutic management of eye disease. Although we know that students are adequately prepared for their board examinations in pharmacology and ocular disease, how can we measure their abilities in the therapeutic management of eye disease? Certainly not every student will take examinations for licensure in states that have enacted legislation to include the diagnosis and therapeutic management of eye disease, but some will.

The entire issue of training optometry students to treat eye disease therapeutically is complicated by the fact that only a few optometric institutions reside in states that authorize optometrists to diagnose and therapeutically manage eye disease. This is not to say that no other institution trains students to manage eye disease. In fact, the management of eye disease is taught well in schools and colleges of optometry. In addition, our pharmacology curriculum within the schools and colleges is very complete. However, it is not possible for any training program, be it optometry or medicine, to expose each student to every disease and all its variations. However, it is possible to provide some practical experience and the cognitive resources to make the challenge of the management of eye disease, both treatable and non-treatable, easier.

How do students, faculty, and optometric institutions know that the cognitive skills of the therapeutic management of eye disease have been mastered at the entry-level? This past year, the International Association of Boards (IAB) offered a national, standardized examination entitled the Diagnosis and Management of Ocular Disease. The entry-level test was developed and administered by the National Board of Examiners in Optometry, and it was offered at the same time as the National Board Examination. In addition to being made available for students, the test was offered to practitioners.

Of the students and practitioners who took the Diagnosis and Treatment of Ocular Disease examination, 85% passed. Worthy of note, practitioners had a 10% higher pass rate than students.

Should every optometry student have to take the Diagnosis and Treatment of Ocular Disease examination? Certainly not. The test is offered by the International Association of Boards for both practitioners and students on a voluntary basis. Does passing the International Association of Boards examination mean that students will pass state licensure examinations in those states where the diagnosis and therapeutic management of eye disease is part of the definition of optometry? Certainly not. Each state board has unique requirements for licensure. However, if students want to establish a benchmark in the development of their cognitive ability to diagnose and treat ocular disease, the entry-level examination provided by the International Association of Boards serves the purpose well.

In 1986, four states are accepting the results of the IAB examination for the Diagnosis and Management of Ocular Disease or their own state administered examination. Those states will utilize the national examination exclusively in 1987. Thirty-three other states are recommending that the ocular disease management examination be taken by applicants.

The role of the optometrist in diagnosing and treating ocular disease is expanding. Therefore, we need both a reevaluation of the cognitive and clinical exposure in our schools and colleges as is pointed out by Dr. Lesher, and a standardized testing procedure for licensing graduates. □

John W Potter, OD

John W. Potter, O.D.
Editor
Journal of Optometric Education

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CANADA

LETTERS

Gerontology

Congratulations on the Fall 1985 issue of your association's publication, the *Journal of Optometric Education,* with its featured articles on gerontology and optometry education. You have every right to be proud of this fine issue. Your association has brought special attention to the unique vision needs of our nation's elders.

The Administration on Aging (AoA) is particularly pleased that you published the proposed curriculum model on geriatric optometry. By expanding the horizon of eye care professionals, older Americans today and in the future will benefit greatly.

We would appreciate having the opportunity to disseminate this special issue to our ten regional offices. We will be in touch with you to obtain these additional copies.

Again, congratulations and thank you.

Carol Fraser Fisk
Acting Commissioner on Aging
Department of Health &
Human Services

Pharmacology Training

Following the publication of my article, "An Analysis of Pharmacology Training in Schools of Optometry, Medicine and Dentistry," (Winter 1985, co-author: Marti G. Waigandt, B.S.), I received a number of inquiries concerning whether a comparison of hours spent in laboratories and seminars would have produced significantly different data than the published comparison of hours spent in the classroom. *Journal* readers should know that in a follow-up paper I presented before the recent annual meeting of the American Public Health Association, such an expanded analysis was made.

In the follow-up study, there were significant differences in teaching pharmacology in areas of major concern to the individual profession. Local anesthetics continue to be a mainstay in the practice of dentistry. The scope of treatment in medicine is much broader and therefore a large proportion of pharmacology training is devoted to drugs involved in chemotherapy and to those that affect the nervous and cardiovascular systems. With regard to the agents that have direct application to the general practice of optometry, optometric students receive more than thirty times the hours given to medical and dental students.

Data comparing the overall training in pharmacology showed that the current optometry school graduate receives a number of pharmacology training hours roughly equivalent to medical students and considerably more than dental students.

Alex Waigandt, Ph.D.
Department of Health, Physical
Education and Recreation
University of Houston

Committee on Practice Management/Enhancement Appointed by ASCO President Johnston

Harris Nussenblatt, O.D., M.P.H., will chair a new committee planning the Practice Management/Enhancement Conference in April 1986. The committee was recently appointed by ASCO President Edward R. Johnston, O.D., M.P.A. Other members of the committee are: John Classe, O.D., J.D., of the University of Alabama in Birmingham and Richard Hazlett, O.D., Ph.D., Southern College of Optometry. The committee will emphasize: trends in the health delivery system, legal implications, professionalism, third party reimbursement, and practice options.

Correction

There were errors and an omission in the article, "A Proposed Curriculum Model for Geriatric Optometry," published in the Fall 1985 issue. On page 24, IX should read "Normal Age-Related Eye/Vision Changes and their Functional Implications." On the same page, X. "Common Systemic and Ocular Diseases Associated with Aging" should be included. The correct spelling of the author's name is Alfred A. Rosenbloom, O.D., M.A.

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P R O F I L E

The Learning Disabilities Unit at the State College of Optometry/SUNY

Harold A. Solan, O.D., F.A.A.O. and Florence E. Springer

Introduction

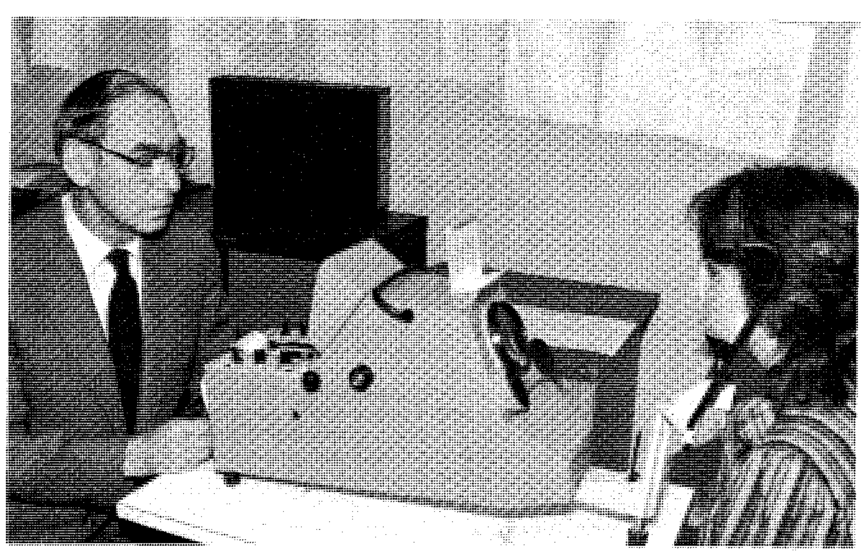
The prevalence of learning disabled children in this country has been variously reported from 4% to 15%. Most teachers agree that about 4 children in a heterogeneously grouped class of 25 experience learning problems. Based on a school population of forty-six million, we are considering an estimated learning disabled population between 1,840,000 and 6,900,000 children. The size of the group alone tells us that there is no simple solution to this problem. The disability crosses color lines and invades all social classes. In the United States, an epidemic of learning disabilities truly exists.[1]

Currently celebrating its tenth anniversary, the Learning Disabilities Unit strives to fulfill the three goals of the State College of Optometry: education, service to the public, and research. Although it is one of the smaller clinical units with a limited staff, the Learning Disabilities Unit is recognized as one of the leading diagnostic groups for children and adults with learning disabilities in the New York metropolitan area. Referrals are received from public and private schools; colleges; hospitals; a wide variety of state and private agencies; professional specialists, both medical and educational; and our own clinics. With the current increased emphasis on learning disabled adults, many more individuals requesting diagnosis of longstanding learning disabilities are now being seen. Graduate students and adults from professional schools have been serviced as well as college students. Children, however, still comprise the principal service population.

Education

The Learning Disabilities Unit services the college in a number of ways. Three didactic courses utilize the personnel and facilities of the Learning Disabilities Unit: tests and measurements, developmental disabilities and learning disabilities laboratory. In addition, some of the senior students are assigned to the unit for a segment of their primary care optometry (P.C.O.). About twenty-five percent of the seniors choose the Learning Disabilities Unit as a clinical elective for one quarter, spending 3 hours per week (30 hours). They observe "intakes" and attend case conferences with the chief psychologist, Florence E. Springer, where the multidisciplinary nature of learning disability is discussed through case presentations. A portion of the time is spent observing perceptual testing and training. Students participated this year in a perceptual testing research project collecting data in one of the local elementary schools.

Photographs by Steven Goodman, Center for Bio-Communications, State College of Optometry/SUNY.



The Eye-Trac provides projective measures of reading efficiency which may be compared with the subject's interpretive reading skills.

Harold A. Solan, O.D., F.A.A.O., is a clinical professor and director of the Learning Disabilities Unit at the State College of Optometry/SUNY. Florence E. Springer is an associate professor and chief psychologist of the Learning Disabilities Unit.

The visual training residents spend the equivalent of one day per week in the Learning Disabilities Unit. During the summer they attend several lectures dealing with some of the basic concepts of learning disabilities such as: taking case histories, various rationales, diagnostic and treatment procedures, psychological factors and understanding the problems of the disadvantaged child. From September through June, the residents perform perceptual evaluations under supervision, attend case conferences, write reports and participate in perceptual training.

The Learning Disabilities Unit's role in education also includes consulting with clinicians and students in visual training and primary care concerning the disposition of cases and providing "in service" courses for the faculty relating to new diagnostic and therapeutic procedures or sharing the results of research. All of the unit's staff are encouraged to participate in professional local programs, as well as national meetings for professional development.

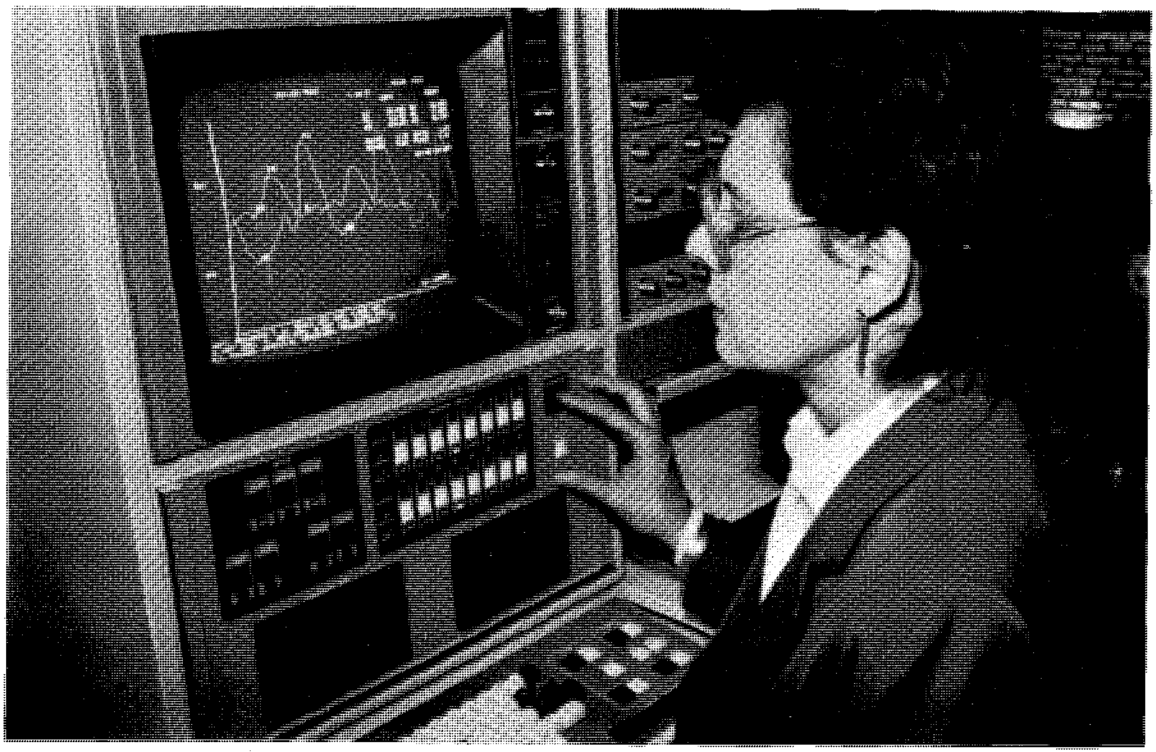
Service

Each person who is referred from professional sources other than our primary care or vision training clinics, receives a visual examination following the developmental, background and visual history. All patients receive a complete visual examination which includes ocular health assessment, refraction, tests for binocular vision, accommodation and ocular motility. Depending upon the presenting complaints and the findings, the visual examination may be extended to include additional tests such as recording eye movements. Of course, there is always the option to refer the patient to a specialty clinic such as Strabismus or Contact Lens. Children between the ages of 5 and 9 years have extensive perceptual testing, since a high incidence of perceptual dysfunction among primary grade learning disabled children has been found. Based on the reason for referral, a complete psychoeducational evaluation requiring several hours is completed. The evaluation includes intellectual, educational, neuropsychological and projective testing.

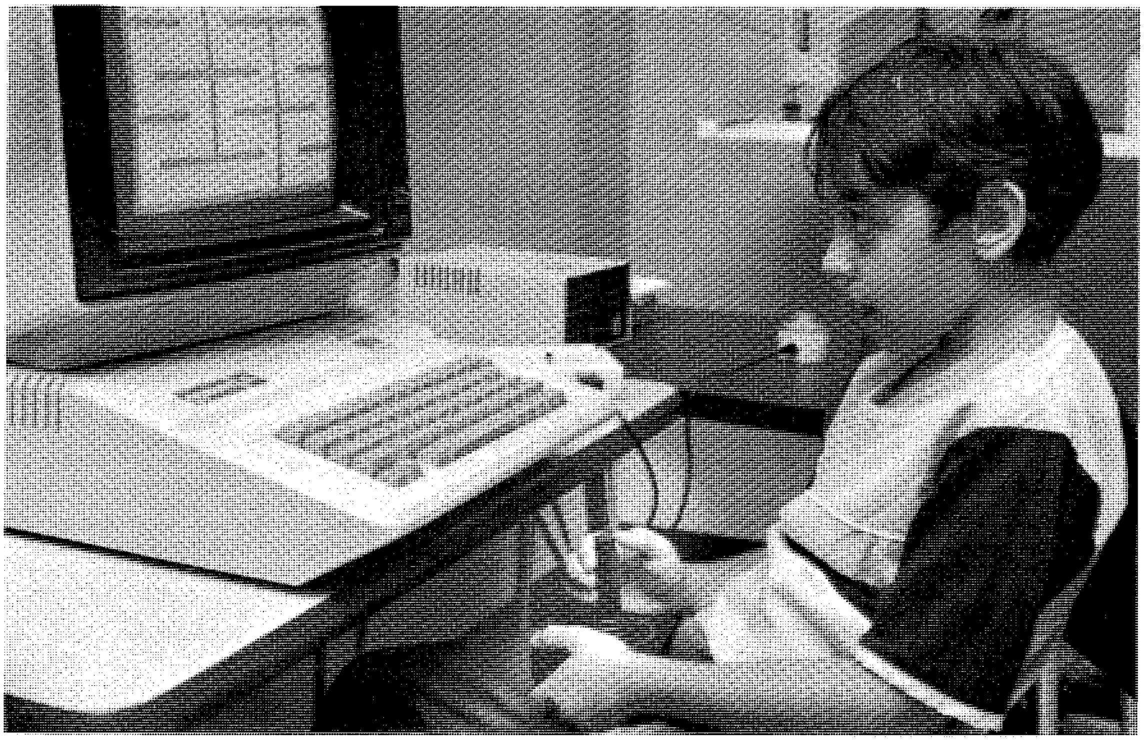
At a reporting conference, the parent and child or adult share the test findings with the examiner. Recommendations for an integrated treatment plan are formulated. Referrals to learning disability specialists, psychiatrists, social workers, psychotherapists, optometrists, neurologists and other professionals may be made based on the diagnosed problems. Contacts with these professionals are established by the examiner with the consent of the parent/adult. Services also include collaboration with schools and their learning disability teams, colleges, and professional schools in the best interests of their students.

Treatment is available in the college's Vision Training Clinic and in the Learning Disabilities Unit's Perceptual Laboratory and Reading Clinic on a one-to-one basis. Experience has established a special need to provide learning disabled individuals with the visual functional readiness to sustain effort in reading and study-type activities for extended periods of time. Since learning disabled children in the primary grades often show deficits in sensory-motor integration, intersensory integration, and visual processing, and since deficits in these areas have been related to reading,[2,3,4,5] perceptual therapy, where appropriate is recommended.

In the reading clinic, both children and adults are seen by staff reading specialists for individual reading and language therapy. Each program of instruction is individually planned based



The Learning Disabilities Unit research program includes studying visual and auditory evoked potentials related to sensory integration. Dr. Vesna Sutija is seen analyzing data.



The maze is just one of the numerous programs used to enhance perceptual and conceptual skills, develop visual attention, and improve spatial planning and visualization.

on the results of the visual, perceptual and psychoeducational evaluations. For young adults who are not learning disabled, but are inefficient readers, the Reading Clinic is equipped to measure and enhance those visual abilities which are associated with efficient reading skills such as span of perception and eye movements. The goal of the therapy is an improved reading rate and comprehension.

For the past ten years, Ph.D. students in clinical psychology programs from New York University have completed one year externships in the Learning Disabilities Unit and have engaged in psychoeducational testing under the direct supervision of the chief psychologist.

Research

Research in two principal areas has been stressed: eye movements and the relationship of perceptual-motor development to readiness and reading in the primary grades. During 1985, five papers in these areas will appear in optometric and educational journals.

Sensory, intersensory and sensory motor processing are the fundamental stages in the hierarchy leading to symbolization and conceptualization. Visual and auditory evoked cortical potentials reflect this activity. Therefore, an extensive study is being undertaken to develop techniques of recording intersensory evoked potentials towards predicting and monitoring the efficacy of optometric treatment for children who have these deficits and are also identified as reading/learning disabled.

In the future the data base now being established will be used to investigate the relationship between the cognitive, educational achievement, psychological and visual dysfunctions in a learning disabled population.

The Future

The demand for the services of the Learning Disabilities Unit continues to grow from schools, agencies and professionals who educate and treat learning disabled children and adults. During 1984, there were 2,911 patient visits compared to 2,214 in 1983, a 25% increase in the number of visits. The Learning Disabilities Unit sees children and adults from all economic strata. Helping the economically disadvantaged child who otherwise would not be able to obtain the quality of care he/she is now receiving at the College's Learning Disabilities Unit has been a source of pleasure for all involved in the program.

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Bausch and Lomb Encourages Proper Lens Care for Extended Wear Contacts

In materials sent to all its accounts in December 1985, Bausch and Lomb noted that "In recent months . . . reports in professional literature and the public press have described problems purported to be associated with the extended wear of contact lenses. It has been noted that while some individuals can continuously wear lenses for periods of up to thirty days without difficulty, other patients may only be able to tolerate the lenses for a week or less.

As extended wear lenses have become a more popular form of vision correction, patient instruction and hygiene issues have surfaced. According to reports, the potential risk of complications with extended wear is reduced when patients have received appropriate instructions on lens care and when there is diligent follow-up on the part of both the eye care professional and the patient. Therefore, we have become convinced that the importance of lens after care cannot be overemphasized with your patients. If patients experience continued blurred vision, eye irritation, redness, tearing, or other unusual symptoms such as pain, they should discontinue wear promptly and contact you."

In order to assist eye care professionals in assuring proper lens care, Bausch and Lomb provided all its accounts with a Patient Instruction Card and a Patient Fact Sheet which could be ordered in bulk.

Otto Wichterle Award to be Presented in Prague

The Otto Wichterle Award will be presented in Prague, Czechoslovakia, this year, announced International Hydron. The setting for the award ceremony will be LENS 86 which convenes in Prague April 24th and continues through April 27th. LENS 86 is an international conference on contact lenses jointly sponsored by International Hydron Corporation and the Czechoslovak Academy of Sciences.

"Prague is a fitting location for the presentation," said Martin Pollak, president of Hydron, as it is the birthplace of the soft contact lens. The award is named for Otto Wichterle, the Czechoslovakian inventor of soft contacts and of the spin-casting method of manufacturing.

The award was established by International Hydron in 1984 to honor achievement in the field of contact lens research. Richard Hill, O.D., Ph.D., was the first Otto Wichterle Award winner. He was cited by Hydron for his work in corneal physiology and contact lens wear. Dr. Hill is a professor at Ohio State University's College of Optometry.

The agenda for LENS 86 includes sessions on keratorefractive surgery, corneal response to extended wear, hard gas-permeable lenses for extended wear, the importance of tears in contact lens wear, neurology in human corneal function, ocular infections and contact lens wear, allergy, toxicity, and inflammation. New materials and the future of extended wear will be reviewed, as will lens movement, bifocal soft lenses, and the significance of corneal polymegathism.

Additional information is available from the Marketing Department at American Hydron, 185 Crossways Park Drive, Woodbury, New York 11797, (800) 645-7544. The Illinois College of Optometry is providing Continuing Education Certification for participation.

Occupational Needs for Overhead Viewing Met by Varilux

Multi-Optics Corporation, a member of the Essilor Group, has released the only occupational progressive lens, VARILUX OVERVIEW, permitting precise vision at arm's length above the head.

Varilux Overview has the patented Varilux aspheric surface allowing clear vision at near, intermediate and distance, plus an occupational upper segment. During normal use, the position of the upper segment does not interfere with far vision and is aesthetically pleasing.

The lens, developed originally to meet the overhead viewing requirements of U.S. astronauts, has applications for a myriad of occupations and hobbies, i.e., airline pilots/simulation testers, painters, plumbers, surgeons, electricians, etc.

For further information, contact local Varilux laboratories nationwide or Multi-Optics Corporation, 363-E Vintage Park Drive, Foster City, CA 94404.

CIBA to Consolidate Operations in Atlanta

CIBA Vision Care Corporation has announced plans to consolidate contact lens manufacturing and distribution operations at its Atlanta headquarters.

The move will include a gradual expansion of its facilities in Atlanta with a phaseout of company operations in Framingham and Southbridge, Mass. The consolidation will begin early in 1986, and is expected to be completed by the end of 1986.

John E. O'Day, president of CIBA Vision Care, said combining operations will increase efficiency, speed the movement of products from research and development to the market, and allow the company to improve its competitive position within the contact lens industry.

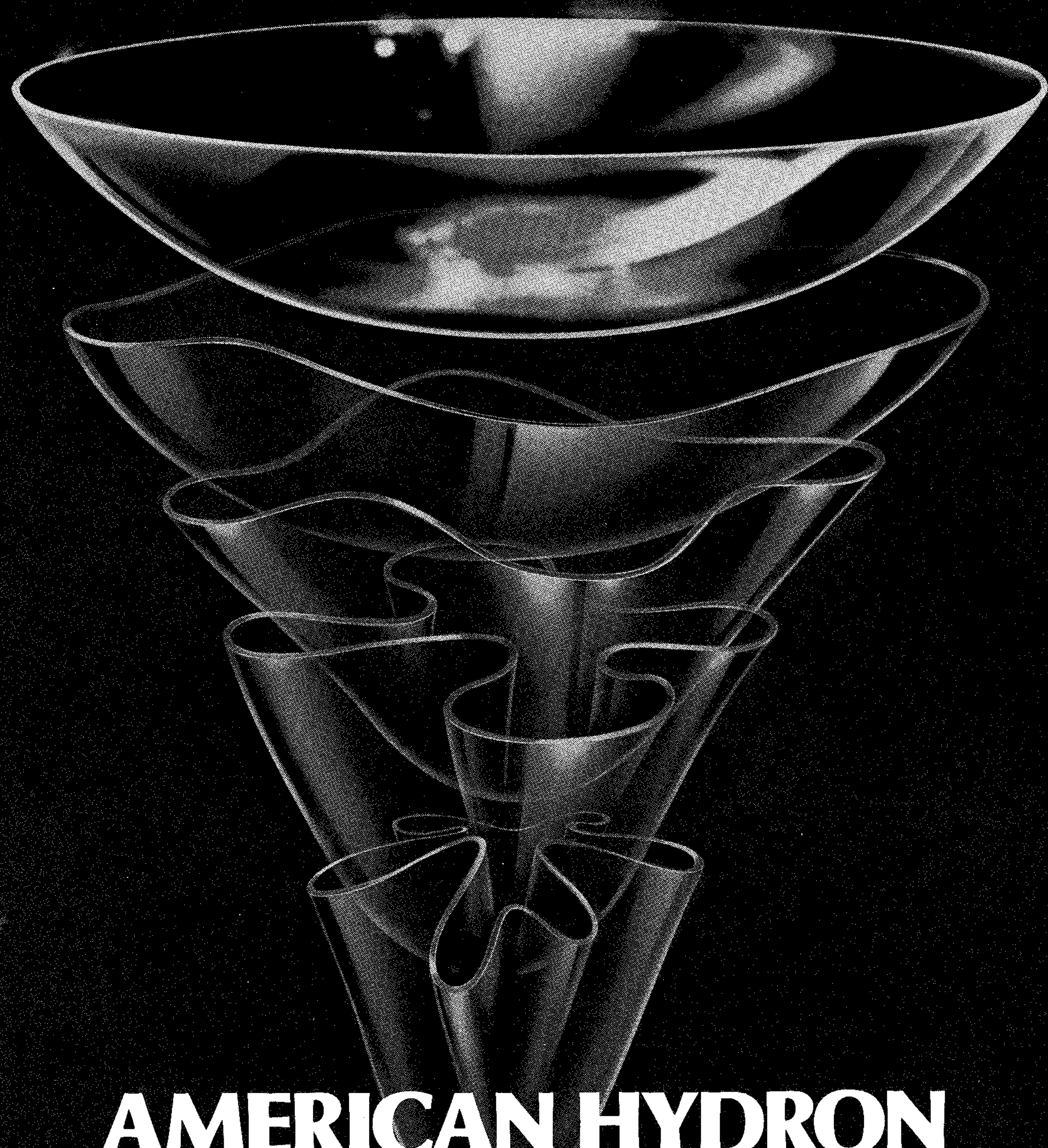
CIBA Vision Care Corporation manufactures, markets and distributes soft contact lenses from Atlanta. The company's lens products include CIBASOFT®, TORISOFT®, and BI-SOFT® (tefilcon). Its major product is the SOFT-COLORS® line of cosmetically tinted lenses.

AO President Addresses OLA Convention

In a major address to distributors attending the Optical Laboratories Association convention in Las Vegas, American Optical Ophthalmic Business President Michael A. Jensen shared his thoughts on the future of the industry and the role to be played by the American Optical Corporation.

According to Jensen, the AO Ophthalmic Business ". . . has only one goal, and that is, to be the leading glass and plastic lens manufacturer in the country." Jensen revealed during his presentation that the company is making substantial investments ". . . to become your full-line supplier of frames and lenses."

Jensen further disclosed that the company's marketing direction was dedicated to improve distributor relations, noting the shift from reliance on AO-owned distribution to independent distributors over the past few years.



Grades Management at the Southern California College of Optometry

Walter Wm. Chase, O.D., M.Sc.

Introduction

When it comes time to evaluate students, there are a number of familiar steps which occur after the student has finished an examination. Most of these steps are appropriate regardless of the kind of evaluation tool used, whether it be a written examination of the multiple choice variety, an essay exam, a grades laboratory report or practical, or even a clinical performance evaluation. The steps fit sequentially into broad categories so that, if all types of evaluation are included, the total sequence looks like that shown in Table 1.

The phrase "grades management" as used in this report encompasses all of the above steps, each of which could be done either by hand or with computer assistance. The sequence has several possible entry and exit points. For a quiz, for example, you would enter at step #1, but for a laboratory report you might enter at step #8. While some steps are always optional, some steps are not feasible without computer assistance and would have to be skipped.

SCCO Experience with Grading Machines

The 1969 year end final examination was the last time in which SCCO faculty had to do all of the steps in Table 1 by hand. The grading key at that time was a typical hand punched paper overlay for the red pencil scoring of a multiple choice test. It typically took three hours to identify the incorrect choices on over sixty sets of examinations. More time was then spent figuring scores, recording grades and preparing the hand drawn entry for "most impressive faculty graphic arts poster" to be taped to the office door showing the class performance curve in at least three vivid colors. This, of course, was the signal for all sixty-plus students to come into the office, one by one, to ask, "How did I do —what's my grade?"

Grading machines were not new in 1969, but they were not exactly ubiquitous, either, so a demonstration was arranged for SCCO faculty. The company representative had been asked to use the first midterm of the new fall quarter for the demonstration. What he demonstrated was that what would have been over three hours of hand grading could be finished in a little less than three minutes using the machine. This unit's digital display even provided the class average score, how many answer sheets had been scored, and what percentage of the class had correctly answered each question. Each individual answer form had the missed questions edge marked in purple ink and the score printed at the bottom. The edge marking permitted fanning the stack of answer sheets to see at a glance which questions were missed most often, and which students had the most (or least) purple ink on the edge—a kind of visual analysis.

TABLE 1
Steps in Grades Management

A. Data Collection
  1. prepare grading key or performance criteria
  2. evaluate student performance

B. Analysis
  3. calculate a score for each student
  4. analyze class performance
  5. analyze examination and item performance
  6. rescore and reanalyze if necessary
  7. calculate current or final student grades
  8. identify student progress problems

C. Recording
  9. record, summate scores in accumulative gradebook
  10. prepare student and class performance information for posting

D. Reporting
  11. post examination results
  12. report end of term grades to administration
  13. report scores and grades to individual students

The sequence of steps following the administration of an evaluation tool is presented. Collectively, the steps are referred to as "grades management." They fit into the four categories indicated, representing different types of activity.

Walter Wm. Chase, O.D., M.Sc., has been at the Southern California College of Optometry since 1966, serving as chairman of the Department of Basic and Visual Science and director of the Research Computing Center. He is currently a professor in visual science, with teaching and research responsibilities in the areas of ocular optics and ocular motility.

Though all of the rest of the steps in Table 1, starting at #7, still would have to be done by hand, faculty were busy multiplying 2 hours 57 minutes by the number of exams per year to see what the manhour saving might be; it was impressive. It took Dean Charles Abel, however, to point out the machine's most impressive feature. It was *free*! This was based on the salesman's projected sale of his company's answer forms through the SCCO bookstore which would also realize a small profit from sales. This machine, a Scan-Tron,® was quickly acquired and heavily used thereafter. It was trouble free for the several years that SCCO had it. The only potentially awkward situation was when a student would return the answer form claiming the machine had erred by marking as incorrect an answer that the student had marked correctly. There was no way to tell if the machine had in fact erred, or if the student had intentionally left the item blank and filled it in after the key was posted. This type of error was reported so infrequently that machine errors were always assumed. As will be explained later, this is no longer a concern since new procedures are being followed.

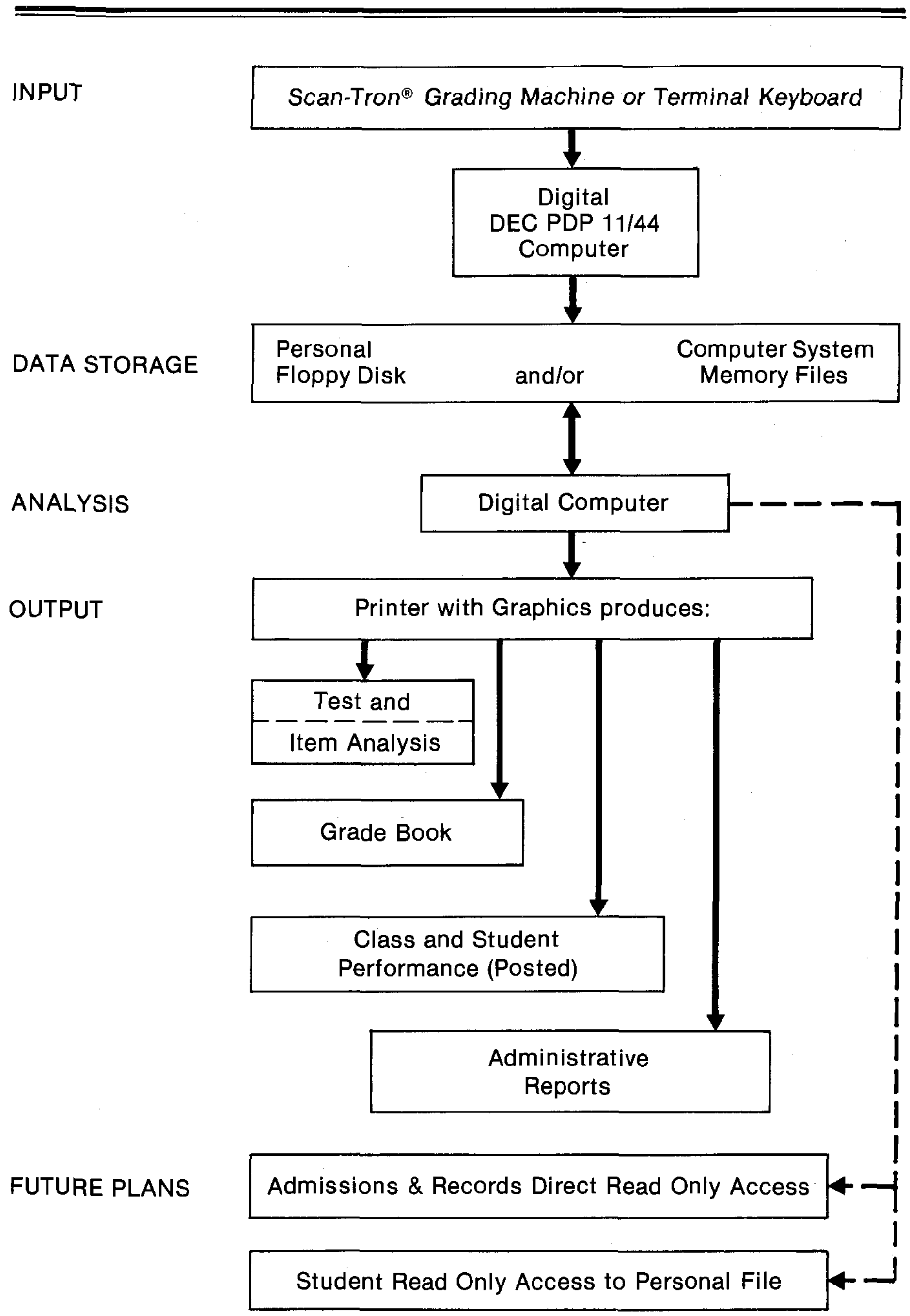
SCCO now has its third grading machine, still from the same company, but too sophisticated to be free of cost. Since it scores up to twelve choices per question, it can be used for more than grading exams. It is connected to our computer, a Digital Equipment Corporation PDP 11/44, so together they form the hardware for the grades management system. The software part of grades management consists of programs written at SCCO to faculty specifications. Altogether the system has taken the hand labor away from most of the steps of Table 1. In addition to the amount of time saved, the computer makes possible numerous enhancements to the evaluation process. It appears that fewer errors are made, as well.

Using the Grades Management System

Using the grades management system is simple. Following an examination students turn in the answer forms, usually keeping their question sheets with their answers marked for reference. The key is posted immediately so they can score themselves. They also may wish to inquire about certain examination questions at this time before machine scoring begins. This is a good time to detect errors in the examination or the key. Later they check their self-score against the posted computer printout to make sure no errors have been made—an important student responsibility.

Once the answer forms have been collected, the sequence shown in Table 2 is followed. Answer sheets are first machine scored, and scores enter directly into the computer for filing. The individual forms are still edge marked and scored directly. The instructor keeps them for reference in case a machine error is suspected. Essay examination scores, laboratory scores, or individual score corrections are entered

TABLE 2
Computerized Grades Management



The diagram shows the interrelationship of the hardware and software elements of grades management.

by terminal keyboard. Since scores are accumulated from one examination to the next, the computer stores the machine scoring results into permanent files. These can be either on floppy disks which the faculty member can keep safe, or on the computer system's permanent memory device. Because of the nature of the computer's protected operating system, the grades management files are very secure with the system itself. Faculty members can, if they wish, take their files on the floppy disks for safekeeping, probably on their own bookshelf. The files may not be more secure there than in the computer, but perhaps it does seem safer than the handwritten gradebook on the bookshelf, clearly marked "GRADES" on the binding. In any case, floppy disk security is dependent on faculty resourcefulness.

Once scores have been filed in the computer, the subsequent analysis depends on the desires of the faculty users and the skill of the software writer. The computer provides instructors with printouts of various kinds immediately after the machine scoring or terminal data entries, as shown in Table 3. Students' scores are printed for posting using each student's private ID number to insure confidentiality (unless a student elects to give away their ID number). If the student thinks a machine error has occurred it is easy for the instructor to check the original answer sheet and provide the student with a photocopy of it along with a copy of the key for comparison.

In addition to posting examination results, cumulative scores also are posted so students can keep track of their progress as it compares with the rest of the class. Since the computer has taken over the time consuming hand work of evaluation, some instructors use the gained time to give examinations (quizzes) on a weekly basis. Students are able to monitor their progress weekly, the amount of material to be studied per exam is more manageable than with infrequent midterms, and students are never more than a week behind in the course—all seen as significant advantages.

A detailed analysis of class performance is provided as well as an analysis of each individual question. Test and item analysis information provided by grades management is carefully studied. Faculty are guided by this analysis into writing improved question items. They can get a sense of what learning is taking place to a much greater extent than when so much hand work was being done that there was no time for test analysis. Students needing help as the term goes along are easier to identify than before, and more time is available for consultation with them.

To emphasize the labor and time saving aspect, here is a review of what those who use grades management *do not* do anymore. They do not do any record keeping by hand. Old gradebooks have been replaced by a binder with computer printed reports. Faculty no longer weight scores, do summing, or grade calculations. Faculty do not hesitate to rescore an individual's record, or an entire exam if it is warranted, because it only takes a few minutes at the terminal keyboard by the computer operator. They do not spend time correcting errors since the machine makes far fewer errors than when work is done by hand. Faculty do not prepare award winning multicolored frequency distributions for posting. And best of all, they do not have to tell ninety-six students, one by one, how they did and what they got, since this is posted for them to see.

TABLE 3
SCCO Grades Management Output Information

A. Information Available for each Examination
- Test Identification Showing:
  - type of test
  - course number
  - date
  - instructor
  - test key
- Test Statistics Showing:
  - number of students taking the test
  - maximum possible score
  - average score
  - median score
  - standard deviation
  - standard error of measurement
  - mean discrimination index
  - test reliability coefficients
  - item discrimination vs item difficulty graph
  - score frequency distribution
- Test Item Statistics Showing:
  - percent of class correct on each question
  - item discrimination index for upper and lower quartiles
  - number of students selecting each possible answer for each question from all students, and from the upper and lower quartiles
- Student Statistics Showing:
  - raw, t, and z scores for each student by name, alphabetically
  - raw scores for each student by sequential ID number, for posting

B. Cumulative Information Available
- Students by name alphabetically, their ID, their score on every type of test given to date, cumulative total and percentage of total
- As above except student by sequential ID number, for posting
- End of term summations with weighting factors and instructor criteria

The kinds of information the computer can generate from the files of raw scores are determined by faculty requests and the computer programmer's skills. At SCCO, all of the above information is received. Faculty may use all or part of it as seen fit.

Conclusion

The SCCO grades management system undergoes continuous refinement and expansion, and is now quite different than the first version. Faculty are looking forward to further improvements, such as the elimination of step #11 in Table 1 by having the admissions and records office computer directly interrogate grades management at the end of each term. Another enhancement will allow students to have access to their personal records from a computer terminal so they can more effectively keep track of their own progress. It is important to take advantage of the enhancements that computerization makes possible, and then to roll the time saved back into the course for the students' benefit.

A Survey of State Boards of Optometry Concerning Educational Requirements in Pharmacology

Gary A. Lesher, Ph.D.

Introduction

As one of the largest colleges of optometry in the country, the Illinois College of Optometry educates students from all over the country. To give all students the choice to practice anywhere in the country, they must be prepared to meet and pass 50 different sets of state board requirements and exams. While many of these requirements may seem quite standard across most states, this is not true in the area of pharmacology where state board requirements for various courses, the number of contact hours and curricular content are changing quite rapidly.

This survey was conducted in an effort to plan pharmacology course offerings to meet these needs, both now and in the future. The survey was mailed to all state boards of optometry in order to determine their requirements in pharmacology coursework for new optometry graduates. It was also important to determine what changes, if any, they plan for the near future. Since it was felt that the survey results would also be of interest to the state boards for comparison and/or updating their pharmacology requirements, the final question on the survey was whether they would like to see the results of the survey when completed. Other schools and colleges of optometry also may find the information in this survey valuable since many of them also attract students from across the country. This information also should be useful to optometry students in planning what courses to take to qualify for a particular state board exam.

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Methods

The survey instrument consisted of 10 questions (Table 1) aimed at determining the number of class hours and any specific course content required by the specific state board. The survey was sent with a cover letter explaining its purpose to all state boards of optometry in July of 1984. A second copy of the survey with a second letter was mailed to the states that had not yet replied in August. A telephone follow-up was made in October 1984 to encourage the last few states to respond. Forty-nine of fifty states plus the District of Columbia and Puerto Rico eventually responded and are included in the survey results.

Results and Discussion

Of the 52 possible respondents, 51 returned the completed survey (98%) either by mail or by phone. Table 1 presents the original survey questions. If a state board answered "no" to question number one, it was asked to skip questions 2-7 and complete numbers 8-10 of the survey.

Twenty-one of the 51 respondents (41%) answered "yes" to question #1—they do have special requirements for pharmacology coursework for new graduates. Many of the states that answered "no" to question 1 also added that the candidate must be a graduate from an accredited school or college of optometry. This simple requirement insures that the candidate will have a minimum of pharmacology coursework since all the schools have required pharmacology courses in the curriculum. Of the 21 states answering "yes" to question #1, 19 (91%) have a minimum number of class hours for pharmacology coursework (see Table 2). The average was 70 class hours with a range of 40 to 100 hours. New Mexico will have a new requirement of 105 class hours in pharmacology to obtain a license to use therapeutic agents.

In answer to question 3, four of 21 states (19%) specify a minimum number of class hours in ocular pharmacology instruction (see Table 2). Of those that specified hours the average is 25 class hours (range 20-30).

In answer to question 4, ten of 21 (48%) require some form of emergency medical training, most asking that the O.D. have a current CPR certification (see Table 2).

In answer to question 5, several states said that course content should include systemic effects and/or reactions to

TABLE 1
Survey Questions

1. Does the (state board) have any special requirements for pharmacology coursework to qualify an optometry graduate to take your state board exam? Yes or No (If your answer is no, you may skip questions 2-7)
2. Does the (state board) have a minimum number of credit hours for pharmacology coursework?
Yes or No If yes, how many hours do you require? Are these quarter or semester hours?
3. Does the (state board) have a minimum number of credit hours of Ocular Pharmacology required to take your board examination?
Yes or No If yes, how many hours do you require?
4. Does the (state board) have any requirement for training in treatment and/or management of medical emergencies (i.e. CPR, etc.)?
Yes or No If yes, how many hours do you require?
5. Does the (state board) have any specific requirements for coursework in systemic effects and/or reactions to topical pharmaceutical agents?
Yes or No If yes, how many hours do you require?
6. Does the (state board) have any specific grade requirements for pharmacology coursework to qualify a candidate to take your state board examination?
Yes or No If yes, what is the minimum grade requirement?
7. Does the (state board) have any other specific educational requirements or regulations pertaining to pharmacology coursework or the use of topical pharmaceutical agents (either diagnostic or therapeutic)?
Yes or No If yes, please specify.
8. Does the (state board) accept the results of the NBEO pharmacology exam (Part II B, section 9), or do you require passing a pharmacology section on your own board exam?
Accept NEBO Require your own pharmacology exam Other (please specify).
9. Does the (state board) have any plans within the next two years to change and/or add to the pharmacology educational requirements?
Yes or No If yes, please specify.
10. Would you like to receive a copy of the results of this survey when it is completed?
Yes or No

topical pharmaceutical agents. Many of the states have curricular content mentioned in their legislation, but no specific hours are mentioned. These areas include general, ocular and clinical pharmacology, as well as sections on the reactions to topical agents, emergency management, ocular toxicity and ocular allergies. Two of the 21 states (10%) list a specific number of class hours for systemic effects from topical ocular agents. Arizona requires one hour and Michigan three hours dealing specifically with systemic effects of ocular agents. The Michigan law also specifies that the student have 10 class hours in the use of topical diagnostic agents.

In answering question 6, two of 21 (10%) require a minimum grade of 70 in the pharmacology coursework to qualify for their board examination. Those two states were Nebraska and South Carolina.

"The use of pharmaceutical agents by optometrists is one of the most rapidly changing areas in the profession."

For question 7, a number of states said they require continuing education credits to maintain a current license. However, as far as having any additional pharmacology coursework requirements for a new graduate to take a state board exam, all states (100%) replied "no."

With question 8, all state boards were asked again to reply (see Table 3), and 47% (24 of 51) said they accept the results of the NBEO pharmacology exam (section 9, part IIB), while 39% (20 of 51) said they would still require the student to take a pharmacology exam on their state board exam. Seven states (14%) said that they require both the NBEO exam and a state board pharmacology exam.

TABLE 2
States Answering Yes to Question One

State	Pharmacology hours (class time)	Ocular Pharm hours (class time)	Emergency Medical Training
AZ	40	—	no
CA	55	20	CPR Certified
CO	55	—	CPR Certified
GA	80 (8 qt hr)	—	no
ID	55	—	CPR Certified
IA	100	—	no
KY	90	—	Emergency care on practical exam
LA	96 (6 sem hr)	—	no
MI	60	30	CPR Certified
MN	60	—	CPR Certified
MS	60 (6 cr hr)	—	CPR Certified
MO	96 (6 sem hr)	—	no
NE	100 (6 sem hr)	—	no
NM	70	—	no
NY	none specified	—	CPR Certified
OH	57	—	CPR Certified
OK	none specified	—	CPR Certified
SC	80	—	no
TN	60 (6 qt hr)	—	no
VA	55	20	no
WI	60	30	no

In answering question 9, fourteen (28%) of the state boards said they expect changes in their regulations within two years (see Table 3). Three states—Illinois, New Mexico and Iowa—already are changing their requirements as a result of new legislation passed this year.

Nearly all the state boards answered "yes" to question 10 (92%), indicating that they would like to see the results of this nationwide survey on pharmacology requirements. Those states have all been sent the survey results. It is hoped that the states might use these results, not in an effort to homogenize the pharmacology requirements across all states, but to compare and update their requirements and to educate their legislators with regard to what is being done across the country.

Conclusion

The use of pharmaceutical agents by optometrists is one of the most rapidly changing areas in the profession. New state laws and regulations concerning pharmaceutical agents are being passed each year. This survey was an effort to compile the current requirements for new graduates concerning pharmacology coursework. However, even as this article was being written, several states have passed new laws. For example, the Illinois State Board of Optometry did not respond to the survey; however, in January 1985, its governor signed the amended Illinois Optometric DPA bill. New rules and regulations concerning pharmacology requirements obviously will be written in the near future. New Mexico, a state that already has a DPA bill, has recently passed a TPA bill and now will have additional pharmacology requirements for a license to use those therapeutic agents (105 class hours). The Iowa legislature also has passed a TPA bill, so they will be rewriting their pharmacology requirements in the near future. It is important therefore to continually update the pharmacology courses and content to allow ICO graduates to practice anywhere they choose.

While this survey concerns the pharmacology requirements for a new optometry graduate, many of the states have different requirements for previously licensed O.D.'s to obtain certification for the use of DPA's and/or TPA's in their states. These additional regulations, along with the need in many states for continuing education classes in pharmacology, present a significant additional need for training in pharmacology outside the college classroom. Thus, curriculum development is needed that also will allow practicing O.D.'s to upgrade their knowledge and skill in the use of pharmaceutical agents to obtain DPA and/or TPA certification. The Illinois College of Optometry is currently planning these types of training situations for experienced practitioners.

TABLE 3
Response to Survey Questions #8 and #9

	Question #8			Question #9
State	Accepts NBEO	Requires Own Exam	Requires Both	Plan Changes
AL		b		Yes
AK	a			Yes
AZ	a			
AR	a			
CA	a			
CO		b		
CT	a			
DE	a			
DC	a			
FL			c	
GA			c	
HI		b		
ID			c	
IN	a			
IA		b		
KS		b		
KY			c	
LA		b		
ME	a			
MD	a			
MA	a			Yes
MI		b		
MN	a			
MS		b		
MO		b		
MT	a			
NE	a			Yes
NV		b		Yes
NH	a			Yes
NJ			c	Yes
NM		b		Yes
NY			c	
NC			c	
ND	a			
OH		b		
OK		b		
OR	a			
PA	a			Yes
PR		b		Yes
RI	a			
SC		b		
SD	a			Yes
TN	a			
TX		b		
UT	a			
VT	a			Yes
VA		b		
WA		b		
WV		b		Yes
WI	a			
WY		b		Yes

a = Accepts NBEO pharmacology exam. b = State requires own pharmacology exam. c = State requires NBEO and own pharmacology exam.

A Pilot Study of a Computer-Based PMP

(Patient Management Problem)

Samuel D. Hanlon, O.D. and Julie B. Ryan, O.D.

Introduction

A primary responsibility of each optometric institution and individual faculty is to assure the competency of students graduating from the schools and colleges of optometry. By assuring at least a minimum level of competency, the standard of patient care is maintained. In order to provide the educational environment necessary for skills to be mastered, the educational facility must provide a sound curriculum, proficient instructors and an effective method of evaluation.

The evaluation of health education is similar to that of health care for which Donabedian[1] devised an evaluation system divided into three components: structure, process and outcome. Structure includes the tools and resources available such as the physical plant and equipment as well as the credentials of the faculty. These elements are relevant to quality education in that they increase or decrease its probability, but they do not guarantee quality. The process of education includes the curriculum, course content, teaching methods and, generally, the application of the available resources and knowledge. Standards for curricula at the schools and colleges of optometry exemplify the importance of the educational process. While these standards are essential, they do not guarantee the quality of the graduate. Measuring the students' performance is a direct method of measuring the quality of the education received, or outcome. Therefore, quality student performance is the assurance of quality education (though not necessarily the process of education).

In order to be considered valid, student evaluations must provide results which are representative of the subject matter and instructional objectives. If a student is being trained to provide patient care, then the evaluation must concentrate on measuring clinically relevant attributes. Direct measurement of clinical skills used in optometric practice is essential, but it is also very difficult to accomplish. Conventional testing methods, such as multiple choice examinations, although widely used for didactic testing, prove to be less than adequate for clinical evaluations. The problem of how to best assess clinical skills has been of concern to health care institutions and credentialing boards for many years.

> *"The PMP attempts to simulate the cognitive circumstances of real-life examination and requires behavior similar to the cognitive processes required in practice."*

The Southern California College of Optometry uses multiple methods for clinical evaluations. Each student must successfully complete two proficiency examinations, three case reports and a multiple choice examination. In addition, they are evaluated by their clinical staff who score their overall performance on each patient and on specific skills after observing a complete examination.

Even with a system this extensive, there are still inherent problems. One major deficiency with this system, or any like it, is its lack of adequate assessment of problem solving skills. Basic knowledge and technical ability are readily measured with the present system, but the higher order problem solving skills are not. In general, problem solving has gone untested mainly due to difficulties in constructing an appropriate and comprehensive testing instrument.

In the mid-1960s the Patient Management Problem (PMP) was developed by the National Board of Medical Examiners in response to this need.[2,3,4] The PMP attempts to simulate the cognitive circumstances of a real-life examination and requires behavior similar to the cognitive processes required in practice. Over the years, the PMP has been used for assessing clinical problem solving skills and has been shown to be a useful tool.[5,6]

It was inevitable that the interest in PMPs would merge with developing computer technology to produce even

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more realistic simulations. The computer is a natural tool for simulating patient encounters and testing of patient management problems. Computer simulation provides a method of examining and re-examining thousands of candidates simultaneously or on separate occasions on standardized exercises. In addition to scoring and reporting, they may provide instantaneous feedback and analysis to examinee and examiner alike. The National Board of Medical Examiners has studied the feasibility of administering computer-based examinations on a national scale and is committed to implementing such an approach within several years.[5] However, current computer simulations are still primarily used for student self assessment and not for certification.

Computer assisted patient encounters would seem to have these same potential benefits in optometry as they do in medicine. It was the intent of this project to design a computer program that could be used for optometric evaluation and instruction in all clinical areas.

PMP

Format Description

In a PMP, the object is to require from the test-taker the same decision making processes as would be required in the examination of an actual patient. Therefore, development of this program is an attempt to duplicate the flow of an optometric examination. The format consists of a series of examination procedures from which the examiner must pick and choose in order to reveal pertinent information needed to solve clinical problems. Rather than actually doing the procedures which would ordinarily be done, the procedure is selected from a menu and the computer displays the results (figure 1). From any point in the testing process it is possible to return to the main menu and branch to any other procedure.

To make the procedure selection easier and faster, the tests are divided into seven major categories (table 1). These divisions were intended to be consistent with the major emphasis of the procedures but some necessarily provide overlapping information. The categories can be redefined for additional types of examination simulations.

Scoring

In addition to providing the clinical data, the program scores the responses. The score on a PMP represents the test-

FIGURE 1

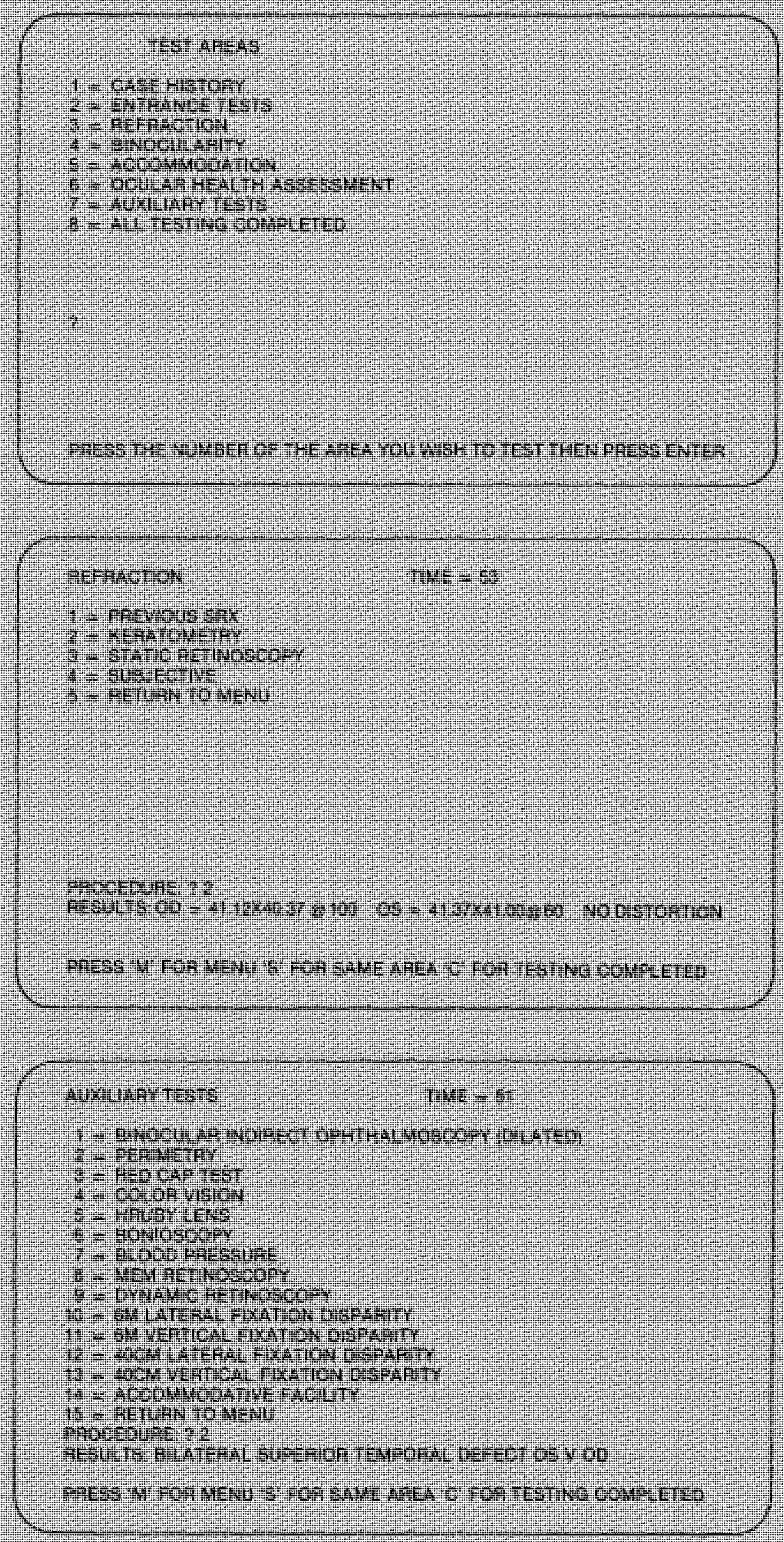

TABLE 1

Procedure	Score	Time
Case History		
1. chief complaint	3.0	2.0
2. PEH	3.0	1.0
3. PMH	3.0	1.0
4. FEH	3.0	1.0
5. FMH	2.0	1.0
Entrance Tests		
1. cover test	2.5	2.0
2. saccades	1.0	1.0
3. versions	1.5	1.0
4. fusion	1.75	2.0
5. pupils	3.0	1.0
6. confrontation	2.0	3.0
7. stereopsis	2.5	2.0
8. NPC	1.25	1.0
9. VA 6m sc	2.0	1.0
10. VA 6m cc	0.0	0.0
11. VA 40cm sc	1.5	1.0
12. VA 40cm cc	0.0	0.0
13. pinhole VA	0.5	1.0
Refractive		
1. previous Rx	2.0	1.0
2. keratometry	1.0	2.0
3. static ret	2.5	3.0
4. subjective	3.0	5.0
Binocularity		
1. 6m lat ph	1.5	1.0
2. 40cm lat ph	1.5	1.0
3. 6m vert ph	1.5	1.0
4. 40cm vert ph	1.5	1.0
5. 6m supravergence	0.0	1.0
6. 40cm supravergence	0.0	1.0
7. 6m BI	0.75	1.0
8. 6m BO	0.75	1.0
9. 40cm BI	0.75	1.0
10. 40cm BO	0.75	1.0
11. gradient	0.5	1.0
Accommodation		
1. NRA	1.25	1.0
2. PRA	0.75	2.0
3. mon Xcyl	–.75	2.0
4. bin Xcyl	0.0	2.0
5. push-up	0.75	1.0
Ocular Health		
1. external	2.5	1.0
2. biomicroscopy	3.0	3.0
3. direct ophth	3.0	2.0
4. tonometry	3.0	3.0
5. fields screen	3.0	5.0
Additional Testing		
1. MEM ret	-1.0	2.0
2. dynamic ret	-2.0	2.0
3. 40cm lat FD	-2.0	1.0
4. 40cm vert FD	-2.0	1.0
5. accomm facility	0.0	2.0
6. bin indirect ophth	2.5	8.0
7. perimetry	3.0	12.0
8. red cap	2.0	2.0
9. color vision	2.5	3.0
10. Hruby lens	0.75	3.0
11. gonioscopy	-1.0	5.0
12. blood pressure	1.0	3.0

taker's ability to solve clinical problems by selective testing. A scoring system similar to one used by Vaughan[7] for a PMP used to evaluate pediatricians was used:

+3—Essential to the case
+2—Would be helpful
+1—Would possibly give some useful information
–1—Probably no useful information to be gained
–2—Waste of time
–3—Potentially hazardous to the patient

These scores represent the appropriateness of the items selected for the particular case being evaluated. With each response, the test-taker must reevaluate the situation and decide, in light of the new information, what additional test procedures are needed.

Timing

A time factor was incorporated to enhance the simulation. Each test procedure was assigned an appropriate amount of "simulated" time based on average real time values as determined by direct observation of clinicians. For each procedure selected, the time was subtracted from the time remaining. Sixty minutes of simulated time was allotted for the PMP and if time was not used efficiently, the test-taker would be forced to base the diagnosis and treatment on limited data.

Program Description

Individual procedures are identified using a two-dimensional array with one dimension representing the name of the testing area and the second dimension being the name of the specific procedure within the area (figure 2). The 3X3 array, for example, would contain the names of nine procedures where each could be referenced by the row and column number. Using our PMP (table 1), area 2, procedure 3 (2,3) refers to versions. A three-dimensional array is used to organize the patient data elements associated with the procedures. This array contains three types of data: first, the results of the procedure; second, the score for the selection; and third, the time required to perform the procedure. The array element (2,3,1) is a description of the patient's version ability; (2,3,2) is the score for requesting the procedure; and (2,3,3) is the time necessary to perform the procedure. One additional two-dimensional array is used for the treatment options in a manner similar to the examining options.

Therefore, the actual program consists of array elements that act as "pigeon-holes" for data rather than specific data. Designing the program in this fashion allows enough flexibility to permit many different types of patient simulations to be designed from the same computer program. For any PMP, each of the testing areas may be redefined, as well as each procedure in each category. All three aspects of the data are redefinable for each new PMP. This design allows testing of problem solving skills in specialty areas such as contact lenses and vision therapy.

Thus the program consists of an organization of array elements and statements for reading and displaying the various contents of the array locations. A cumulative total of points is maintained as well as the number of tests requested and the amount of time remaining. The program is the underlying "framework" of the PMP that relies on the specific data from a patient in order to complete the simulation.

Patient Selection

The patient selected for the initial PMP is from the primary care service of the Optometric Center of Fullerton. Selection was made based on: 1) a highly significant outcome, 2) required problem-specific procedures, and 3) completeness of the available information.

The following is a summary of the case:

A 32-year-old firefighter presented for an optometric examination with a vague complaint of slightly reduced vision in the distance. This was noticed especially with the left eye which he said had always been worse than the right. Previous vision examinations had revealed low amounts of astigmatism in both eyes with the right eye being correctable to 20/15 and the left to 20/40. Ocular health was reported as good with no cause for the reduced vision in the left eye determined. As a firefighter

FIGURE 2

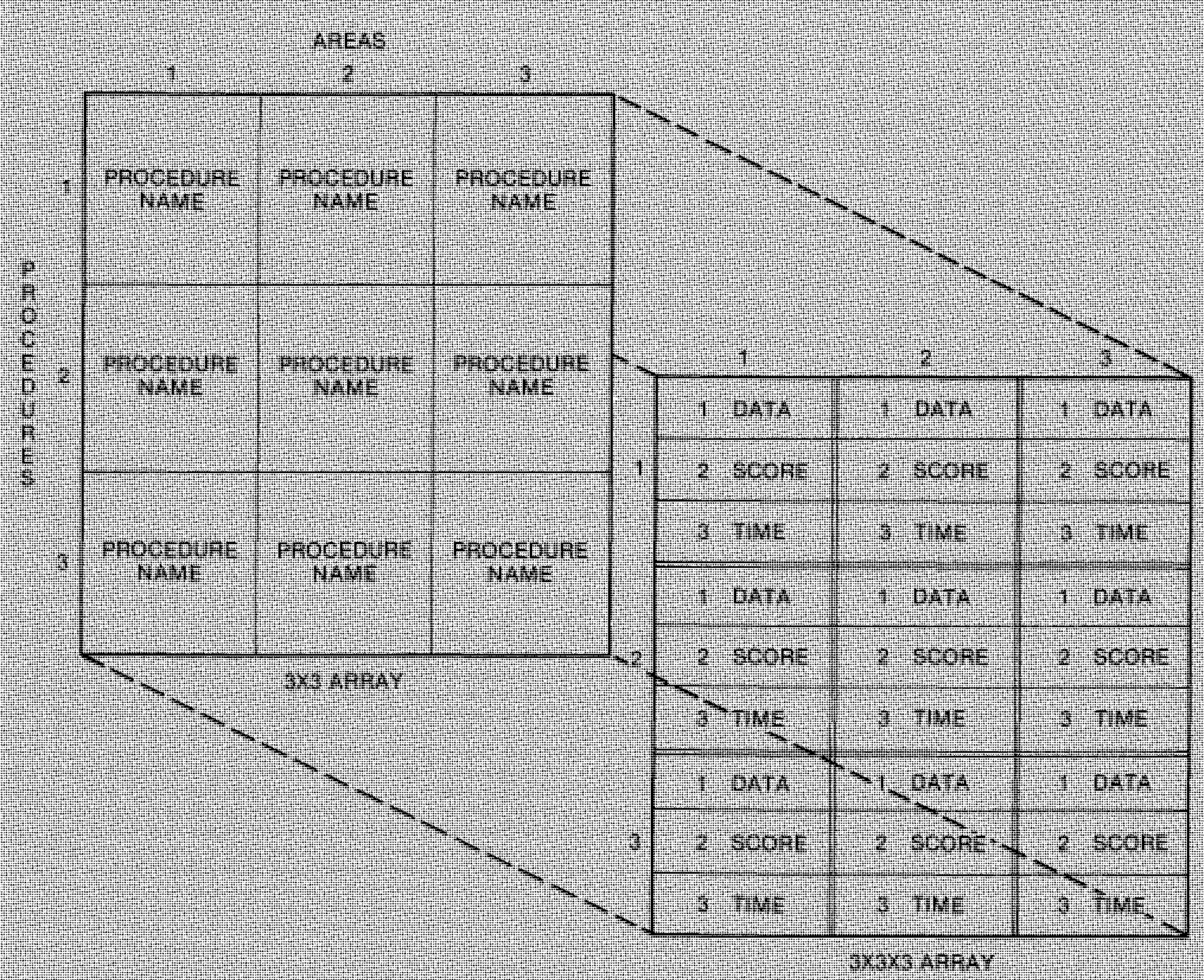

TABLE 2
Raw Data

Subject	PMP	Daily	Observ	M/C
1:	38.2	52.0	45.1	72.3
2:	54.4	70.0	62.7	46.5
3:	42.8	76.0	71.5	52.8
4:	62.3	78.0	70.4	62.0
5:	54.6	60.0	50.6	64.4
6:	65.2	74.0	68.2	80.5
7:	46.8	64.0	62.7	76.6
8:	64.1	70.0	63.8	79.2
9:	53.3	76.0	72.6	67.7
10:	52.5	72.0	60.5	44.9
11:	51.9	70.0	70.4	61.0
12:	83.2	78.0	74.8	78.9
13:	54.8	66.0	57.2	63.4
14:	65.5	70.0	64.9	74.9
15:	60.9	90.0	79.2	92.1
16:	50.3	78.0	69.3	59.1
17:	63.0	68.0	68.2	69.3
18:	63.0	64.0	62.7	68.3
19:	68.0	72.0	64.9	69.0
20:	61.0	70.0	58.3	66.3
NO.	20	20	20	20
MEAN	57.79	70.90	64.90	67.46
MED	57.85	70.00	64.90	68.00
SDEV	9.99	7.91	8.08	11.58

TABLE 3
Correlation Matrix (Pearson's correlation)

df = 18	PMP	Daily	Obs	MC
PMP r	1.00	.390	.414	.425
DAI r	.390	1.00	.893	.169
OBS r	.414	.893	1.00	.233
M/C r	.425	.169	.233	1.00

TABLE 4
Difference Between Means

	PMP	DAI	OBS	M/C
PMP		13.11	7.11	9.67
DAI	13.11		6.00	3.44
OBS	7.11	6.00		2.55
M/C	9.67	3.44	2.55	

Critical range @ .05 = 6.256
Critical range @ .01 = 7.702

he had received regular physical examinations, the most recent of which was five months prior. His general health was reported as good, and he was not receiving any medical treatment.

Visual acuity was 20/40 O.D. and 20/60 O.S. through a spectacle correction of +.50-1.75X105 and +.25-1.75X70 for the right and left eyes, respectively. Pinhole viewing did not improve acuity further.

Stereopsis was reduced to "gross only" though the patient denied any change in depth perception over the past several years. Color vision testing indicated moderately strong deuteranomaly O.D. and O.S. Tangent screen with a 10/1000 target was normal although the superior temporal quadrant O.S. was slightly desaturated to a red Mydriacyl cap comparison of quadrants. Red Amsler-grid was positive for the superior temporal quadrant O.U. Goldmann perimetry revealed a superior temporal depression in the right eye and a superior temporal quadrantopsia in the left eye.

Bitemporal pallor of the optic nerveheads was noted with the left eye being greater than the right. Otherwise, the internal structures appeared within normal limits.

The patient was promptly referred to a neurologist for evaluation of a probable compressive chiasmal lesion. That evaluation confirmed the presence of a chiasmal tumor and surgical treatment was initiated.

Four primary care faculty reviewed the case and were asked to score each procedure according to the scoring descriptions as each pertains to this patient. Since the faculty showed variation in scoring, the average of the four scores was used as the final score for that procedure (table 1).

Pilot Study

Methods

The subjects consisted of twenty second quarter, third-year student clinicians. Third-year clinicians were selected in order to more directly compare the clinic scores to the PMP efficiency score. Each subject was given a standard set of instructions on how to operate the computer and overall intent of the PMP. In addition, each subject was told that there was a limited amount of "exam" time in which to complete the most appropriate testing scheme and that, at the conclusion, a diagnosis and treatment plan would have to be formulated. The PMP scores were compared to average daily grades in clinic, the average of their observation grades and their score on the multiple choice clinic final.

Results

Table 3 summarizes the correlations between the variables. The highest correlation is between the daily scores and the observation scores. This finding is expected since the same faculty assigned both grades and presumably used similar criteria to grade each. The score on the PMP shows a moderate positive correlation with each of the other three. Also notable is the very low correlation between the multiple choice test and the daily and observation scores.

The two-way analysis of variance was used to test the hypothesis that all students averaged the same on the four evaluations and also the hypothesis that the evaluations have the same theoretical mean. The first hypothesis was rejected with a p value of .0001 and the second rejected at a value of .0002.

The means of the four evaluations were compared pairwise using the Tukey T method to determine which evaluation(s) contributed to the significant difference among the four means. At the .05 level the critical range is 6.256 and 7.702 at the .01 level. This critical range was compared to the difference in means between pairs (table 4). The PMP score was significantly different from each of the other three at the .05 level, whereas the other three were not significantly different from each other.

Discussion

As expected, there was only a moderate correlation between the PMP scores and the other methods. In grading a student clinician, the clinic faculty make subjective assessments of many variables including: patient rapport, the length of time of the examination, accuracy in technical procedures, selection of appropriate procedures, and case analysis (plus others depending on the faculty). The problem solving ability is only part of the grade. It would be very difficult, if not impossible, to objectively assess the clinician's problem solving skills by these methods. The more subjective clinical grades, though having less emphasis on problem solving, are important since the evaluation takes into consideration the interpersonal skills required of a professional. The PMP does have the potential of objectively evaluating a clinician's problem solving abilities. It would appear that both the subjective clinical grades and the PMP are important in evaluating clinicians. The multiple choice examination showed a moderate correlation with the PMP and may have a place in assessing the basic prerequisites to problem solving. However, as often pointed out, multiple choice examinations are difficult to use for assessing sequential problem solving skills.

Summary

It is necessary for all health care professionals to attain a certain level of technical proficiency in order to practice. Secondly, they must have a certain level of basic knowledge of the subject area. The third component of health care practice involves the ability to solve clinical problems with the skills and knowledge available. This third component is possibly the most important of the three and is the most difficult to teach and evaluate. All health care insituations incorporate clinical courses in their curricula and it is these clinical experiences that "teach" the problem solving skills. It is assumed that the more experiences students encounter, the greater chance they will have of solving other clinical problems. There are great differences in the experience of graduating clinicians since it is impossible to make each student's experience identical.

Credentialing boards realize that testing technical skills and basic knowledge is necessary, but that it is also necessary to test the ability to solve clinical problems in a manner similar to clinical practice. The PMP was developed for this purpose.

In addition to improved evaluation, a computer operated PMP can be used for teaching problem solving. Faculty can use simulated examinations to demonstrate strategies and students can practice on their own time while receiving immediate feedback from the computer. In this way, the PMP functions as computer-aided instruction.

The computer program developed in this project is patterned after the PMPs currently in use in medicine. Basically, any type of optometric examination can be simulated, thus allowing evaluation of all areas. Utilization of these simulated patient encounters will assist in providing more of a standard in clinical experiences. Patient conditions can be simulated that are rare enough that only a few students are able to observe an actual patient with the condition. It will also be beneficial in determining which students have difficulty with clinical decisions so that they may receive additional instruction and practice.

Computer technology is changing rapidly, providing the potential for making simulated patient encounters more realistic and the creation of them even easier. Recently, there have been developments in computer software specifically designed for producing patient simulations.[8] Two aspects that will add tremendously to the realism of simulations will be the addition of graphics and video as well as natural language data entry rather than menu selections.

In the future, computer simulated patient encounters will most likely play an increasing part in optometric education. Ultimately, the effects of the simulations will hopefully be to increase the practitioner's ability to solve complex clinical problems and thereby provide better patient care.

Acknowledgments

Special thanks are given to Dr. Paul De Land for his assistance in the statistical analysis.☐

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Annual Survey of Optometric Educational Institutions

1984-85

The following is a summary of portions of the 1984-85 Annual Survey of Optometric Educational Institutions conducted by the American Optometric Association Council on Optometric Education. The accompanying tables highlight information on student enrollment, academic achievement, financial aid and student expenditures for the year 1984-85. This report is published as an annual feature of JOE.

Student Enrollment

Total student enrollment for the academic year 1984-85 for all U.S. schools was 4,460; this represented a decrease of 1.77% over the previous year's enrollment of 4,539. First year students totaled 1,170 representing a decrease of 1.43% from the previous year's 1,187.

The sharp rise in female enrollment noted over the last few years fell off for the year 1984-85. Total female enrollment increased by 7.74% from 1,291 students in 1983-84 to 1,391 students in 1984-85; thus women represented more than 31% of the total enrollment. But the number of women in the 1984-85 entering class comprised 34.66% (408 students) compared to 34.2% (406 students) in 1983-84.

Minority enrollment for all U.S. accredited schools accounted for 12.65% (564 students) of the student body in 1984-85 compared to 12.87% (584 students) in 1983-84. This year's decrease in minority enrollment broke with a previous climb in the percentage of minority enrolled over the past five years. Minority enrollment represented 8.78% of the total student body in 1979-80, 9.52% in 1980-81, 10.66% in 1981-82, 12.17% in 1982-83 and 12.87% in 1983-84. Within the U.S. totals, two schools, the University of California at Berkeley and Southern California College of Optometry, with minority enrollments of 37.9% and 28.5% respectively, were largely responsible for the 12.65%. Seven of the schools continued to have minority percentages under 10%.

Women accounted for 45.4% (317 students) of minorities enrolled in 1984-85, compared to 37.3% in 1983-84. Of minorities enrolled, 41% were Asian American (down from 50.2% last year), 32.1% Spanish surname (up from 21.1% last year), 28% Black American (up from 15% last year), 9% foreign national (down from 10.6% last year) and 3.7% native American Indian (down from 3.1% last year).

Academic Achievement

Of the 1984-85 entering class, 70.8% (814 students) had four or more years of prior college work before entering optometry school. In addition, the majority of this class, 64.4% (740 students) had a baccalaureate or higher degree, whereas only 6.4% (74 students) were reported having 4+ years of prior college work without having received a degree. The number of entering students having four or more years of college represented an increase of 5.03% from the 1983-84 total of 775 students. The number of students having a baccalaureate or higher degree increased by 4.37% from 1983-84's total of 709 students.

Of the remaining first year students, 8.7% had 2+ years of prior college work, and 20.3% had 3+ years.

The mean grade point average for entering students in 1984-85 was 3.15, as compared to 3.16 in 1983-84. Fourteen of the sixteen U.S. optometric educational institutions had mean grade point averages of 3.0 or better and five of these institutions had mean grade point averages of 3.25 or better. These grade point averages were based on a total of 1,180 entering students reported in *Information for Applicants to Schools and Colleges of Optometry*, Fall, 1986.*

Financial Aid

The amount of aid (other than loans) granted through institutions for the academic year 1984-85 is given in percentages for fifteen of the U.S. institutions. The amount of student loans granted through institutions for 1984-85 is given in the same manner. These show the percentage of students receiving aid in each of the four classes, percentage of average aid, and the percentage from federal and state sources.

The average of students receiving financial aid granted through institutions excluding loans was 21.8% in 1984-85, a slight decrease from 22.14% in 1983-84. The average of students receiving student loans through institutions was 61.06% in 1984-85, as compared to 62.57% in 1983-84.

The average of students who received financial aid (excluding loans) from the federal government showed an increase from 20.07% in 1983-84 to 24.58% in 1984-85. The average of students who received student loans from the federal government increased from 87.28% in 1983-84 to 87.57% in 1984-85.

Student Expenditures

Annual student expenditures for tuition, fees, books, supplies and other costs excluding living expenses ranged from $2,250 to $8,050 for residents and $3,146 to $12,039 for non-residents in 1984-85. The mean average expenditure for costs other than room and board was $4,707 for residents and $9,179 for non-residents. These represented increases of .81% and 12.5% over the 1983-84 mean costs of $4,669 and $8,154 respectively.

The average expenditures for room and board in 1984-85 ranged from $2,113 to $6,190. The mean average expenditure was $3,708, an increase of 5.3% over the previous year's $3,521.

Taken altogether, the mean average cost of education for an optometry student in 1984-85 totaled $8,415 for residents and $12,887 for non-residents. These figures represented increases of 2.7% and 10.38%, respectively, over the costs of $8,190 and $11,675 in 1983-84.

**Information for Applicants to Schools and Colleges of Optometry*, Fall, 1986, St. Louis, Missouri: American Optometric Association.

The following abbreviations have been used in the accompanying tables.

Schools

FSC	— Ferris State College
IAU	— InterAmerican University of Puerto Rico
ICO	— Illinois College of Optometry
IU	— Indiana University
NECO	— New England College of Optometry
NSU	— Northeastern State University
PU	— Pacific University
PCO	— Pennsylvania College of Optometry
SCCO	— Southern California College of Optometry
SCO	— Southern College of Optometry
SUNY	— State University of New York
TOSU	— The Ohio State University
UAB	— University of Alabama in Birmingham
UCB	— University of California, Berkeley
UH	— University of Houston
UMSL	— University of Missouri-St. Louis

Profile of 1984 Entering Class

Grade Point Averages (4.0 Scale)

	High	Low	Mean	Number of Students
FSC	3.90	2.50	3.40	34
IAU	3.27	2.09	2.70	33
ICO	4.00	2.41	3.03	150
IU	n/a	n/a	3.22	62
NECO	4.00	2.25	3.07	87
NESU	4.00	2.82	3.30	23
PCO	3.96	2.50	3.08	149
PU	3.96	2.29	3.12	85
SCCO	4.00	2.75	3.24	96
SCO	3.93	2.09	2.89	103
SUNY	3.98	2.40	3.29	59
TOSU	3.95	2.74	3.31	60
UAB	3.78	2.22	3.15	40
UCB	3.78	2.14	3.16	69
UMSL	3.95	2.34	3.09	32
UH	3.97	2.32	3.28	98

SOURCE: *Information for Applicants to Schools and Colleges of Optometry, Fall, 1986. St. Louis, Mo: American Optometric Association.* *n/a—Not Available*

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Number of First Year Students Enrolled with:

	2+ Yrs.	3+ Yrs.	4+ Yrs.	B.A., B.S.	M.A., M.S.	Ph.D.	TOTAL
FSC	10	9	4	8	2	0	33
ICO	31	37	4	73	3	0	148
IU	0	22	9	30	1	0	62
NECO	0	0	10	76	0	9	95
NSU	8	4	0	9	2	0	23
PCO	0	24	6	117	2	0	149
PU	12	27	6	39	0	1	85
SCCO	3	14	9	69	0	0	95
SCO	22	24	12	45	0	0	103
SUNY	0	3	0	55	1	0	59
TOSU	15	11	9	22	3	0	60
UAB	0	8	0	31	1	0	40
UCB	0	19	2	45	1	1	68
UH	0	27	1	65	3	1	97
UMSL	0	5	2	23	2	0	32
U.S. TOTALS	101	234	74	707	21	12	1149

1984-85 Annual Survey of Optometric Educational Institutions

	Financial Aid Granted Through Institutions Excluding Loans							Student Loans Granted through Institutions					
	Percentage of Students Receiving Aid					From	From	Percentage of Students Receiving Loans					
	1st Year	2nd Year	3rd Year	4th Year	Average	Federal	State	1st Year	2nd Year	3rd Year	4th Year	Average	Federal
FSC	34	16	0	7	14	59	41	63	65	78	73	69	32
ICO	14	27	18	45	26	44	28	79	85	83	87	83	99
IU	10	2	3	7	5	0	n/a	27	29	68	54	44	95
NECO	43	51	32	48	44	30	55	71	74	84	71	75	100
NSU	60	55	60	50	56	30	60	56	55	80	75	66	52
PCO	10	10	5	5	7	25	25	85	85	85	85	85	99
PU	9	8	10	12	9	4	96	19	18	20	20	19	100
SCCO	18	20	23	29	22	19	81	79	79	80	86	81	100
SCO	0	0	0	0	0	n/a	n/a	0	37	34	38	36	90
SUNY	58	62	59	50	57	50	52	96	96	98	98	97	98
TOSU	25	43	38	25	32	0	8	21	40	45	30	34	88
UAB	12	16	17	11	14	34	62	72	71	78	74	73	88
UCB	5	9	3	4	5	0	44	31	39	40	21	32	90
UH	unk	25	30	17	24	unk	unk	unk	50	56	52	52	unk
UMSL	19	10	12	10	12	unk	unk	74	63	85	68	70	95

1984-85 Annual Survey of Optometric Educational Institutions

Annual Student Expenditures

	Resident Educational Expenditures					Non-Resident Educational Expenditures					Average Room & Board Expenditures
	1st Year	2nd Year	3rd Year	4th Year	Average	1st Year	2nd Year	3rd Year	4th Year	Average	
FSC	$7,443	$5,436	$4,435	$5,127	$5,610	$9,128	$8,096	$8,095	$9,697	$8,754	$2,508
ICO	3,295	3,295	3,295	3,295	3,295	9,899	9,544	9,034	9,864	9,585	3,295
IU	5,643	4,776	3,415	2,962	4,199	9,421	8,784	7,766	6,397	8,092	2,715
NECO						10,502	10,328	10,318	9,821	10,242	5,607
NSU	3,915	3,165	2,765	1,865	2,928						3,562
PCO	8,391	7,616	7,016	7,096	7,530	12,391	11,616	11,016	11,096	11,530	2,113
PU						10,675	9,375	9,075	8,725	9,463	2,420
SCCO						9,240	9,094	8,113	7,671	8,529	6,190
SCO	8,198	8,973	8,824	4,563	7,639	12,598	13,373	13,224	8,963	12,039	4,726
SUNY	8,300	7,800	7,800	8,300	8,050	11,300	10,800	10,800	11,300	11,050	4,700
TOSU	4,050	4,650	4,150	3,780	4,158	10,881	11,481	10,981	10,611	10,989	3,500
UAB	3,255	4,014	3,350	2,702	3,330	7,653	8,412	7,748	7,100	7,728	3,072
UCB	2,900	1,900	2,300	1,900	2,250	6,170	5,170	5,570	5,170	5,520	3,327
UH	4,150	1,934	1,323	1,180	2,146	5,150	2,934	2,323	2,180	3,146	3,691
UMSL	5,481	4,987	6,190	4,737	5,349	11,981	11,487	12,690	11,237	11,849	4,207

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Full-Time Students Enrolled in the Professional Degree Program

	First Year		Second Year		Third Year		Fourth Year		TOTALS		
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Total
FSC	20	13	21	10	23	4	24	6	88	33	121
ICO	104	51	101	37	87	22	103	26	395	136	531
IU	38	24	45	17	42	23	41	27	166	91	257
NECO	55	40	47	36	56	20	67	32	225	128	353
NSU	17	6	22	3	18	6	21	3	78	18	96
PCO	91	65	86	64	91	42	101	37	369	208	577
PU	58	27	74	11	64	18	72	11	268	67	335
SCCO	56	41	59	36	63	29	64	31	242	137	379
SCO	81	24	78	26	79	16	98	16	336	82	418
SUNY	35	24	28	35	32	24	32	27	127	110	237
TOSU	36	24	42	19	43	14	44	14	165	71	236
UAB	33	11	25	13	27	14	22	13	107	51	158
UCB	47	27	38	27	41	23	39	24	165	101	266
UH	73	24	52	41	62	28	66	30	253	123	376
UMSL	25	7	20	11	23	8	17	9	85	35	120
U.S. TOTALS	769	408	738	386	751	291	811	306	3069	1391	4460

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Minority Group Students Enrolled

	Black American		Spanish Surname		Native American Ind.		Asian Amer.		Foreign Nationals		TOTALS			% of Student body
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Total	
FSC	1	1	0	0	0	0	0	0	0	0	1	1	2	1.65
ICO	6	5	11	2	0	0	19	10	7	1	43	18	61	11.49
IU	2	8	3	1	1	1	5	4	2	3	13	17	30	11.67
NECO	3	1	1	1	0	0	5	2	5	3	14	7	21	5.95
NSU	0	0	2	0	6	4	0	0	1	0	9	4	13	13.54
PCO	9	16	5	5	1	1	10	7	1	5	26	34	60	10.40
PU	0	0	6	0	0	0	0	13	10	3	16	16	32	9.55
SCCO	1	3	7	9	0	0	45	42	1	0	54	54	108	28.50
SCO	4	4	9	3	1	2	5	2	3	0	22	11	33	7.89
SUNY	3	6	5	3	0	0	5	4	1	0	14	13	27	11.39
TOSU	2	2	0	1	0	0	1	1	0	0	3	4	7	2.97
UAB	3	1	2	2	0	0	0	1	0	0	5	4	9	5.70
UCB	5	2	13	5	1	0	37	38	0	0	56	45	101	37.97
UH	4	1	11	9	2	0	5	6	8	6	30	22	52	13.83
UMSL	1	2	0	0	0	1	2	0	1	1	4	4	8	6.67
U.S. TOTALS	44	52	75	41	12	9	139	130	40	22	310	254	564	12.65

Contact Lenses: The CLAO Guide to Basic Science and Clinical Practice, Oliver H. Dabezies, Jr., O.D., ed., and seventy-eight contributors, Grune & Stratton, Inc., Orlando, FL, 1984, 2 volumes, ring bound, 848 pp., 750 illus., color plates, $199.00.

Contact Lenses presents a comprehensive review of contact lens fitting. The two volumes of the work are divided into 16 sections which are further subdivided into a total of 62 chapters. Among the topics included in these sections are: anatomy and physiology, instrumentation, hard lens fitting and care, soft lens fitting and care, contact lens-induced pathology and specialty lens designs as well as more difficult fitting procedures.

The illustrations used in these texts are excellent. In particular, color plates showing various fluorescein patterns, soft lens-induced complications such as giant papillary conjunctivitis and superior limbic syndrome, and the various forms and uses of ocular prosthetics are extremely beneficial to the reader.

The most informative sections are those pertaining to basic anatomy and physiology, soft lens-induced problems, therapeutic lenses, ocular prosthetics and keratoconus. The chapter on giant papillary conjunctivitis, in particular, is outstanding. In addition, information pertaining to specialized fitting procedures such as bifocal, aphakic and extended wear contact lenses is beneficial. The binder format will allow the practitioner to keep updated on new lens designs, materials and fitting procedures.

Some significant flaws, however, are evident with these texts. The sections describing polymer chemistry, lens properties, instrumentation, and deposits are lengthy, technical, and lacking in sufficient clinical application. The inclusion of more tables summarizing "How to do" and "What to do" clinically would have been very useful. There is limited treatment of rigid gas-permeable lenses while an emphasis on PMMA lenses is evident. This is typified by the frequent reference to fenestration as a means of reducing hard lens-induced edema.

In several sections, information on a particular topic is given in as many as 3 or 4 chapters. This redundancy is most likely a result of 78 contributors, presenting a tremendous editorial dilemma.

A reference list is present at the end of each chapter, but references are not noted individually within the chapter. In many instances, a statement is given in which further explanation and reference notation are needed but absent. Appendices at the end of several chapters are helpful, although with many of the topics this information would have been more beneficial within the chapter.

Contact Lenses: The CLAO Guide to Basic Science and Clinical Practice is extremely comprehensive, containing descriptions of almost every conceivable contact lens-related topic. However, students and practitioners would benefit most by using this source not as a primary text, but rather as a reference text, especially for contact lens-induced pathology and specialty fitting procedures and lens materials.

Guest Reviewer: Edward S. Bennett, O.D., M.S.Ed., University of Missouri School of Optometry.

Computerized Visual Fields, W.R. Whalen and G.L. Spaeth, (eds.), Slack, Inc., Thorofare, New Jersey, 1985, 414 pp., hardbound, 228 illus., $75.

Computerized Visual Fields is an advanced, technically written text on automated perimetry that deals primarily with the Octopus Instrument. While some of the basic principles apply to other instruments, the detailed description of the workings of the Octopus will not be useful to owners of other automated perimeters.

The book is divided into two sections. Section I, "Practical Technology," includes the history and development of computerized perimetry, as well as a description of threshold techniques and the decibel value scale. Chapter 5 contains a clear explanation of screening versus quantitative testing, and the various types of printouts including gray scale and numeric. Some useful guidelines in the assessment of the reliability of a given patient's field are discussed in Chapter 6.

Section II, "Clinical Application," begins with an interesting overview of the purposes of perimetry by George Spaeth. Chapter 10 deals with interpretation of abnormal fields, with practical information on differentiating actual pathology from false positive results. A number of excellent examples of true field loss versus artefact (i.e. from the rim of a trial lens) are illustrated. The remainder of the text deals with computerized perimetry in glaucoma, neurological, and retinal disorders.

Computerized Visual Fields is certainly a well-written, sophisticated text on automated perimetry. The book includes a number of useful and practical "pearls" on performing and interpreting an automated field. However, this information is scattered among a great deal of theoretical information that makes for difficult reading. Also, because the text only deals with the Octopus instrument, it loses some of its relevancy to owners of other instruments.

A recently released text which contains more practical information for the doctor of optometry who either owns or is shopping for a perimeter is "Automatic Perimetry in Glaucoma: A Practical Guide," edited by Stephen M. Drance, M.D., and Douglas Anderson, M.D. This will be reviewed in an upcoming issue.

Guest Reviewer: Paul C. Ajamian, O.D., Omni Eye Services, Atlanta.

Computer Essentials for the Ophthalmologist, D.R. Sanders and G.E. Meltzer, Slack, Inc., Thorofare, N.J., 1985, 143 pp., 30 illus., soft cover, $24.50.

The use of computers in ophthalmic practitioners' offices is becoming more commonplace each day; however, it is often difficult for eye doctors to obtain information on how to evaluate office needs and select an appropriate computer. *Computer Essentials for the Ophthalmologist* is a book that will be of use to any ophthalmic practitioner who desires background information on how to select an office computer.

The book is divided into three sections dealing with computer basics, assessing office needs and purchasing systems, and applications in the ophthalmologist's office. The first section describes computer hardware and software and discusses the terminology of computing. While some parts are choppy and may be difficult for someone new to the area to follow, the book does cover the relevant material. While there are a number of examples of clinically oriented programs for the practitioner, the software discussions mostly address commercially available generic software packages for business related applications and could spend more time with specific ophthalmic oriented packages.

There are excellent guidelines presented for introducing computers into the office and desired features for word processing programs, particularly for the novice computer user. In addition, there is discussion of a number of special applications such as telecommunications, direct connect claims payment, personal finances, and graphics that will be of interest to current computer users.

While the book is written for the ophthalmologist, most of the material is applicable for the optometrist (and other health practitioners). The one drawback for the optometric reader is the lack of emphasis on patient communications using the computer and too much emphasis on billing and filing insurance claims.

This book will be of value both to the practitioner new to computers and to the practitioner who would like to broaden his knowledge in the area. It is recommended for anyone who desires to work with computers in the ophthalmic field.

Guest Reviewer: Harris Nussenblatt, O.D., M.P.H., University of Houston College of Optometry.

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