

The Journal of the Association of Schools and Colleges of Optometry

# OPTOMETRIC EDUCATION

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# Association of Schools and Colleges of Optometry

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## EDITORIAL

## Growing Pains: Entry-Level Competencies and the Maturation of a Profession

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

Efforts to define entry-level competencies for our profession have occurred at national meetings, within a number of organizations (including the American Optometric Association, the National Board of Examiners in Optometry, the Council on Optometric Education and the Association of Schools and Colleges of Optometry), and, indeed, on an individual basis by each school and college of optometry. Despite broad debate, Optometry has not yet been able to articulate the notion of entry-level competency on a profession-wide basis. Why? Other health care professions have established statements of competencies and/or attributes for entry-level providers. For example, the Association of American Medical Colleges published the report, "Learning Objectives for Medical School Graduates," in January 1998 and "Competencies for the New Dentist" emerged as a resolution at the American Dental Association's 1997 House of Delegates. A perceived conflict between the profession's aggressive growth in scope of practice and the apparent limitations of defined competencies has hindered the efforts of our profession to define the expected competencies of a student graduating from a Doctor of Optometry degree program. Not

infrequently, when someone suggests that a given skill or body of knowledge is not entry-level, they are met with concerns from the profession about the political implications of such a statement or with concerns from some optometric educators that sub-disciplines are in danger of being diminished or lost.

Unfortunately, these fears hinder our ability to grow, both as a profession and as an effective educational enterprise. So, what is different about the other health care professions? Other health professions are comfortable with the understanding that scope does not equal entry-level. They accept the premise that no provider can be an expert (or even proficient) in all areas of responsibility as allowed by law; rather they believe that each provider is aware of his or her limitations and will act professionally and responsibly. Lastly, they have an established and accepted structure for postgraduate education that recognizes and certifies advanced or specialized competencies. Each of these variables reflects a profession-wide level of maturity and confidence.

This issue of *Optometric Education* contains a report of the Association of Schools and Colleges of Optometry (ASCO) entitled, "A Model for Entry-Level Determination," (MELD). In the summer of 1997, ASCO charged an Entry-Level/Curriculum Task Force to examine and reconcile the outcomes of the 1997 Critical Issues Seminar on Entry-Level Competency

with the 1992 ASCO Curriculum Model as it related to the definition of entry-level competency. The MELD report is the result, and is, in effect, a decision model which provides a structure, defines guiding principles and elucidates a process through which a consensus upon "What is entry level?" may be determined. Notably, because of its design as a decision model, MELD is not necessarily limited to entry-level competencies; rather, it may be used to guide discussions relative to pre- and postgraduate competencies as well. It is important to emphasize that the MELD report represents only the first step of optometric education's efforts to better define "entry-level competency." Indeed, using the MELD report as an operational paradigm, ASCO has now established a second task force with a charge to develop a document that delineates the broad attributes (or competencies) expected of every student graduating from a school or college of optometry with the Doctor of Optometry degree.

The development and broad acceptance of such a set of standards will require participation and input from all sectors of the profession. Perhaps more importantly, however, success requires the profession and optometric education to emerge from its growing pains, and step up as a mature, self-assured profession that is comfortable defining reasonable educational expectations for beginning Doctors of Optometry.

*Dr. David Heath is dean of academic affairs at The New England College of Optometry and served as co-chair of the ASCO Entry Level/Curriculum Task Force.*

# Looking Toward the Future...

## VA Optometry

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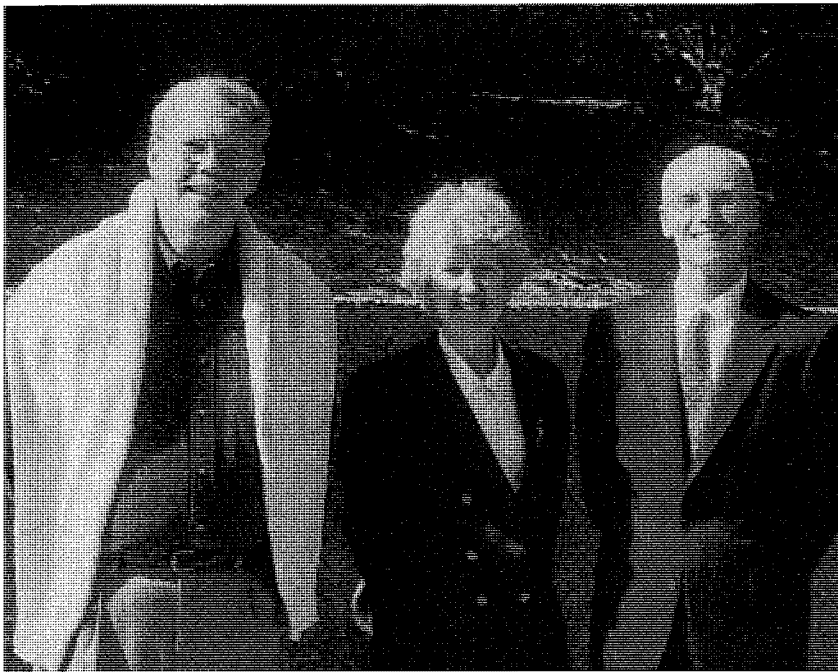
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*Optometric Education Editor Felix M. Barker II, O.D., M.S.; Managing Editor Patricia Coe O'Rourke; and Associate Editor Roger Wilson met recently at ASCO's Rockville, Maryland headquarters for an editorial planning session. Dr. Wilson will become editor of the journal on July 1, 1999 when Dr. Barker steps down after seven years as editor.*

## Letters to the Editor

In his editorial "Tenure?" (summer 1998), Felix Barker mentions academic freedom as the bedrock reason for maintaining the tenure system but fails to indicate two other important rationales for perpetuating the current system.

Firstly, one of the main reasons many people decide to pursue careers as professors is the job security afforded by the tenure system. Take that away and a large proportion of these individuals would probably opt for other professional careers that could be quite challenging and far more lucrative.

Secondly, the tenure system protects faculty from the arbitrary and capricious whims of university administrators who often seem to be motivated by factors other than what is best for the academic enterprise. Think of the turmoil in educational programs that would be generated by the lack of continuity and the frequent upheavals in faculty composition that would likely result without the protection of tenure.

Sincerely,

Jerry Rapp, Ph.D.  
Professor  
SUNY State College of  
Optometry

### ASCO Meetings Calendar

(Note: the March meetings are at the Lansdowne Conference Resort, Leesburg, Virginia)

- March 25-27** Executive Committee Dinner and Meeting  
6:00 p.m. - 9:00 p.m.
- March 26** Board of Directors Meeting  
9:00 p.m. - 11:30 a.m.  
Critical Issues Seminar - "Student Indebtedness"  
2:00 p.m. - 5:00 p.m.
- March 27** Critical Issues Seminar  
9:00 a.m. - 6:00 p.m.
- March 28** Critical Issues Seminar  
9:00 a.m. - 11:30 a.m.

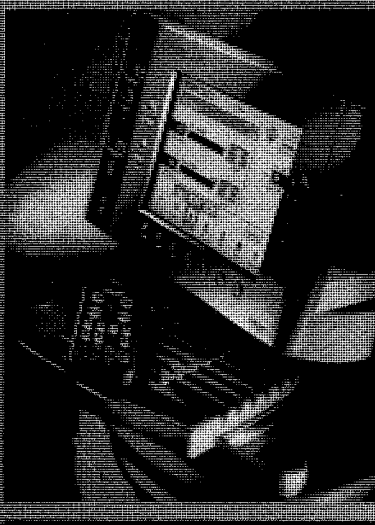
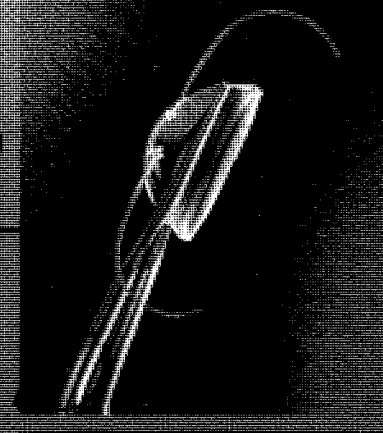
(Note: the June meetings are at the Henry B. Gonzalez Convention Center and Marriott Rivercenter, San Antonio, Texas)

- June 22** Executive Committee Breakfast  
8:00 a.m. - 11:00 a.m.  
Annual Meeting of the Board of Directors  
1:00 p.m. - 5:00 p.m.
- June 23** Annual Meeting of the Board of Directors  
8:00 a.m. - 12:00 p.m.  
Annual Luncheon  
12:30 p.m. - 2:30 p.m.
- June 25** Sustaining Member Advisory Committee Breakfast  
7:30 a.m. - 10:00 a.m.

For the most up-to-date information on ASCO meetings, contact ASCO's website at <http://www.opted.org>

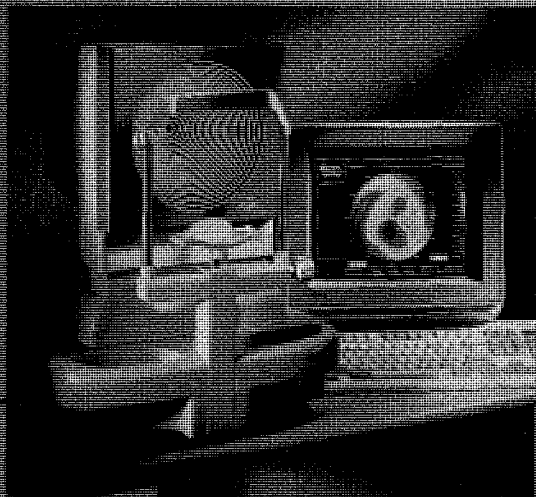
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## INDUSTRY NEWS

**B & L Introduces New Contact Lens**

In the country where soft contact lenses were first invented almost 40 years ago, Bausch & Lomb unveiled a breakthrough in soft contact lenses. Bausch & Lomb's PureVision™ lens, designed for up to 30 days of continuous wear, was introduced to more than 600 eye care practitioners at the European Research Symposium in Prague, Czech Republic. It has received 7-day approval in the European Union and Canada and is under review for 7-day FDA approval in the United States.

PureVision contact lenses are the result of Bausch & Lomb's ongoing commitment to fulfill patient and practitioner needs for a lens that offers both greater convenience and excellent ocular health," said Carl E. Sassano, B & L's executive vice president and president of Bausch & Lomb Vision Care. "We have invested over 25 years of research and development to create a lens material that surpasses the performance of current extended wear lenses."

According to Sassano, research shows significant patient preference for continuous wear. In a study conducted by BASES International in the United States, the United Kingdom and France, up to 72 percent of current contact lens wearers stated that they would buy a continuous wear lens, if recommended by an eye care professional. Another recent study found that 54 percent of current contact lens wearers would ask their eye care professional for monthly extended wear, compared to 42 percent for one-week extended wear and 27 percent for single-use/disposable daily wear.

**CIBA Vision Provides Grant To AOA Symposium**

CIBA Vision recently sponsored and provided a \$25,000 educational grant to the American Optometric Association's 16th Annual Contact Lens & Anterior Segment Symposium in conjunction with the

Low Vision, Paraoptometric and Sports Vision Sections.

The New Technology Seminars, one of this year's highlights, featured a variety of speakers who shared information on the most advanced technologies available. Dr. Sally M. Dillehay, manager of academic development at CIBA Vision, spoke on the company's revolutionary Lightstream Technology, which is being used in the production of CIBA Vision's new daily disposable lenses, Focus Dailies.

"CIBA Vision recognizes the value of continuing education for both patient and practitioner," said Dr. Richard E. Weisbarth, executive director, professional services and customer satisfaction, for CIBA Vision. "In doing so, CIBA Vision strives to support such worthwhile events as this symposium, ensuring that the eye care professionals are in the know when it comes to new technologies and the most advanced patient care possible."

**Fitting Recommendations Are Key To Success, Vistakon Says**

Vistakon, a division of Johnson & Johnson Vision Products, Inc., says that feedback from eye care professionals participating in the rollout of its new ACUVUE®BIFOCAL (etafilconA) contact lenses has demonstrated that closely following the fitting guidelines developed by the test panel is essential to fitting success.

"Doctors reporting the greatest success with the new lenses have adhered closely to the fitting tips," said Dr. Stanley J. Yamane, vice president of professional affairs, Vistakon. "The value of the gradual rollout is that we can apply what we have learned, especially regarding the importance of the fitting recommendations in ensuring excellent product performance and patient satisfaction."

"These lenses give eye care pro-

fessionals the opportunity to easily provide a wide range of presbyopes – spectacle wearers, contact lens wearers and emmetropes who are emerging presbyopes – the chance to experience the freedom and comfort of ACUVUE contact lenses," Yamane added.

**Wesley Jessen Offers Rebate**

Wesley Jessen will offer consumer rebates for its Precision UV™ (disposable lenses in 1999. Patients who purchase four six-packs will receive a \$25 mail-in rebate on their initial purchase, as well as a second \$25 rebate that can be redeemed when the patient repurchases the lenses. Practitioners prescribing Precision UV lenses also will be eligible to win vacation trips and other prizes, as part of a new frequent buyer reward program for the brand.

Wesley Jessen reported that for the first nine months of 1998 its U.S. sales of Precision UV increased 11% compared to the same period a year ago.

**Paragon Vision Sciences Launches PARAGON Thin™**

Just one year after the introduction of Paragon HDS™, one of the most successful and effective products in the company's history, Paragon Vision Sciences has launched PARAGON Thin™, the second new product from the company's advanced scientific platform – HDS Technology (Hyper-purified Delivery System).

"Paragon Thin exhibits exceptional surface smoothness, superb stability, maximized wetting characteristics and crisp, uncompromising optics. This is truly a significant innovation in establishing a new standard for thin contact lens profiles. Paragon Thin delivers a whole new standard for stable, thin lens profiles while delivering a moderate 30DK (revised Fatt method)," said Krist Jani, vice-president of sales and customer marketing.

# Clinical Decision Making and Problem-Based Learning

Depew Chauncey, Ph.D., O.D.

Susan Baylus, O.D.

Mark Zorn, Ph.D., O.D.

## ABSTRACT

*Problem-based learning at The New England College of Optometry was introduced into the second year clinical program in the fall of 1991. The primary goals were: (1) to serve as a transition phase for the second year students into patient care; (2) to provide our students the opportunity, early in their professional education, to apply existing knowledge and newly acquired knowledge in a patient care situation; and (3) to begin acquiring skills in clinical decision making. The design and implementation of this course is the subject of the following paper.*

**KEY WORDS:** problem-based learning, clinical education, decision making, clinical curriculum

*Dr. Chauncey is associate professor and instructor of record for the second year Problem-Based Learning course and clinic director of The Pine Street Inn Eye Clinic, Boston.*

*Dr. Baylus is assistant professor at NEWENCO and responsible for the first year Problem-Based Learning program. She is currently employed at Ophthalmic Consultants of Boston.*

*Dr. Zorn is professor of Biological Science and chair of the Department of Biological Science and Disease at NEWENCO.*

## Introduction

Problem-based learning (PBL) is a teaching method significantly different from the traditional lecture format in which acquisition of facts is frequently the primary goal. It is also significantly different from case analysis which is focused on data analysis and problem solving. Studies<sup>1,2</sup> have shown that after six months to two years the retention of knowledge obtained via problem-based learning is considerably greater than that obtained via the more conventional lecture format.

According to Barrows<sup>3,4</sup>, problem-based learning is "an instructional method characterized by the use of patient problems as a context for students to learn problem solving skills and acquire knowledge about the basic and clinical sciences. The basic outline of problem-based learning is: encountering the problem first, problem solving with clinical reasoning skills and identifying learning needs in an interactive process, self-study, applying newly gained knowledge to the problem, and summarizing what has been learned."

In the optometric curriculum at The New England College of Optometry much of the basic science material is taught via the traditional lecture format. Often the result is that

some students are not motivated to learn as well as they should despite faculty assurances that "they will need the information later in the clinic." This apparent lack of motivation may result from not understanding the importance of this information as it relates to providing appropriate patient care.

We have also found that our students often have difficulty applying memorized facts to a patient care centered intellectual activity. Therefore, a major goal of The New England College of Optometry problem-based learning program is to provide a context that demonstrates the significance of the information that must be acquired and that provides the students with opportunities to develop their clinical decision making skills. The problem-based learning format is compatible with these goals in that it allows the student to acquire information in the clinical context and to apply this knowledge as it relates to the patient's problems.

## Discussion

### Introduction

Problem-based learning, in the context of this course, is a clinic based, self-directed format of learning. It is clinic based in the sense that: (1) the course is taught in the clinical facilities to introduce the students to the clinical environment in terms of behavior, dress and daily routine and (2) all the cases are simulated patients, describing problems and conditions similar to those the students will encounter when they begin primary care. The course is self-directed in that the students, meeting in small study groups, have the flexibility to address the simulated patient encounter in a manner directed by the needs and interests of the student members. The study group can identify and study the specific areas that most interest the group. Therefore, two study groups working with the same simulated patient may identify significantly different bodies of knowledge to investigate (learning issues).

### Implementation

Problem-based learning is significantly different from the traditional lecture format and any institution considering introducing it into its curriculum should prepare the students for the change prior to beginning the program. The students at The New

England College of Optometry did not react enthusiastically to their initial exposure to the new format. It is probable that a more positive reaction could have been received from the students if they had been informed earlier, educated as to the details of what to expect and made aware of the advantages of this format of learning to their education. As it happened here, the students arrived in the Fall expecting to begin patient care and were told, "We have this great new program and you must wait until the spring to begin your patient care."

Lectures or discussion groups describing problem-based learning are inadequate to prepare faculty or students for working or studying within the format. Demonstrations of study group sessions using experienced students or faculty as demonstrators are much more effective with both groups.

### *Course Format*

This is a two-quarter course that is presented in the fall and winter quarters of the second academic year. The class is divided into small study groups of six to eight students with one faculty member. Each study group meets weekly for one and one half hours. In addition to the problem-based learning portion of the course, the students receive their first experiences with actual patients by participating in vision screenings at schools within the greater Boston area, and clinical observations at the varied external college clinical assignments for fourth year students. The clinical observations provide the students an opportunity to observe experienced student clinicians providing patient care and to observe the daily routine and functioning of a busy primary care eye clinic.

### *Cases*

Prior to the writing of specific cases for the course, learning and behavioral objectives were developed for the entire course by an ad hoc faculty committee. This list of the learning and behavioral objectives was included in the information the students received at the beginning of the course.

Each case was designed to encompass specific learning objectives. These learning objectives were provided to the facilitator in a document called the "Teaching Guide." The guide contains the learning issues written into the

case as well as other specific points that the case was designed to illustrate. It is important to note that the students are not limited to this list of learning issues, but the list can be thought of as the minimum number. The students are not provided with the case-by-case learning issues.

The cases are simulated patient encounters that are designed to provide the students with data and information in a manner analogous to the manner in which they would be obtained if dealing with an actual patient. The cases are prepared and reviewed by the course facilitators prior to the beginning of each year.

The cases are written in two formats: (1) all data and patient information are recorded on an examination form similar to that used in the teaching clinic of the college and (2) the patient information is presented in a dialog format as if the students were speaking with a patient in the context of an optometric examination. The examination data are available only at the request of the students and after they explain why the information is important to the hypotheses.

During presentation in the first format, the students receive the information in a sequence analogous to the order in which it is received from a patient. The first page is the patient profile, history and chief complaint, the second is the entrance tests, the third refractive data, etc.; the final page is the health assessment. The students are required to analyze the data for accuracy and consistency. Inconsistent data are often included intentionally in areas where they frequently occur. For example, the students are required to predict refractive error based on entering visual acuities and to confirm that any change in subjective refraction is consistent with the available data. This format has an additional value in that it familiarizes the students with the clinic record-keeping system and trains the students in reviewing patient exam records. An important reason to have students review collected data for inconsistencies and omissions is that by doing so they may review and self-correct their own data collecting methods during forthcoming patient encounters.

In the second format, the facilitator assumes the role of patient providing the case history and all examination data. The facilitator/patient requires the students to continuously analyze

their hypotheses relative to the available data and to justify the value of each additional piece of data. It is especially valuable in exposing students to the concept of the problem-specific examination. Record-keeping experience is provided as the students are required to maintain patient examination records as they progress through this exercise.

The subject matter within the cases includes areas such as myopia, hyperopia, anisometropia, presbyopia, headache and common ocular and systemic disease states.

### *Study Group*

During the study group meeting the group discusses: (a) information they have been provided; (b) what additional information they need; and (c) any hypotheses that may be reasonably proposed. Additional data and information are obtained as the case progresses. The students continually review and revise their hypotheses as their knowledge about the patient gets more extensive. They must identify aberrant data including data that are unusual on epidemiological grounds and try to predict, based on their hypotheses, what further testing may be needed and what the tests may reveal.

As the study group proceeds through the case, the students are expected to identify areas where their current level of knowledge is insufficient to adequately manage the patient in the optimal manner. These are referred to as "learning issues." At the end of the problem-based learning session, members of the study group select from the learning issues a specific subject to research during the following week. Rarely, issues may have to be assigned, but the purpose of student selection is to give the student a sense of personal investment and to maximize the student's interest in the activity. The students are encouraged to utilize various learning resources, i.e., texts, literature reviews, research literature, verbal communications with faculty, and the less traditional sources like various support groups and counseling activities, i.e., Alcoholics Anonymous, ALANON, AIDS Support Groups, etc.

For the next meeting each member of the study group prepares a short, written one or two page report of the learning issue that she/he has selected. Copies of each report are distributed to all members of the study

group and the facilitator. The reports are informal and may include pictures and/or graphs. It must show how the new information relates to understanding the patient's diagnosis, interpreting the signs and symptoms and how they influence the management of the patient. The patient is then revisited relative to the newly acquired knowledge, and there is a discussion of how the students may have handled the case differently had they been privy to this new knowledge.

At the conclusion of each session, the faculty and study group members review how the sessions are progressing. Students evaluate their performance and that of the study group as a whole. They are encouraged to suggest ideas that may make the study group more efficient or enjoyable. If there is obvious group tension or disharmony within the study group, intervention may be necessary. Ideally, such intervention should come from the members of the study group but intervention by the facilitator may be required. In cases in which a study group member is not participating at a satisfactory level, it may be desirable for the faculty to discuss the matter privately with the student. Important goals of this self-evaluation process are to accustom the students to think and listen critically, to be self-critical and to learn to give and take constructive criticism.

#### **Student Evaluation<sup>10,11</sup>**

Following each study group meeting, students are evaluated on their participation, preparation, and professionalism. Participation is judged by quality rather than quantity. If a student makes one or two relevant comments during the session, it may be more valuable to the group than a student who is excessively verbose, but contributes no ideas. Professionalism includes human relations, appropriate dress, punctuality and record keeping. Preparation indicates how well the student's learning issue was researched and presented.

Participation is judged on three levels: (a) Leadership Role - 3 points; (b) Participant Role - 2 points; (c) Passive Observer - 1 point. A minimum number of points are required to receive a passing grade or honors for the quarter. Each week the student evaluates her/his performance, and each student is evaluated by the facilitator. Both the student's self-evalua-

tion and the facilitator's evaluation are available and the students are encouraged to review them weekly and to confer with the facilitator if their evaluations are inconsistent.

In the area of professionalism and preparation, the student is allowed no more than two negative marks

#### **Facilitators**

Faculty participating in the problem-based learning course are referred to as facilitators because the term is more descriptive of the faculty member's duties to the study group. They are responsible for facilitating the identification of learning issues and the student's acquisition of this information. The facilitators participating in problem-based learning at The New England College of Optometry receive formal training in facilitating a problem-based learning study group. The training consists of discussions with faculty experienced in problem-based learning and in study group simulations with experienced students or faculty experienced in problem-based learning acting as members of the Study Group. New facilitators have the opportunity to observe students working in Study Groups and to participate in simulated problem-based learning study groups in the roles of student and facilitator. When it has been possible, new faculty have attended the problem-based learning Training Program at Tufts Medical School or in-house training has been conducted by faculty from the Tufts program.

The early problem-based learning literature indicates that expertise in the subject area<sup>3,4</sup> is of minor importance relative to skill in leading a small group. However, the more recent literature<sup>12-15</sup> indicates that study groups with facilitators who are knowledgeable perform better than those whose facilitators are not knowledgeable in the subject area. This program has always employed facilitators that are knowledgeable in the subject areas.

Facilitators assume different roles in the various phases of the program, depending on the rate of advancement of the study group. At first the facilitator practices<sup>4</sup> "modeling" during which time he/she is a role model, demonstrating to the students the manner in which the simulated patient encounter should be approached. As the student participation level increases, the facilitator

"coaches" the study group, becoming less an active participant but making suggestions and asking leading questions to facilitate the discussion. Finally as the weeks progress and the study group becomes more self-directed, the facilitator "fades" into the background, leaving the study group to direct its daily activities. At this point the primary responsibilities of the facilitator to the study group are to: (1) listen, (2) encourage critical thinking, (3) challenge assumptions, (4) provide feed back when appropriate, (5) guide and facilitate learning, and (6) create a pleasant learning environment.<sup>1,6</sup> He/she must avoid: (1) guiding discussions, (2) asking too many questions, (3) suggesting hypotheses and (4) providing information via mini-lectures. Otherwise the concepts of self-direction, self-study and self-criticism are lost.

#### **Assessment**

Most attempts at assessment of problem-based learning programs have not been very successful at differentiating students trained in problem-based learning programs from students trained via conventional programs<sup>2</sup>. The reason may be that these assessment methodologies have failed to measure the cognitive and behavioral differences observed in problem-based learning trained students<sup>6</sup>. A recent report by Schmidt, et al<sup>16</sup> comparing the diagnostic performance of medical students trained via a problem-based learning program relative to those trained in a conventional program found that the problem-based learning students were more accurate diagnosticians by about 5% and another study by Farnsworth<sup>17</sup> suggested that "there is a significant relationship between the repeated use of case simulations in problem-based learning and the accelerated development of clinical expertise." Considering the total number of patients a clinician will examine over a career, this represents a significant improvement in the number of appropriate diagnoses.

#### **Assessment at the New England College of Optometry**

Implementation of the problem-based learning program at The New England College of Optometry coincided with an overall restructuring of the clinical curriculum of years two and three. The need for assessment of

**Table 1**  
**Faculty Evaluation**

	Pre-PBL Mean	Std. Dev.	Post-PBL Mean	Std.Dev.	P-Value
Technical Skills	1.462	0.618	1.966	0.817	0.0016
Knowledge Base	1.746	0.713	2.168	0.552	<.0001
Analytical Skills	1.925	0.698	2.340	0.742	0.0055

the new program was obvious to NEWENCO'S Dean of Academic Affairs, Dr. David Heath, who designed an assessment instrument to evaluate the level of students' skills pre and post the revised program. The evaluation tool was described by Dr. Heath as being "formative and targeted at discrete curricular modules." The student's technical skills, knowledge base and analytical skills were evaluated in major categories of refraction, functional vision, anterior segment health, posterior segment health and in subcategories of each. In all, a total of 59 items were included. Each item was rated on a 1-5 point scale with detailed descriptors of the observable behavior for each of the five levels. Clinical faculty assigned to the third professional year evaluated students who had been exposed to problem-based learning (entering the third year) and those who had not been exposed to problem-based-learning (completing the third year). (Table 1) The same groups of students evaluated themselves using a similar evaluation instrument. (Table 2) Statistical analysis was performed with the MacIntosh StatView 5.0 program using the paired t-test as a two tailed test.

The results of this assessment are very encouraging. Students who were enrolled in problem-based learning were rated by the clinical faculty statistically higher in each of the general categories, Technical Skills, Knowledge Base and Analytical Skills. (Table 1) The student's self-evaluations indicated

that the problem-based learning group rated themselves statistically higher in Knowledge Base and Analytical Skills but the ratings in Technical Skill were unchanged. (Table 2)

It is significant that there was no decrease in the students' Knowledge Base because many of the skeptical faculty believe a definite decrease would occur. A possible basis for this skepticism is that in this program the students have considerable control over what they study and, therefore, all students may not be exposed to the same material or at the same level. According to the program evaluation, this predicted decline in knowledge base was not realized.

Based on earlier assessments of problem-based learning programs in medical education<sup>16, 17</sup>, these results were predictable, especially the improvement in analytical skills.

An important goal of the problem-based learning format is to instill an appreciation for life-long learning. We have not attempted to assess any change in students' appreciation for life-long learning and few attempts have been reported in the medical education literature<sup>18</sup>.

## Response

### Faculty Response

Based on informal discussions and anecdotal information, the initial reaction of the faculty to the program was skeptical. Concern was expressed regarding the educational value and cost effectiveness of the problem-based

learning format. Faculty unfamiliar with problem-based learning usually react in this manner<sup>19, 20</sup>. They have difficulty with the concept of teaching students decision making versus the traditional teaching and testing of facts. They do appreciate the advantage of presenting material in the clinical context rather than the traditional classroom lecture. It appears that some faculty are unwilling to give up control over the facts presented to students and they are uncomfortable with the freedom of students to decide what is important for them to learn. They are more accustomed to a fact-based curriculum rather than one in which it is accepted that there is no necessity for all students to learn identical information. They are uncomfortable with the idea that utilization of knowledge is more important than memorization of facts and they are devoted to the more traditional "lecture-memorize-pass the exam"<sup>15</sup> format.

As faculty gain experience with problem-based learning, they usually become enthusiastic proponents. Seeing students become excited about self-directed, independent learning usually gives them a new outlook toward the program<sup>19-21</sup>.

As the director of this program for the past five years, I believe the faculty involved are supportive of the course and of problem-based learning as a viable teaching method. The opportunity to work with the same small group (8 students) over a two-quarter period has provided the facilitators with a renewed appreciation for the rewards of teaching.

### Student Response

We find that, initially, problem-based learning can be very frustrating for students who are more attuned to "finding and solving the problem." They want an immediate and definitive "answer."

At the end of the first year, the initial student response was predictable,<sup>22</sup> based on student evaluations of the course and discussions with individual students. The adjustment to problem-based learning was painful for some. Frustration was expressed when students were presented with simulated patients without clear cut answers. Their inclination was to treat the case as a case analysis problem rather than a problem-based learning problem. As they became aware that this was more reflective of primary care in the real world, they became more accepting of

**Table 2**  
**Student Self-Evaluation**

	Pre-PBL Mean	Std. Dev.	Post-PBL Mean	Std.Dev.	P-Value
Technical Skills	2.765	0.181	2.929	0.229	0.173
Knowledge Base	2.679	0.164	3.103	0.247	<.0001
Analytical Skills	2.606	0.059	3.102	0.289	0.001

the problem-based learning format. It was a task keeping the Study Group in the problem-based learning format because the students wanted to treat each simulated patient as a "case analysis" problem. They wanted to simply identify the problems and solve them.

As the students become acclimated to their study group, the independent learning begins to be an exciting, positive experience. Within a reasonably short period, the groups are capable of functioning well without the presence of the facilitator. Occasional guidance is needed but for the most part the groups are reasonably independent and self-directing.

## Conclusions

Based on the survey data and anecdotal information from students and faculty, we believe that the problem-based learning format is an effective manner of teaching clinical decision making. Faculty and students have reacted positively to the program both in terms of enjoyment and as an educational experience.

Although some students never feel comfortable with the problem-based learning format, the data indicate that students' knowledge base and analytical skills are better developed following exposure to the problem-based learning format in a clinical context.

## Future Plans

Our data indicate that problem-based learning has been successful and that it has an important place in the curriculum of The New England College of Optometry, and perhaps in optometric education in general.

At this time problem-based learning has been introduced into the didactic curriculum of the first and third professional years, in the ocular disease tract of the third year, and as an integrated seminar in the first year curriculum. Currently, the first year

program is a one-quarter course. This course is being evaluated and the feasibility of extending it to two or three quarters will be considered.

(NOTE: Examples of the case formats with the Teaching Guides are available upon request from Dr. Chauncey)

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## References

1. Albanese MA, Mitchell S. Problem-based learning: A review of the literature on its outcomes and implementation issues. *Acad. Med.* 1993; 68 (1): 52-81. (See references therein.)
2. Norman GR, Schmidt HG. The psychological basis of problem-based learning: a review of the evidence. *Acad. Med.* 1992; 67 (9): 557-565. (See references therein.)
3. Barrows HS. How to design a problem-based curriculum for the clinical years, Springer Publishing Co., NY, 1985.
4. Barrows HS, Tamblyn RM. Problem-based learning: an approach to medical education. New York: Springer Publishing Co, 1980.
5. Rouse MW. Problem-based learning: an alternative to traditional education; *JOE* 1990; 15(4): 111-112.
6. Wilkerson L, Gijsealaers WH, eds. Bringing problem-based learning to higher education: theory and practice. San Francisco: Josey Bass Publishers, 1996: 1-3.
7. Halpern DF. Thought and knowledge: an introduction to critical thinking. 3rd ed. Lawrence Erlbaum and Associates, 1996.
8. Vincelette J, Lalande R, Delorme P, Goudreau J, Lalonde V, Jean P. A pilot course as a model for implementing a pbl curriculum. *Acad Med* 1997; 72 (8): 698-701.
9. Tipping J, Freeman RF, Rachlis AR. Using faculty and student perceptions of group dynamics to develop recommendations for pbl training. *Acad Med* 1997; 70 (11): 1050-1052.
10. Schor NE, Troen P, Kanter SL, Janosky, JE. Interrater concordance for faculty grading of student performances in a problem-based learning course. *Acad Med* 1997; 72 (2): 150-151.
11. Blake JM, Norman GR, Keane DR, Mueller CB, Cunnington J, Didyk N. Introducing progress testing in McMaster University's problem-based learning medical curriculum: psychometric properties and effect on learning. *Acad Med* 1996; 71 (9): 1002-1007.
12. Schmidt HG, Van Der Arend A, Moust JHC, Kokx I, Boon L. Influence of tutor's subject-matter expertise on student effort and achievement in problem-based learning. *Acad. Med.* 1993; 68 (10): 784-791.
13. Schmidt HG, Moust JHC. What makes a tutor effective? A structural-equation modeling approach to learning in problem-based curricula. *Acad Med* 1995; 70 (8), 708-714.
14. Dolmans DHJM, Wolkhagen IHAP, Schmidt HG. Effects of tutor expertise on student performance in relation to prior knowledge and level of curricular structure. *Acad Med* 1996 71 (9): 1008-1011.
15. Wetzel, M. Developing the role of the tutor/facilitator. *Postgrad. Med J* 1996; 72: 474-477.
16. Schmidt HG, Machiels-Bongaerts M, Hermans H, Ten Cate TJ, Venekamp R, Boshuizen HPA. The development of diagnostic competence: comparison of a problem-based, an integrated, and a conventional medical curriculum. *Acad Med* 1996; 71(6): 658-654.
17. Farnsworth CC. Measuring the effects of problem-based learning on the development of veterinary students' clinical expertise. *Acad Med* 1997; 72 (6): 552-554.
18. Fox RD, West RF. Developing medical student competence in lifelong learning. *Med Ed* 1983; 17: 247-253.
19. Bernstein P, Tipping J, Bercovitz K, Skinner H. Shifting students and faculty to a pbl curriculum: attitudes changed and lessons learned. *Acad Med* 1995; 70 (3): 245-247.
20. Vernon, DTA. Attitudes and opinions of faculty tutors about problem-based learning. *Acad Med* 1995; 70 (3): 216-223.
21. Vernon, DTA, Hosokawa, MC. Faculty attitudes and opinions about problem-based learning. *Acad. Med* 1996; 71 (11): 1233-1238.
22. Kaufman DM, Mann KV. Comparing student's attitudes in problem-based and conventional curricula. *Acad. Med* 1996; 71 (10) 1096-1099.

# Use of Information Technology in Optometric Education

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## Abstract

*Optometric educators may prepare their students for current and lifelong learning by use of educational technology. Computers and telecommunication networks have been called the emerging economic tools of the future. A dramatic increase in the number of computers at colleges and universities has occurred in response to perceived benefits for students, teachers, and administrators. This article discusses the theoretical framework for the use of educational technology and a specific academic assignment, the Electronic Media Paper (EMP). The EMP assignment was given to second year optometry students and required the search of two different electronic media for information. Results suggest that use of the Internet for information searches may be a useful tool for specific academic assignments and for searching for other optometric information. Professionals in the future will probably be concerned with a broad range of skills and will need continual updating and development.*

**Key Words:** Optometric education, computer-assisted instruction, educational technology, information technology, use of computers in education.

## Introduction

Computer acquisition by higher educational institutions is a reflection of perceived gains from computer usage.<sup>1</sup> Administrators have found computer use beneficial for the scheduling of classes, student registration, financial aid enhancement, public relations, student recruitment, and other purposes.<sup>2</sup> Faculty members have found computers beneficial for teaching, grant searches, research, increased publication opportunities, providing service within and outside the institution, and finding jobs.<sup>2</sup> Students have found computer usage beneficial for finding information, handling data, completing assignments, networking with other students, collaborative projects, and other purposes.<sup>2</sup>

Some authors have discussed other aspects of student learning with computer assisted instruction (CAI). For instance, Johnston and Gardner<sup>3</sup> suggest that student learning may benefit from the use of CAI in three areas:

- Direct instruction: CAI may be used to introduce new subject content and to help students evaluate

their mastery of the material. Examples include tutorial programs and interactive simulations.

- Working tools: CAI may help students gain skills for accomplishing specific tasks, increasing secondary skills while pursuing an academic endeavor. Examples include acquiring skills by using word processing, database management, spreadsheets, and statistical software programs.
- Information exchange: CAI may help students gain skills to obtain or exchange information. Examples include on-line databases, e-mail, computer conferencing, and bulletin boards.

David Jonassen<sup>4</sup> argues for student use of computers as tools to construct knowledge. He states that computers should be used as "Cognitive tools (that) actively engage learners in creation of knowledge that reflects their comprehension and conception of the information rather than attempting to reproduce the knowledge of the professor."<sup>4</sup> In this constructivist model of learning, student applications of CAI serve as stimuli for student reflection, critical thinking and problem solving abilities.<sup>4</sup>

The purpose of this paper is to present a framework for educational use of technology in schools and colleges of optometry. As an example of using technology in optometric pedagogy, the Electronic Media Paper (EMP) is discussed.

## Classification of Educational Technology

When discussing educational technology one has to consider a wide range of instructional media. For example, chalkboards, flipcharts, overhead projectors, and slides are common teaching technologies that are effective instructional devices and often taken for granted.<sup>6</sup> Since educational teaching media vary, one may wonder when to use standard teaching tools or more advanced tools such as computers and the Internet. Wilson<sup>6</sup> reminds us that faculty members must relate educational technology use to the missions of colleges and universities.

Diana Laurillard<sup>7</sup> devised an educational technology framework that reflects dialogue established between a teacher and learner from the use of educational technology.<sup>7</sup> Her three dialogue categories are designated as interactive, adaptive and discursive.<sup>7</sup> In

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an **interactive** dialogue a student performs an act to accomplish the desired learning task and the teacher provides feedback. In **adaptive** dialogue a teacher uses the student's perception of concepts to modify their mutual dialogue. In **discursive** dialogue a student's and a teacher's perceptions of concepts are openly and easily accessible to each other. Laurillard suggests specific types of educational technology associated with each dialogue category. For example, interactive dialogue includes computer simulations, microworlds, and modeling. Adaptive dialogue includes computer tutorial programs, tutorial simulations, and tutoring systems. Discursive dialogue includes audio-conferencing, video-conferencing, and computer mediated conferencing.<sup>7</sup> A framework for educational technology use may benefit from empirical evidence.

## Research On Educational Technology

Most research on learning with technology has been conducted to find an appropriate combination of medium, student, subject content, and learning task.<sup>8</sup> Starr and Milheim<sup>9</sup> surveyed members of 30 educational newsgroups about their views and usage of the Internet in secondary and higher education. Half (50.3%) of their respondents said they had personally used the Internet two years or less, suggesting the Internet is a new tool among educators. More than 90% of the respondents used E-mail and the World Wide Web and about 60% used newsgroups, file transfer protocol (FTP), and telnet. The Internet was used by more than 80% of the respondents for personal research and working with a colleague. Only 40% used the Internet for class materials, student research, and class demonstrations. Respondents overwhelmingly felt the impact of the Internet would be very positive (65.4%) or positive (31.5%).<sup>9</sup>

Their results were similar to those of Shifflett and colleagues<sup>10</sup> who found 73% of professors surveyed at the California State University system used a microcomputer daily. However, only 22% of the respondents used a computer for enhancement of their classroom presentations, and 31% said they had integrated use of computer applications into their courses.

The tendency has been to obtain technology and then try to find an educational use for it.<sup>7</sup> To avoid merely

"adding on" pedagogic technology to existing teaching methods, causing dilution of effort, ineffective use of systems, and cost increases, adequate planning must occur.<sup>6,7</sup> Perhaps starting with a teaching strategy or educational objectives may be more effective.

## Educational Objectives with Technology

Several strategies have been suggested to enhance educational objectives for technology. Those strategies include defining learning objectives, identifying students' needs, designing the learning activities, and analyzing development costs.<sup>7</sup>

Ellsworth<sup>2</sup> proposes four levels of student learning for the successful application of an Internet student assignment. Each level is considered developmental and requires mastery before proceeding to the next level. The stages are:

- Level 1: Why Are We Doing This? Students must see the connection between what is being learned and the methods and media for the teaching.
- Level 2: Learning the Technology. Using the hardware and learning the software and protocols involved in connecting and accessing e-mail, and other Internet components.
- Level 3: Mastering the Tools. Learning the search tools of the Internet, such as search engines, Gopher, Archie, the World Wide Web and others.
- Level 4: Applying What Has Been Learned for Problem Solving. Students appreciate the use of the Internet in information gathering and problem solving.

With these learning objectives in mind, a student assignment was formulated for second year optometry students that included a traditional library search and an Internet search for information. The following section describes the assignment.

## Procedure

As part of the course requirements for an ophthalmic optics course at Southern College of Optometry (SCO), students were instructed to write an electronic media paper (EMP). Students individually had to conceive an ophthalmic optics related question or topic and obtain permission for its use by e-mailing their

instructor. Two different electronic information searches were required for the EMP. The first was a search using Visionet, an electronic optometric database produced at SCO. Students had access to Visionet in the College's Library. The second search was finding information using the Internet. Students had access to the Internet in the College's Learning Resource Center. Within the paper a section had to be included that described both electronic searches.

Specific instructions for the EMP were given in a handout during the first day of the course. Students were told that either of the electronic media might not have information on their subject or question. However, at least one of them had to have pertinent information to write the EMP. On-line sources for learning how to access and use the Internet and search engines were included in the handout. Those sources include the World Wide Web, Gopher, and FTP. The writing style format of the American Psychological Association<sup>11</sup> (APA) was adopted for the EMP since the current writing style suggested for optometric publications does not contain electronic citations or references.<sup>12</sup> Also, students were given on-line sources available for APA style citations that are not included in the APA manual.<sup>13</sup>

A survey, the EMP Student Questionnaire (Appendix), was given to all of the 120 second year optometry students who wrote an EMP. The survey was given after completion of the EMP to give students an opportunity to use the Visionet or the Internet for educational information searches other than the course assignment. Descriptive statistics of student responses were obtained, and a Chi-square was performed between those students previously using the Internet before the EMP for academic purposes at SCO and those who had not.

Consisting of 16 questions, the EMP Student Questionnaire obtained information in two basic areas (Appendix). The first area was designed to obtain information about students' prior use of the Visionet and the Internet. The second was designed to obtain perceptions about students' information searches using the Visionet and Internet.

## Results

Fifty (42%) of the students in the ophthalmic optics course returned their surveys. Respondents were

divided into two groups, according to how they answered Question 2 (Appendix). One group had used the Internet at least once to find information for an academic assignment at SCO before the EMP project (46% of respondents, Table 2), while the other group had not (54% of respondents, Table 2). Using those two groups, the remaining questions were analyzed for group differences in answers by use of a Chi-square statistical procedure. A significant difference between the groups in the answers occurred only in Question 1 (Table 1). This suggests there was a difference in usage of the Visionet database before the EMP assignment among students who had or had not previously used the Internet at SCO for a required assignment.

Response percentages were tabulated for answers to questions on the questionnaire. Well over half (60%) of the second year students responding to the survey reported they had not used the Visionet database for an assignment before the EMP (Table 2, Question 1). Slightly over half (54%) said they had used the Internet for a required assignment at SCO before the EMP (Table 2, Question 2). An almost equal number (52%) indicated they had used the Internet at least once for a required assignment at a college or university before coming to SCO (Table 2, Question 3).

Almost two-thirds of the students (64%) said they found most of the information for their EMP with the Visionet (Table 2, Question 4). The majority of students, 54% (Table 2, Question 5), said they did not explore Internet connections, such as Gopher or FTP, besides the World Wide Web for their information searches.

Since completion of the EMP assignment to answer the student survey—a period of about one month—a much smaller percentage of responding students had accessed the Visionet (22%) for an optometric or educationally related purpose than those who had accessed the Internet (56%) for the same reasons (Table 2, Questions 6 & 7).

Over three-fourths (80%) of the students said they did not have difficulty finding information from the Visionet (Table 2, Question 8) and 58% said they did not have difficulty finding information on the Internet (Table 2, Question 9). About three-fourths (74%) said they did not have difficulty judging what information to use for their EMP from sources found on the

Visionet (Table 2, Question 10) and 60% said the same for the Internet (Table 2, Question 11).

After practice, 72% (Table 2, Question 12) of the students said they found finding information using the Visionet "user friendly," and 68% (Table 2, Question 13) said the same for the Internet. Since they now had experience with the Visionet, 64% (Table 2, Question 14) said they would probably use the Visionet to find information relating to optometry when they were in practice. However, a larger percentage of students (74%) said they would probably use the Internet to find information relating to optometry while in practice (Table 2, Question 15). Two-thirds of the students (Table 2, Question 16) indicated they felt that writing the EMP gave them a greater knowledge about an ophthalmic optics topic than they would have probably acquired from their class alone.

## Discussion

One purpose of the Electronic Media Paper was to introduce second year optometry students to sources of information that they may not have been accustomed to accessing. The EMP assignment appears to have succeeded in that effort. Before the assignment, 60% (Table 2, Question 1) of the second year students had not used the Visionet for a required assignment, and 54% (Table 2, Question 2) had not previously used the Internet for a required assignment while at SCO. Interestingly, slightly over half the students (52%) reported using the Internet for an assignment at a college or university before coming to SCO (Question 3 & Table 2), a greater percentage (46%) than had used the Internet at SCO before the EMP (Table 2, Question 2). This may be an indication that an increasing number of entering optometry students have information technology experience. Faculty members may be able to use those skills to introduce concepts and information in ways other than traditional teaching methods, such as lecturing. Student skills may allow faculty members to be innovative in their pedagogy.

Finding only one significant difference to an answer to questions on the EMP Student Questionnaire between students previously using the Internet and those who did not while at SCO may suggest that students without

Internet experience were not necessarily at a disadvantage for the EMP assignment. This result may suggest that faculty members may want to consider use of CAI in their courses without fear of penalizing inexperienced students.

Students using more information from their Visionet search than their Internet search is conceivably a reflection of the nature of information on the Internet. For example, 32% (Table 2, Question 11) of the students said they had difficulty judging what information to use from sources on the Internet while only 16% (Table 2, Question 10) had difficulty judging using Visionet. The Visionet is a database consisting of journal articles, books, and other traditional library information sources. The Internet, on the other hand, is a vast source of unrefereed information, some of which may be of questionable validity. Students had to access a large data source, the Internet, and use critical thinking skills to decide what available information would be useful for their needs. What the students found is that much of the information on the World Wide Web relating to ophthalmic optics topics is advertising from companies and not necessarily useful for their papers. Therefore, the EMP served to compare data sources for students and to enhance development of student critical thinking skills. However, one secondary benefit that students may experience is that now they know they may search the Web for information from ophthalmic vendors when they are in practice. In this sense, the EMP supported the use of CAI for lifelong learning.

Results suggest that students will probably use the Internet to find information relating to optometry. Although about half the responding students had used the Internet for an academic assignment before coming to SCO, after having experience with a library-bound database and the Internet, students still preferred to use the Internet. Many more students (56%) had accessed the Internet for an optometric or educationally related purpose than the Visionet (22%) one month after completion of their EMP. This may be an indication that restricted availability databases, such as the Visionet, may have an opportunity for increased usage if they were put on-line. Putting information on the Internet may increase usage by reducing time and space barriers for information seekers.

Akker and Plump<sup>14</sup> state that students' use of technology may reinforce the effectiveness of certain higher order educational objectives. For instance, technology may be used to develop information management and problem solving skills.<sup>14</sup> While writing the EMP, optometry students learn how to use computer hardware, software, and use of search strategies to find information from electronic media and to use that information to answer a clinically related question or topic. Students have to access and evaluate information that may not be in the journal or book formats with which they are accustomed.

As Kerin and Frank<sup>14</sup> state, information downloaded from the Internet is often inconsistent. The information is often out of context and unedited. Students must critically analyze the information and then organize it in a manner useful for them. The EMP was designed to serve as a critical thinking teaching tool. Critical thinking may prove to be a useful skill in clinical practice.

The EMP may be an easy assignment for some students and quite challenging for others. Students enter optometry school with different levels of computer skills. Some have an extensive background while others have had little exposure. To address the range of student skills, the University of Rochester School of Medicine and Dentistry has initiated a program that requires students to show competency in five areas of computer information skills before they graduate.<sup>16</sup>

The EMP is a pedagogic assignment that should serve to increase computer skills of students without previous exposure to electronic information searches.

Professionals of the future will probably need broad skills and need continual updating and development.<sup>17</sup> They are likely to become less concerned with initial professional "qualification" skills for a lifetime career and more concerned with securing access to quality, relevant, and professional assistance and information when need arises at different times in their careers. Optometric educators, by using available educational technology, can enhance their teaching and students' learning experiences and prepare their students for a lifetime of learning.

**Table 1**  
**Chi-Square Test of Independence**

	Pearson Value	Significance
Question 1	7.73	0.005*
Question 3	2.98	0.08
Question 4	4.39	0.11
Question 5	4.09	0.39
Question 6	3.83	0.43
Question 7	5.30	0.26
Question 8	4.39	0.11
Question 9	3.45	0.48
Question 10	2.95	0.56
Question 11	3.48	0.32
Question 12	1.89	0.76
Question 13	5.53	0.13
Question 14	4.78	0.31
Question 15	8.12	0.09
Question 16	5.21	0.27

\* = Significant at the 0.05 level.

**Table 2**  
**Student Questionnaire Results**

	Yes	No Opinion		No	
Question 1	40%			60%	
Question 2	46%			54%	
Question 3	52%			48%	
Question 4	64%	14%		22%	
Question 5	12%	14%		74%	
Question 6	22%	2%		76%	
Question 7	56%	4%		40%	
	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
Question 8	2%	8%	10%	36%	44%
Question 9	18%	14%	10%	40%	18%
Question 10	16%	10%	62%	12%	
Question 11	10%	22%	8%	44%	16%
Question 12	24%	48%	18%	10%	
Question 13	20%	48%	12%	16%	4%
Question 14	20%	44%	14%	16%	6%
Question 15	22%	52%	14%	8%	4%
Question 16	20%	46%	12%	14%	8%

## References

1. Serim F, Koch M. Why teachers use the Internet. Sebastopol: Songline Studios, 1996:3-9.
2. Ellsworth JH. Education on the Internet: A hands-on book of ideas, resources, projects, and advice. Indianapolis: Sams Publishing, 1994.
3. Johnson J, Gardner S. The electronic classroom in higher education: A case for change. Ann Arbor: National Center for Research to Improve Postsecondary Teaching and Learning, University of Michigan, 1989.
4. Jonassen DH. Computers as cognitive tools: Learning with technology, not from technology. Journal of Computing in Higher

## Appendix

### EMP Student Questionnaire

Please answer the following questions or statements about your experience(s) with the Electronic Media Paper (EMP) that you wrote.

True or False: True = 1, False = 2, No Opinion = 3

1. I used the Visionet at least once to find information for a required assignment at SCO before the EMP assignment.
2. I used the Internet at least once to find information for a required assignment at SCO before the EMP assignment.
3. I used the Internet at least once to find information for a required assignment at a college or university before coming to SCO.
4. I found the majority of the information that I used for my EMP from the Visionet.
5. I explored other Internet connections (Gopher, FTP, etc.) beside the World Wide Web during my EMP Internet searches.
6. I have accessed the Visionet since completion of my EMP for an optometric or educationally related purpose.
7. I have accessed the Internet since completion of my EMP for an optometric or educationally related purpose.

Use the following scale for the following: Strongly Agree = 5, Agree = 4, No Opinion = 3, Disagree = 2, Strongly Disagree = 1.

8. I had difficulty finding information for my EMP from the Visionet.
9. I had difficulty finding information for my EMP from the Internet.
10. I had difficulty judging what information to use for my EMP from sources found during my Visionet searches.
11. I had difficulty judging what information to use for my EMP from sources found during my Internet searches.
12. After practice, I found that finding information using the Visionet was "user friendly."
13. After practice, I found that finding information using the Internet was "user friendly."
14. Since I now have some experience, I will probably use the Visionet to find information relating to optometry when I am in practice.
15. Since I now have some experience, I will probably use the Internet to find information relating to optometry when I am in practice.
16. I feel that writing the EMP gave me a depth and breath of knowledge about an ophthalmic optics topic greater than I would have probably acquired from class alone.

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|--|--|--|
| Education 1995; 6:40-73.   | Computers in the schools 1993; 9:107-117.  | Learner-powered multimedia. Technos 1996; 4:22-6.  |
| 5. Davis BG. Tools for teaching. San Francisco: Jossey-Bass, 1993: 316-341.  | 11. Publication manual of the American Psychological Association. 4th ed. Washington, DC: American Psychological Association, 1994.  | 16. Computing in medical education at the University of Rochester [Online]. Available: <a href="http://www.urmc.rochester.edu/smd/informatics/medcomp.html">http://www.urmc.rochester.edu/smd/informatics/medcomp.html</a> . |
| 6. Wilson BJ. Technology, computers, and educational goals. NEA Hi Ed J 1996; 11:111-3.                                    | 12. Lyle WM, Williams TD, Chase WW. A style guide. 4th ed. Bethesda, MD: American Academy of Optometry, 1996.  | 17. Coulson-Thomas CJ. Developing tomorrow's professionals today. J European Industrial Training 1991; 16:3-11.  |
| 7. Laurillard D. Rethinking university teaching. New York: Routledge, 1993:97-266.   | 13. Li X, Crand N. Electronic Sources: APA style of citation [Online]. Available <a href="http://www.uvm.edu/~ncrane/estyles/apa.html">http://www.uvm.edu/~ncrane/estyles/apa.html</a> . |  |
| 8. Dyrli OE, Kinnaman DE. Preparing for the integration of emerging technologies. Technology and Learning 1994; 14:92-100. | 14. Akker J, Plomp T. What kind of leadership stimulates the integration of information technology in education. Teaching Education 1992; 6:29-34.                                       |  |
| 9. Starr RM, Milheim WD. Educational uses of the Internet: An exploratory survey. Educational Technology 1996; 36:19-28.   | 15. Kerin J, Frank C. Beyond the textbook:   |  |
| 10. Shifflett B, Richardson L, Ghiasvand F, Plecque D, Verduzco M, Thomas J. Computing needs among college educators.      |  |  |

# How to Write Case-Based Laboratories

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## Abstract

**Background.** Studies reported in the health professions literature have shown that utilizing clinical cases to reinforce educational objectives results in better student recall of the information under clinical circumstances. A model for utilizing case-based laboratories has been developed and implemented in a low vision course for third year optometry students. **Methods.** Clinical cases were introduced to the students through case scenarios, role-plays, and simulations. Students were then required to solve patient problems and complete various testing activities. In the process, they were required to demonstrate achievement of stated learning objectives. **Results.** A preliminary survey indicates that both students and faculty felt the case-based format prepared students for clinical patient care better than the traditional task-oriented format. **Conclusions.** The case-based laboratory format has advantages over the traditional task-oriented format for teaching low vision laboratories, and has potential for applications in other clinical courses.

**Key Words:** case-based laboratories, problem-based learning, problem-related learning, low vision

## Introduction

The concept of problem-based learning (PBL) has been advanced in medical education and other health professions for over two decades.<sup>1</sup> PBL is a unique approach to professional education, using tools that relate to a specific teaching-learning process. It is not merely using case examples to reinforce a concept. In a true PBL curriculum, learning activities take on a different appearance. The problems(s) are presented at the beginning of the course, and students choose or are assigned to small working groups. Rather than have lectures and laboratories scheduled in a structured fashion, student groups are generally allowed to meet and work at their own pace. Cases are developed with the idea that as the students solve the problem, they will learn

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the desired information and achieve the learning objectives for the course.

Only a relatively small number of institutions have taken on the task of changing their curricula to a problem-based format.<sup>2,3</sup> For all its advantages as a means of educating health professionals, a number of significant barriers exist to a complete curricular transformation, as is generally recommended by authorities in PBL. First, the faculty-to-student teaching ratio is significantly increased. Small groups of 5-7 students per faculty facilitator are most commonly recommended. Second, small group meeting and discussion rooms are necessary. Health professions institutions that are geared toward lecture/laboratory settings may not lend themselves well to small group independent study. Third, for PBL to be most effective there should not be competing educational requirements, such as lectures for other courses that do not follow the PBL format.<sup>1</sup>

The advantages of PBL in training optometrists are no less significant than in medicine, but the barriers in optometry are even greater. None of the optometry schools in the U.S. has a department of health professions education which serves as a resource for developing a PBL program. Additionally, financing for such a venture would be difficult given the way optometric education is funded. These may be among the factors contributing to the lack of a significant application of problem-oriented learning techniques in optometric education.

Scheiman and Whittaker<sup>4</sup> used a portable patient problem pack for instruction in a strabismus course. The same authors, in another article<sup>5</sup>, used a course format that called for simulated patient problems, weekly quizzes, a detailed set of course notes, large group class discussion of patient problems, small group discussion, and a problem-related evaluation system. This format was developed based on the realization by the authors that a pure PBL approach could not be implemented because of the high faculty/student ratio necessary, and the subject-based nature of the rest of the curriculum.

Other authors have supported the use of problem-related teaching methods in optometric education. Dr. Pascal James Imperato<sup>6</sup>, at a conference sponsored by the Association of Schools and Colleges of Optometry, acknowledged that problem-based learning "...is labor intensive for both students

and preceptors..." but clinical education "...must also respond to newer and better approaches to learning which move away from the passive receipt of information..." Dr. Thomas Freddo<sup>7</sup>, speaking at a symposium entitled "Strategic Planning for Optometric Education," discussed the alternatives to traditional teaching presented at the Curriculum Conference held in Denver, Colorado, in 1992. He cited the need to relate learning objectives to clinical outcomes.

While a true problem-based curriculum presently may be beyond the reach of optometric educators, the use of problem-related learning and evaluation techniques is not.

As part of an effort to advance this type of learning experience, we have developed case-based laboratories to assist students in building problem-solving skills that they can relate to the clinical setting. We have implemented this model in the low vision course for third year optometry students.

This concept for the laboratory setting is based on the interactive lecture<sup>8</sup>, in which a case is presented and options are explored to achieve learning objectives. The objectives for a particular laboratory are determined, and appropriate case-based patient problems are developed. Laboratory exercises are then used to solve the patient problem. Instructions on the operation of equipment or analysis of results are presented in the required readings. Video or slide materials are made available for student review of some topics. Lab instructors are to act only as facilitators. They are directed to answer specific questions, but should encourage students toward independent discovery learning. At the end of the session, the groups are brought together for discussion and closure.

There are several advantages to this format. First, the students come to realize that their laboratory activities have a clinical correlate, and are not to be taken lightly. Second, students must put themselves in the patient's place and realize the difficulties that patients often have in responding to testing. Third, the activities are structured such that the students do not have to perform them in a certain order. This is especially important in laboratories where only a limited number of students can work on one activity at a time because of equipment or physiological limitations (e.g., students can only do

gonioscopy on their partners for a limited time during one session). Finally, the students' lab materials become useful as a refresher when they enter clinical rotations and are then called on to deal with actual patients. If they are successful in working through this simulated clinical exercise on their own, they should be able to duplicate the effort in clinic.

## Methods

There were several reasons to convert the laboratories to a case-based format. One was to improve the participation and interest in low vision care among the students. For a course like low vision, which is often misunderstood and avoided by students, this would be considered a real accomplishment.

Another important goal was the development of problem solving skills and an accompanying improvement in competency in the specific patient care skills the students must have while serving in a low vision clinical rotation. Meta-analysis of learning outcomes of PBL programs strongly suggests better recall of clinical information vs. traditional learning modalities.<sup>9,10</sup> PBL and the case-based lab format used here are based on similar concepts. We feel it is reasonable to assume that the physical association of a clinical skill with a particular laboratory activity will also result in improved student recall with the case-based format.

Each two-hour low vision laboratory session was organized according to the following guidelines:

1. Instructor's introduction. At the beginning of the laboratory session, the instructor should give a brief introduction regarding what is expected of the students during the session. The instructor should not lecture on material related to the topic at hand, but rather should orient the students as to what equipment is needed to perform the designated clinical techniques and how to get started practicing clinical techniques on their lab partners. Because of the amount of time needed for students to practice techniques on each other and accomplish behavioral objectives, this portion of the lab session should not last more than 10 to 15 minutes.
2. Required readings. The students will be expected to read the required material prior to the labo-

ratory session. Some or all of the clinical techniques included in the laboratory session may be covered only in the required readings.

Therefore it is essential for the students to have read the required material prior to the laboratory session. Alternate and/or supplemental readings can also be listed.

3. Required equipment. List any equipment the student will need to bring to the laboratory session in order to complete the exercises for that session.
4. Goals. The goals should be clearly defined in the lab manual and should relate to the students' acquiring fundamental clinical skills necessary to provide low vision care during their low vision clinical rotation and in a practice situation after graduation.
5. Exercises. Students should perform the exercises listed in their lab manuals and answer questions as directed in the lab manual as they practice clinical techniques on each other. Exercises will often include case scenarios, role-plays, and simulations, preferably based on actual Low Vision Rehabilitation Service patients. The instructor should guide the students as they practice on each other, rather than simply demonstrating the techniques to the students. Clinical problem solving skills should be developed.
6. Student behavioral objectives. To receive credit for the laboratory session, each student must demonstrate specified behavioral objectives. The behavioral objectives should be brief and relate to the most essential elements of the clinical techniques being covered. Due to time constraints, behavioral objectives should be selected that will require no more than 3 to 5 minutes to perform.
7. Closing discussion. Approximately 20 to 30 minutes prior to the end of the laboratory session, the instructor should gather the students and initiate the closing discussion. Topics should pertain to skills necessary to perform the designated clinical techniques, as well as to understanding the kinds of problems patients encounter during their low vision rehabilitation. Topics will be included in the lab manual, but should be individualized to discuss problems and situations

that have developed during each laboratory session.

Our typical faculty-to-student ratio is one faculty member and one teaching assistant per section of 14 to 16 students. This has been an acceptable ratio, but we feel an optimum number of students per section is 10 to 12. Limitations of the number of low

vision faculty and available lab space preclude the smaller section size for us.

A sample low vision laboratory session is included (appendix 1).

## Results

The case-based format appeared to be successful in its intended goals,

based on initial student and faculty feedback during the course. To further evaluate this outcome, we administered a preliminary survey to students and faculty at the end of the students' clinical rotation in low vision. Sixty-four students and three faculty members (excluding the authors) involved in both the case-

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## Appendix 1 Sample Low Vision Laboratory

### Laboratory 4 Near Low Vision Devices

#### Required Reading

- Cole RG. Visual acuity and the predicted reading add. in Rosenthal BP, Cole RG. Functional Assessment of Low Vision. St. Louis: Mosby-Year Book, Inc, 1996: 27-39
- Musick JE. How to restore the gift of reading. Rev Opt May 1993; 130(5): 55-56, 60-62
- Low vision class notes

#### Required Equipment

trial lenses, trial frame

#### Goals

Upon completion of this laboratory session, the student should be able to:

- 1) recognize which patients are candidates for near low vision devices
- 2) select an appropriate near low vision device for evaluation with a patient, based on ocular diagnosis, visual acuity, patient goals, preferred working distance, and whether or not device is to be used with a bifocal add
- 3) specify parameters of near devices appropriate for individual applications
- 4) instruct patients in the proper use of near low vision devices
- 5) recognize physical and psychosocial problems patients experience when learning to use a near low vision device

#### Exercises

Students should pair up. The student playing the role of the patient should select one of the case scenarios provided. From the case scenario, determine your primary goal for near vision and your ocular diagnosis. Wear a low vision simulator appropriate for your ocular diagnosis for the rest of the exercise. The simulators for today's lab will be frosted goggles, some of which may simulate central scotomas. The student playing the role of the doctor should do a brief case history, test near visual acuity, and evaluate near low vision devices. Each student should take a turn playing the role of the patient and the doctor. Evaluate spectacle, hand-held, and stand magnifiers on each other. Evaluate the use of these magnifiers in conjunction with proper lighting and reading stands.

Answer the following questions while performing the exercises:

- 1) List your patient's primary goal for near vision: \_\_\_\_\_
- 2) Record your patient's near acuity through the simulator, while wearing habitual correction \_\_\_\_\_
- 3) With what "power" should you begin evaluation of near devices for your patient's primary goal? \_\_\_\_\_
- 4) Notice how many words or letters are in your field of view when using the various types of magnifiers. Which type of magnifier (spectacle, hand-held, or stand) affords the largest field of view? \_\_\_\_\_

- 5) List appropriate parameters for the near device you would prescribe for your patient \_\_\_\_\_

## Student Behavioral Objectives To Be Checked Off by Faculty or Teaching Assistant

NAME \_\_\_\_\_

- \_\_\_\_\_ student appropriately calculates starting point for testing near devices based on patient's primary goal and patient's near acuity
- \_\_\_\_\_ student properly demonstrates use of reading stand and lighting for one type of near device to be selected by faculty or teaching assistant
- \_\_\_\_\_ student properly instructs patient regarding use of one type of near device to be selected by faculty or teaching assistant

## Topics For Closing Discussion

- 1) How did the use of near devices affect your reading speed? ...reading duration?
- 2) What physical problems did you encounter while using near devices?
- 3) What psychosocial problems might patients experience while learning to use a near device?
- 4) What factors might improve success with near devices?
- 5) How do you determine which reading add to begin testing with?
- 6) How will the patient's ocular diagnosis affect the near prescription? What other factors can affect the near prescription?
- 7) What patient responses indicated to you that you were testing with too much or too little magnification?
- 8) With which near devices do you think patients might encounter binocular problems?
- 9) Under which conditions are a spectacle-type magnifier advantageous? ...a hand-held magnifier? ...a stand magnifier?
- 10) When using a hand-held magnifier, at which working distances is it advantageous to look through a bifocal? ...over a bifocal?
- 11) Given a bifocal add, a preferred working distance, a best-corrected near visual acuity, and an ocular diagnosis by your instructor, select a stand magnifier from the list provided in lab, based on enlargement ratio and image distance (can be done as a group activity).

based low vision labs and clinical low vision rotations responded.

Seventy-three percent of the students and 67% of the faculty felt that the case-based format used in the low vision labs prepared students for clinical patient care better than the traditional task-oriented format. Sixty-seven percent of the students and 67% of the faculty felt that the case-based format promoted an atmosphere more conducive to learning than the traditional task-oriented format. Seventy-three percent of the students and 100% of the faculty preferred the case-based format overall, and 67% of the students and 100% of the faculty would recommend the case-based format to instructors in other courses.

## Discussion

The utilization of clinical cases to reinforce concepts in didactic courses is not new, but the cases are usually

presented after lectures and demonstrations. Case-based laboratories, however, utilize the clinical case to teach the skill and concept from the beginning. This process resulted in a more clinically centered understanding by the student of the use of the procedure in the patient care setting.

Several authors have suggested PBL as a means to develop clinical thinking and problem solving skills through the use of the clinical case. Yet PBL is impractical for most clinical educators with limited resources. Case-based laboratories are a means of developing many of the same skills in students with little additional resources needed on the part of the instructor. This pilot course demonstrates the potential for the case-based format and acceptance by both students and faculty.

Further testing of the model will apply more direct measures of retention of clinical skills using the case-based format.

## References

1. Barrows H, Tamblyn R. Problem-based learning: an approach to medical education. New York: Springer, 1980.
2. Donner RS, Bickley H. Problem-based learning: an assessment of its feasibility and cost. Hum Pathol 1990;21(9):881-85.
3. Mennin SP, Martinez-Burrola N. The cost of problem based vs. traditional medical education. Med Educ 1986;20(3):187-94.
4. Scheiman M, Whittaker SG. Problem based learning: use of the portable patient problem pack. J Optom Educ 1991;16(2):49-53.
5. Scheiman M, Whittaker SG. Implementing problem based learning in the didactic curriculum. J Optom Educ 1990;15(4):113-18.
6. Imperato PJ. Current issues concerning clinical optometric education. Optom Educ 1996; 22(1):18-20.
7. Freddo TF. Education for entry level competency: teaching strategies. Optom Vis Sci 1994;71(2):91-93.
8. Foley RP, Smilansky J. Teaching techniques: a handbook for health professionals. New York: McGraw-Hill, 1980.
9. Vernon DT, Blake RL. Does problem-based learning work? A meta-analysis of evaluative research. Acad Med 1993;68(7):550-563.
10. Albanese MA, Mitchell S. Problem-based learning: a review of literature and its outcomes and implementation issues. Acad Med 1993;68(1):52-81.

# A Model for Entry-Level Determination (MELD) — An ASCO Report

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## Background

In July 1992 the Summit on Optometric Education: Conference on the Scope of Optometric Practice was held in St. Louis, Missouri. Out of that meeting, the statement *Optometry - A Responsible Profession* emerged and was subsequently adopted by both the American Optometric Association (AOA) and the Association of Schools and Colleges of Optometry (ASCO). This statement and associated strategic action items set the basis for a national discussion of "Entry-Level Competency."

*"Entry-level competencies include the professional attitudes, skills and knowledge base required to ensure safe and effective patient outcomes and to support life-long learning."*

*Optometry - A Responsible Profession (1992)*

**Action Item SP3:** "The AOA and ASCO should interpret on a

*continuing basis what should be entry level competency, via a survey of practitioners and board members and a series of conferences."*

*Action Plan Conference (1995)*

Subsequent to the 1992 Scope of Practice Conference, several groups further examined the concept of entry-level competency. Among others, these included the Summit on Optometric Education: Conference on Curriculum, the National Board of Examiners in Optometry (NBEO) through its examination committee structure, the Council on Optometric Education (COE) within the framework of accreditation standards, and ASCO through its annual Critical Issues Seminar in March 1997.

Each of these efforts involved groups of practitioners, educators and/or administrators who identified in broad terms the defining characteristics of "Entry Level Competency" and who then applied those within the context of the situation (e.g. curriculum content, NBEO questions, accreditation standards, licensing requirements). While each of these efforts involved discussion, debate and consensus building, each also brought unique perspectives and different interpretations of similar language and variations as to which

determinants of entry-level were the most critical. The lack of consistency among these various groups within an environment of increasing commitment by licensing boards and accrediting agencies to "entry-level" competency as a construct is increasing the urgency to develop a nationally accepted model through which "entry-level" skills and knowledge may be reasonably derived.

As demands upon the educational institutions to respond to the state by state legislative expansion of the scope of optometric practice continue to increase, the need to define entry-level competency becomes more acute. While the expanding scope of the practice of optometry is clearly in the best interest of the public, the structure of the profession and the educational process must be appropriately modified to maintain or enhance the quality of eye care delivery.

The goal of this white paper is to put forth a model for determining entry-level competency, which reconciles the historical debates and provides a common framework for future decision making.

## Planning Assumptions

"Entry-level competency" reflects a body of knowledge, skills and attitudes at one point in a professional career. For optometry this point has been and is currently upon the granting of a license to practice following the completion of the Doctor of Optometry degree and the passing of licensure exams. What knowledge, skills and attitudes are appropriate at the point of entry into the practice of optometry are not defined in isolation; rather they are affected by many variables including state laws, the nature of the educational process, the structure of the profession, health care policies, the economy, and technology, to name but a few.

Below are planning assumptions relative to 1) the educational and professional environment, 2) the nature of the optometrist as a health care professional and 3) requisite characteristics of the model. It is important to state planning assumptions about what is, what may be and what is not, and upon which the ensuing model has been based.

### The Nature of the Educational and Professional Environment

- Entry-level competency is not the same as Scope of Practice.
- Licensure examination is a measure-

*The Model for Entry-Level Determination (MELD) was developed as a "white paper" by the ASCO-appointed Entry-Level/Curriculum Task Force: David A. Heath, O.D., Ed.M. (Co-Chair); Elizabeth Hoppe, O.D., M.P.H. (Co-Chair); Morris Berman, O.D., M.S.; David Loshin, O.D., Ph.D.; and Teresa Madden, O.D. ASCO's Board officially accepted the paper at its October 31, 1998 meeting.*

- ment of entry-level competency.
- The educational programs leading to a Doctor of Optometry Degree will continue to be four years in duration.
- There are skills and knowledge, which are within the scope of the profession but beyond the professional degree education of the optometrist.
- The future is uncertain, and any model for defining entry-level competency must not only be responsive to the existing educational and professional environment (e.g. optional residencies), but must also be able to accommodate such changes as 1) the establishment of sub-specialties and/or 2) required residency training.

#### The Nature of the Optometrist as a Health Care Provider

- "As taught": All optometrists are expected to be aware of their own limitations and conduct themselves accordingly.
- All providers are responsible for ongoing self-learning and for

remaining current in their knowledge and skills.

- All providers are expected to utilize all resources, including intra- and inter-professional consultation, co-management and referral in securing the best possible care for their patients.
- All providers are expected to commit themselves to the profession as expressed in the Optometric Oath and AOA Code of Ethics.
- All providers are expected to manage their practices in a manner that is appropriate within the health care delivery system and that promotes patient access to eye care.
- The future is uncertain and professional assessment may well extend beyond entry-level and include relicensure or continuing competency. Decision models for defining entry-level competency should be equally applicable at other junctures in a professional career.

#### The Nature of Entry-Level Competency

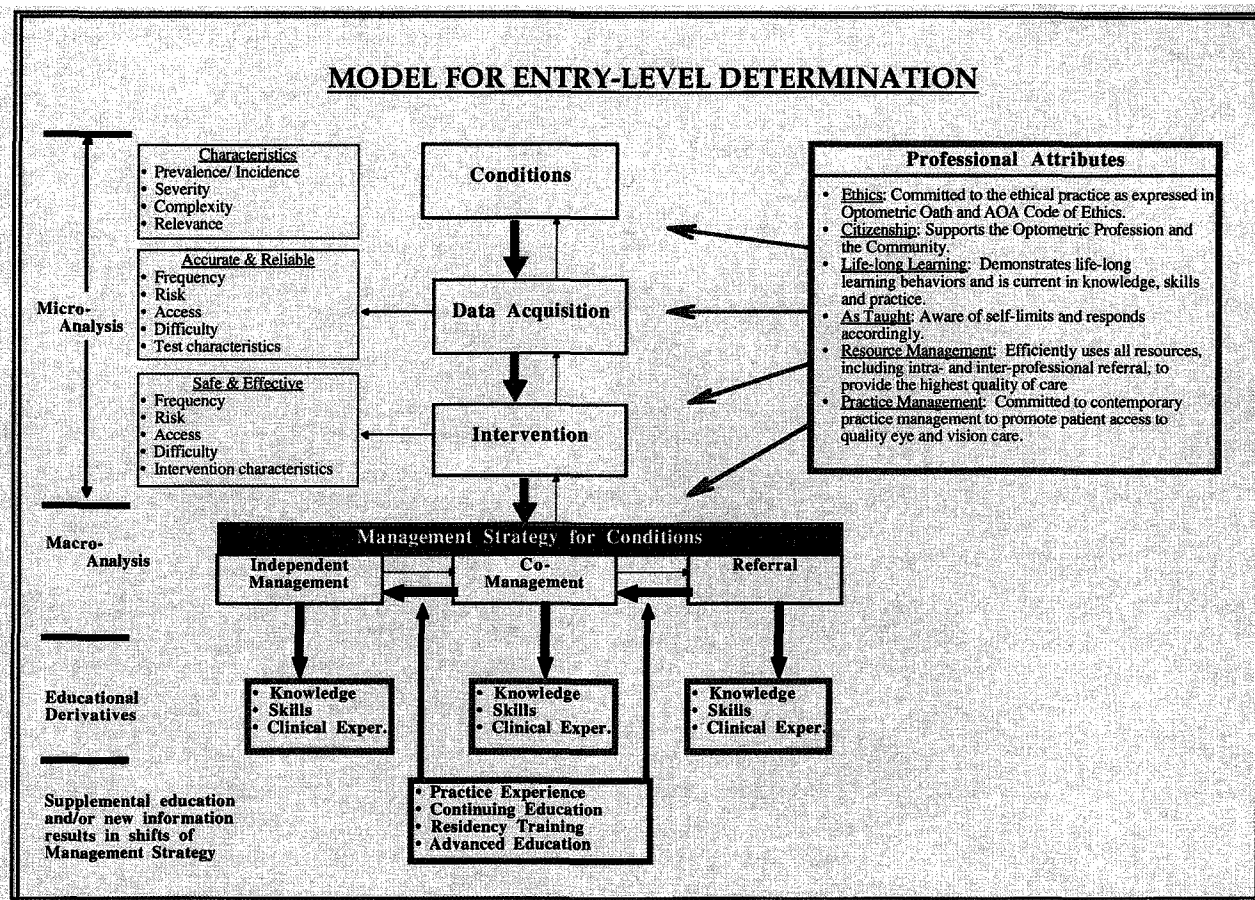
- Entry-level competency is dynamic and subject to changes in available

knowledge, technology and methods of eye care delivery.

- All licensed providers are expected to manage every relevant condition in a manner, which assures safe and effective care for the patient. However, the level at which the condition is managed is expected to differ from entry-level with practice experience or supplemental education. Thus, all conditions that are within the scope of optometric practice are managed by the entry-level practitioner.
- Entry-level competency as a construct is complex and situationally dependent: What is entry level with one patient may not be entry level with the next.

Reflecting the assumptions above, the Model for Entry-Level Determination does not state what is and what is not entry-level. Rather it provides a structure, defines guiding principles and elucidates a process through which a reasonable consensus upon whether a condition, a certain body of knowledge and/or a skill is or is not entry-level.

Figure 1



## Model for Entry-Level Determination (MELD): Structure

The model for Entry-Level Determination is designed to be applied to specific situations, knowledge and skills. Throughout discussion of this decision making model, refer to Figure 1, which provides a summary of the model's structure and characteristics. Terminology has been derived from previous meetings and reports and is defined in Tables 1 and 2.

In Figure 1, MELD may be viewed as having four substrates:

- **Micro-analysis:** Conditions, Data Acquisition and Intervention
- **Macro-analysis:** Management Strategy
- **Educational Derivatives:** Knowledge, Skills and Clinical Experience needed to support entry-level competency
- **Supplemental Education:** Implications for post entry-level education

### Macro-Analysis: Management Strategies

Central to the MELD decision-making model is the construct of Management Strategy. In MELD this is as it relates to a condition, rather than the patient. The model assumes that as primary care provider, the practitioner always has an ongoing responsibility for the overall care of the patient.

Both the Summit on Optometric Education and the 1997 ASCO Critical Issues Seminar used management expectations to define the entry-level competency of a recent graduate when managing a specific condition. The

MELD uses three management categories, rather than the four used in the ASCO Curriculum Model, or the five included in the 1997 CIS survey. These three levels: 1) Independent Management, 2) Co-Management, and 3) Referral are defined in Table 1. Central to this categorization is the level of professional and personal responsibility for the management of a given condition. In effect, is full responsibility assumed by the provider alone, shared or relinquished?

Using three categories, the MELD views the management strategy as only a broad outcome category, which reflects the summation of multiple micro-decisions or sub-analyses regarding entry-level knowledge and skills. A significant change in any one sub-decision has the potential to shift the management strategy from one category to the next. Indeed, it is the sensitivity of management strategy that has made the entry-level competency discussion so contentious.

When deciding upon the management level, a second parameter to be addressed is inherent in the concept of the reasonable and prudent practitioner. The statement, "*Optometry — A Responsible Profession, notes 'Optometric Practice is dynamic, with the emphasis on patient care services at the general practice level.'*" A final judgment, based upon a preponderance of information as to whether or not the entry-level provider should manage a condition independently needs to be tested against the concept of the standard of practice within a general practice setting. A knowledge of AOA defined practice guidelines, along with insights into the

contemporary practice of optometry contributes to this judgment.

### Micro-Analysis: Conditions, Data Acquisition, and Intervention

Prior to concluding whether an entry-level provider should be independently managing, co-managing or referring a patient, the condition, data acquisition skills and intervention requirements must be analyzed. Table 2 provides a listing and delineation of the critical parameters to be used to determine whether a condition, a data acquisition process or an intervention strategy is entry-level. The defining parameters for each category were identified through an examination of recurring themes in previous entry-level discussions.

The MELD uses these three general categories to reflect a loose sequence in the clinical decision making process. It is critical to understand that while there is a sequence, it is not linear and decisions in one category may impact all others. This organization of the MELD was developed to be more reflective of the clinical care process than the commonly used categories of knowledge, technical skills, analysis and attitudes.

The nature of the category **condition** is reasonably self-evident. The MELD assumes that all conditions are entry level and that each condition may require more than one management strategy depending upon the characteristics of the presentation.

The category of condition has been used in prior meetings and publications. In the 1992 Curriculum Conference, the Curriculum Model

**Table 1**  
**Macro-Analysis**

### Management Strategies

<b>Independent Management:</b>	Independent management occurs when the provider maintains sole responsibility for decision making relative to the care of a patient's condition. This may include the use of ancillary personnel, the use of other providers and/or resources to acquire information or deliver treatment not typically available within the general practice setting.
<b>Co-Management:</b>	Co-management occurs when the responsibility for decision making relative to the care of a patient's condition is shared with one or more other providers: When all or a portion of the treatment (active intervention) is determined and applied by another practitioner. Optometrists participating in co-management would accept responsibility for overall care, including pre- and post-treatment care, and for the longitudinal continuity of care.
<b>Referral:</b>	Indicates a transfer of responsibility for decision making relative to the care of a patient's condition by one provider to another. Referral is when none of the treatment (active intervention) is performed by the referring optometrist. The referring optometrist does not accept responsibility for pre- or post-treatment care; neither does he or she assume the longitudinal continuity of care for that particular condition.

**Table 2**  
**Micro-Analysis**

**Conditions: Characteristics**

<b>Prevalence/Incidence:</b>	How frequently does a condition present in a general practice of optometry and/or general population?
<b>Severity:</b>	To what degree is the condition resistant to intervention and/or is of high risk to the patient?
<b>Complexity:</b>	Is the condition primary or secondary, or are there multiple conditions present?
<b>Relevance to practice:</b>	Is the condition primarily with the purview of the optometrist, or is it better managed by another provider?

**Data Acquisition: Accurate and Reliable**

<b>Frequency:</b>	What is the frequency with which a diagnostic technique or strategy is used to acquire data and how critical is the data to the overall management of the condition?
<b>Risk:</b>	What is the risk to the patient of the data acquisition method, the risk to the patient of not acquiring the data and what is the risk to the provider in making the decision?
<b>Access:</b>	Is the method of data acquisition generally accessible in terms of equipment, cost, reimbursement, time and infrastructure?
<b>Difficulty:</b>	What is the complexity or difficulty of the psychomotor skill required to acquire the data?
<b>Test Characteristics:</b>	What are the validity and reliability characteristics of the data acquisition method?

**Intervention: Safe and Effective**

<b>Frequency:</b>	Is the intervention strategy commonly used to treat or otherwise manage a condition?
<b>Risk:</b>	What is the risk to the patient if using, or deciding not to use a specific intervention?
<b>Access:</b>	Is the intervention strategy generally accessible to the provider in terms of cost, reimbursement, time and infrastructure requirements?
<b>Difficulty:</b>	What is the complexity or difficulty of the skills needed for direct intervention by the provider?
<b>Intervention Characteristics:</b>	Is the intervention effective?

was developed using the theory of outcomes based education (OBE). OBE theory is a top down model for curriculum design. Beginning with the identification of those clinical conditions occurring in the general population that the optometrist is most likely to encounter, the Curriculum Model then went through a series of analyses to derive outcome learning objectives. The 1997 ASCO CIS also embraced conditions as one category, along with techniques, knowledge and attitudes, but did not identify any one category as driving the other(s) and its survey of "entry-level" approached each as independent. The MELD assumes an alternative position in which an interaction between categories is ongoing and each may be affected by the others.

**Data Acquisition** reflects a phase of clinical care, which, while dominated by clinical techniques, also includes knowledge, analysis and in many cases the use of information directly obtained by someone other than the primary

provider. Examples could include pretesting by ancillary personnel or the requisition of laboratory tests. One underlying assumption is that it may be inappropriate for the optometrist to directly collect data if it can be obtained in a more efficient and cost effective manner using other resources.

The primary expectation of data acquisition (besides being necessary) is that the data be accurate and reliable. Again, a series of defining measures and corresponding questions are identified in Table 2. In MELD these parameters are used to determine whether the data acquisition required for the diagnosis of the condition is an appropriate expectation for the entry-level provider.

Like data acquisition, the category of **Intervention** was developed to avoid being only technique based. While clearly including therapeutic techniques, such as foreign body removal or vision therapy, the intervention category embraces knowledge, critical thinking, communica-

tion skills and attitudes along with needed psychomotor skills. It is also obvious that many interventions and/or therapies do not involve psychomotor skills at all.

**Educational Derivatives**

From the analysis of "what is entry level?" at both the micro and macro-analytical level, the requirements for educational preparation may be derived. These requirements have most commonly been identified as 1) knowledge, 2) skills (psychomotor, communication, etc.), and 3) clinical experience. By testing educational outcomes, (or in the licensing process - entry-level criterion) within the MELD, those identified as entry-level may become the basis for defining the appropriate educational content and experience.

It is also worth observing that the anticipated level of management has significant implications for the depth of knowledge needed or the sophistication of skills required. (The knowledge needed for referring a condition

being less than that needed for independent management.) In the former an understanding of the broader concept may be sufficient while the latter requires an in-depth and detailed working knowledge.

When determining the knowledge, skills and experience needed for entry level competency, the analysis must also include a foundation in Ethics, Practice Management and Public Health. An appropriate foundation in each of these areas, and a fidelity to professional values, are essential to providing high quality eye care while assuring efficient and effective access to health care services.

### Supplemental Education

*"The maintenance of continuing competencies and professional growth must be ensured by continuing learning and assessment and thereby it sustains the integrity of the professional licensure. Additional education and training provide advanced practice skills and knowledge in specialized areas beyond those requisite at entry."*

*Optometry — A Responsible Profession* (1992) Adopted by the AOA and ASCO (1996)

The question of "what is entry level?" is also driven by the construct of "what is not?" The 1992 statement, "Optometry — A Responsible Profession" clearly recognized the need for post-entry-level education. Among the assumptions underlying this model were two (derived from the above) that have major implications for the profession's overall educational organization:

- There are skills and knowledge, which are within the scope of the profession but beyond the professional degree education of the optometrist.
- The future is uncertain and any model for defining entry-level competency must be able to accommodate 1) the establishment of sub-specialties and/or 2) required residency training.

The section of the MELD identified as supplemental education is included as a variable to recognize that various forms of post entry-level education (including practice experience) will shift the management strategy used by a provider from one category to another. Similarly, debate around structured postgraduate education should recognize this shift as a specific goal and expected outcome.

## Applying the Model for Entry-Level Determination

There are in reality two questions frequently posed within the entry-level debate. The first, "The entry level practitioner should be able to manage \_\_\_\_\_ independently" speaks to the macro-analysis level. The second, (frequently applied to discrete packets of knowledge or specific skills), "Is \_\_\_\_\_ entry-level?" requires a micro-analytical approach.

The Model for Entry-Level Determination is designed to serve as a template for debate. Applying the MELD is reasonably simple and the entry-level question may originate at either the macro or micro level. While some debates may require discussants go through the entire process, some questions may be answered by looking at one subsection only, while others may require moving back and forth between sections.

**Macro:** "The entry level practitioner should be able to manage \_\_\_\_\_ independently."

When the management level is incorporated into the question, the analysis ends at the management level rather than begins there. As the question is invariably linked to a condition the analysis must begin in the condition category and the defining characteristics of the condition must be identified. It is important to remember that the model assumes that all conditions are entry level and that conditions may fall into more than one management strategy depending upon the specific characteristics of the presentation. Without the specifics of the condition, the appropriateness of independent-management as an entry-level expectation is unanswerable.

Once the specifics of the condition are delineated, requirements for data acquisition and a subsequent intervention strategy must be analyzed. When all three have been reviewed, the appropriate management strategy may be determined. Ultimately an expert judgment must be made based upon a preponderance of evidence and tested against a contemporary standard of practice.

**Micro:** "Is \_\_\_\_\_ entry-level?"

When the target is already specific to one of the three categories, the analysis is more limited, but not isolated to one category alone. Clearly, the analysis must first involve the application of the category's queries to the target of the question. For example, "Is the cover test entry-level?" This would be analyzed

in terms of frequency, risk, access, difficulty and test characteristics.

The second step is to assess the question within the context of the other categories. This may require movement back and forth (looping) between categories. In the example of the cover test, we must remember that the defining goal is accurate and reliable data. Thus, the answer also must be asked within the context of condition. In this case: "Should the entry-level practitioner be able to procure accurate and reliable cover test results on infants, adults, elderly, the multiple handicapped, etc.?"

## Summary

The inability of past efforts to arrive at a clear answer to the question of entry-level competency is a testimony to the complex and dynamic nature of our health care and disciplinary environment. The Model for Entry-Level Determination has been developed to move the entry-level debate to a higher level of specificity and to develop uniformity of the process through which organizations and individuals address the issue.

Again, it must be emphasized that the Model for Entry-Level Determination does not attempt to state what is and what is not entry-level. Rather it provides a structure, defines guiding principles and elucidates a process through which a reasonable consensus upon whether a condition, a certain body of knowledge and/or a skill is or is not entry-level.

What is entry-level today may or may not be entry-level in the future. Indeed, what is entry-level will shift as we better address the question of what is not. As debates on the future role of residency programs and the potential development of structured subspecialties are resolved, what is entry-level competency (and/or what is expected upon completion of the Doctor of Optometry degree) will be fundamentally altered.

It is our hope that this white paper will serve as a strategic reference when educational institutions, accrediting agencies, professional organizations and licensing concerns attempt to define professional competencies expected upon the completion of the Doctor of Optometry degree and beyond.

# Ultimate Success Rates On National Board Examinations - A Research Brief

Leon J. Gross, Ph.D.

Norman E. Wallis, Ph.D., O.D.

Richard K. Present

**W**hat percentage of students has passed all components of the National Board examinations at the point of graduation?

## Abstract

This research brief investigated the percentage of students successfully completing the 4-component National Board examination sequence at the point of graduation. Data for the graduating classes of 1995, 1996, and 1997 revealed ultimate pass rates for the entire four components ranging from 87.0% to 90.9%. These data are discussed in relation to corresponding data preceding the National Board test sequence expansion of 1993. In addition, ultimate pass rates are discussed with regard to initial pass rates and the number of opportunities to sit for tests prior to graduation.

**Key Words:** National Board examinations, licensure, pass rates

All three authors serve on the staff of the National Board of Examiners in Optometry in Bethesda, Maryland. Dr. Gross is director of psychometrics and research, and Mr. Present is assistant director of psychometrics and research. Dr. Wallis is executive director and a former president of the Pennsylvania College of Optometry in Philadelphia, Pennsylvania.

The percentage of candidates who pass on their first attempt can be considered an *initial* pass rate. The percentage ultimately passing by the time of graduation is considered an ultimate pass rate. The *ultimate* pass rate is intrinsically higher than the initial pass rate, and of greater importance with regard to minimizing the time between graduation and entry into practice.

Ultimate pass rates are of great interest to optometric educators and state board members. Two decades ago, this issue was sufficiently controversial to prompt the then Department of Health and Human Services to award a research grant to ASCO to investigate whether there was any excessive delay in the licensure process attributable to the National Board examinations. The findings and conclusions were unremarkable. Nonetheless, renewed interest in this issue emerges periodically, particularly if the examination program expands or if aggregate test performance declines.

Prior analysis has indicated that the overwhelming majority of students successfully complete the National Boards by the time of graduation. This internal, unpublished study evaluated the graduating classes of 1989 and 1990, based on all students who sat for both the Basic Science (BS) and Clinical Science (CS) examinations. For the

graduating class of 1989, 1064 students sat for both examinations; 1011 (95.0%) had passed both by the time of graduation. For the graduating class of 1990, 1066 candidates sat for both examinations, with a success rate of 93.1% at the time of graduation. These ultimate pass rates are presented in Table 1.

An additional study provided further insight regarding ultimate National Board success rates. Gross<sup>1</sup> had reported a high correlation (.75) between performance in BS and CS, based on the initial attempt on each of these two examinations. Of particular significance was that 98.5% of the candidates who passed BS in their initial attempt also passed CS in their initial attempt.

In 1993, the National Board examination program expanded significantly. The previous stand-alone examination on the treatment and management of ocular disease (TMOD) was added to the CS examination, with a separate pass-fail score. As a result, it was possible for candidates to pass the overall CS examination, but fail the embedded TMOD examination. That same year, the Patient Care (PC) examination was added as the third part to the National Board sequence.

The two additional examinations, TMOD and PC, doubled the number of tests that comprised the National Board examination sequence. A potential side effect of the new examinations was a decrease in the ultimate pass rate, as discussed by Gross<sup>2</sup>. An additional factor that could reduce the ultimate pass rates is that three of the four examinations (CS, PC, and TM) are not administered until the last year of the 4-year educational program, which limits the opportunity for retaking a failed examination prior to graduation. In particular, the PC examination is limited to one administration prior to graduation.

The graduating classes of 1995, 1996, and 1997 were analyzed with regard to ultimate pass rates. These data are presented in Table 2. Using the same criterion as Table 1, the students included in the analysis are those who sat for each of the examinations by the time of graduation. These data are based on 924 students for 1995, 1002 for 1996 and 1171 for 1997. The increasing number of students sitting for all four components of the National Boards apparently reflects the increasing number of states using the PC examination for licensure.

**Table 1**  
**National Board Examination Success Rates by the**  
**Date of Graduation: 1989-1990**

Examinations Passed	1989		1990	
	Number	Percent	Number	Percent
Both exams	1011	95.0	992	93.1
BS only	21	2.0	12	1.1
CS only	11	1.0	32	3.0
Neither exam	21	2.0	30	2.8
Total	1064	100.0	1066	100.0

\*based on students sitting for the entire examination sequence of BS and CS  
percentages rounded to the nearest tenth

The initial row of data for each year indicates the percentage of students who passed all four components by the point of graduation. Nationally, this percentage was 87.0% for 1995, 90.9% for 1996, and 89.8% for 1997. The four rows that follow list the percentages of students who passed a different combination of three of the four components. For example, the second row indicates the percentage of students who passed all exams except for TMOD (i.e., passed BS, CS, and PC).

The overwhelming majority of students passed all four components by the time of graduation, and most of the remaining candidates passed all but one of the examinations. For example, for the class of 1995, 87.0% of the students passed all four components, and 11.0% exhibited only one deficit.

Perhaps most interesting are the comparisons among single-deficit com-

ponents. For example, BS has consistently manifested the lowest initial pass rate; yet, it does not exhibit the lowest ultimate pass rate because BS offers the greatest number of opportunities for failees to repeat, as this is the earliest test administered in the National Board sequence. In contrast, PC has exhibited the highest initial pass rate. Yet, it exhibits the lowest ultimate pass rate because there is only one opportunity to sit for this test prior to graduation. Also, for each of the three cohorts, the percentage of students having only CS as a deficit rounds to 0%. In fact, for the class of 1996, the actual number of students with only a CS deficit is zero. These low percentages are the result of CS having a high pass rate (although slightly lower than that for PC), but also providing an opportunity for retesting one time prior to graduation.

The National Board released these

data to each of the academic deans and presidents. Each academic institution received only the data for its own students, accompanied by the corresponding national data for comparison purposes. This statistical report will be disseminated on a routine basis in the future.

This research brief began with an inquiry regarding ultimate National Board pass rates. The data quantify this outcome. A logical next question — whether the pass rates are too high or too low — will go unanswered. There is no “correct” answer to this question, for how can anyone really “know”?

Nonetheless, the data suggest that the overwhelming majority of students do not experience any delay in licensure as a result of this rigorous 4-component examination program. In fact, with the progressive shifting of the PC examination from the summer to the spring, state boards and candidates now receive the results shortly after the final commencement exercise of the season. As a result of this combination of changes, the protection of the public has been enhanced by the added assessment rigor, and the candidates have been able to qualify for practice earlier.

## References

1. Gross, L J (1991) Comparative performance on National Board basic science and clinical science tests. *Journal of Optometric Education*, 16:57-59.
2. Gross, L. J. (1991) Examination standards for licensure: the reality of '75'. *Journal of Optometric Education*, 16:72-75.

**Table 2**  
**National Board Examination Success Rates by the Date of Graduation: 1995-1997**

Examinations Passed	1995		1996		1997	
	Number	Percent	Number	Percent	Number	Percent
All	804	87.0	911	90.9	1052	89.8
All but TM	31	3.4	16	1.6	11	0.9
All but PC	59	6.4	29	2.9	34	2.9
All but CS	1	0.1	0	0.0	4	0.3
All but BS	10	1.1	22	2.2	30	2.6
BS and CS only	6	0.6	1	0.1	1	0.1
BS and PC only	1	0.1	3	0.3	6	0.5
BS and TM only	0	0.0	0	0.0	1	0.1
CS and PC only	3	0.3	4	0.4	5	0.4
CS and TM only	1	0.1	4	0.4	1	0.1
PC and TM only	1	0.1	2	0.2	5	0.4
BS only	1	0.1	1	0.1	2	0.2
CS only	2	0.2	0	0.0	3	0.3
PC only	1	0.1	4	0.4	10	0.9
TM only	0	0.0	1	0.1	2	0.2
None	3	0.3	4	0.4	4	0.3
Total	924	100.0	1002	100.0	1171	100.0

\*based on students sitting for the entire examination sequence of BS, CS, PC, and TM  
percentages rounded to the nearest tenth

# IN REVIEW

**Clinical Ocular Oncology**, Second edition. Devron H. Char, Lippincott-Raven, 1997 452 pages, \$188.

The second edition of *Clinical Ocular Oncology* differs from the first in two distinct respects: far fewer color plates and greater emphasis on the molecular-biology aspects of tumor management. The proportion of text devoted to orbital tumors still occupies nearly one-half the book. While this aspect, with its surgical slant, may be of little interest to most clinical optometrists, important diagnostic features are outlined. The generous use of imaging studies is a prominent feature throughout the text.

In the preface to this second edition, the author forewarns readers that only the most significant references are added. With the mushrooming of information on oncology in the past eight years, it would be a daunting task to focus on anything but the most relevant developments. This has been accomplished. For the educator with an interest in ocular oncology, *Clinical Ocular Oncology* represents a valuable resource

**Reviewer:** Dr. Leo Semes  
University of Alabama at  
Birmingham

**Clinical Decision Making in Optometry**. Ellen Richter Ettinger and Michael W. Rouse. Woburn: Butterworth-Heinemann, 1997, 416 pages, \$47.50.

In the preface of *Clinical Decision Making in Optometry*, Drs. Ettinger and Rouse state, "The goal of this book is to examine the process of clinical decision making in vision care, in an effort to help students and optometrists develop and refine their decision-making skill." Drs. Ettinger and Rouse have achieved their goal admirably in a

book that is an invaluable resource for all clinical teachers.

The book is divided into two parts: Part I includes five chapters on the principles of decision making and Part II consists of eighteen cases written by expert clinicians. The chapters in Part I are on clinical decision-making skills, dealing with clinical uncertainty, epidemiology, information access to the biomedical literature, and ethical decision making. The writing is clear and easy to understand. The clinical examples throughout Part I keep the topics interesting and relevant to clinical optometry.

More than half of this book consists of case studies that are written in a style that mimics the way patients actually present in clinical practice. These cases are unique since the presentation includes diagnostic hypotheses and the clinician's thought process in addition to the traditional components of cases (the case history, diagnostic testing, diagnostic summary and treatment options). These cases are as "real life" as is possible to put on paper; some of the patients even have more than one problem, just like real patients. Each case is also nicely summarized at the end of the chapter in a decision-making flow chart. Since the cases are numbered rather than being listed by topic or diagnosis, the reader can go through the thought process with the author to arrive at the diagnosis. The Appendix at the end of the book gives a list of topics, which will be very helpful to the clinical teacher who wants to make a case presentation about a particular problem.

*Clinical Decision Making in Optometry* is an important book for every clinical teacher who wants to teach students how to think – and that is the most important tool we can give our students.

**Reviewer:** Dr. Nancy Carlson  
The New England College of  
Optometry

**Contact Lenses for Pre-and Post-Surgery**. Michael G. Harris, Mosby, 1997, 174 pp, 32 color plates, 88 illustrations, \$36.95

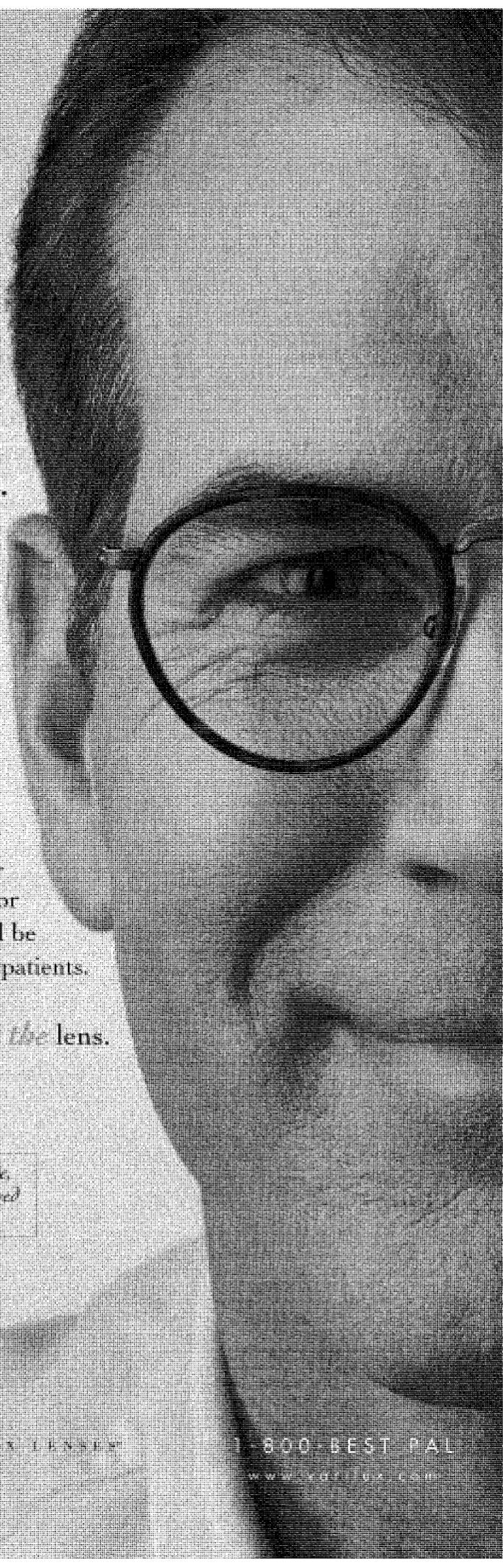
This multiple authored text covers the use of corneal topography in fitting contact lenses, keratoconus, therapeutic soft lenses, and fitting contact lenses for aphakia, postkeratoplasty, and post-refractive surgery. In addition to the normal text and tables, it contains highlighted "Clinical Pearls," which assist the reader in identifying and remembering key points.

The text contains useful and detailed information about corneal topography and its use in fitting post-surgical corneas. It has a good chapter on keratoconus that is mostly devoted to fitting techniques and contains a description of various fitting sets, e.g., NiCone, which is not found in many texts.

Throughout the book, excellent fitting guidelines are found. By necessity, these tend to be less detailed for post-refractive surgery and penetrating keratoplasty cornea, where the variety of clinical presentations precludes exact fitting guidelines. The book does, however, discuss very well the philosophy of fitting these corneas.

This text, part of the Mosby's optometric problem solving series, would be a welcome addition to anyone whose practice includes a low to moderate volume of these types of patients. The information is clearly presented, is accurate and clinically relevant.

**Reviewer:** Dr. Roger Boltz  
University of Houston College of  
Optometry



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