The Journal of the Association of Schools and Colleges of Optometry

OPTOMETRIC EDUCATION

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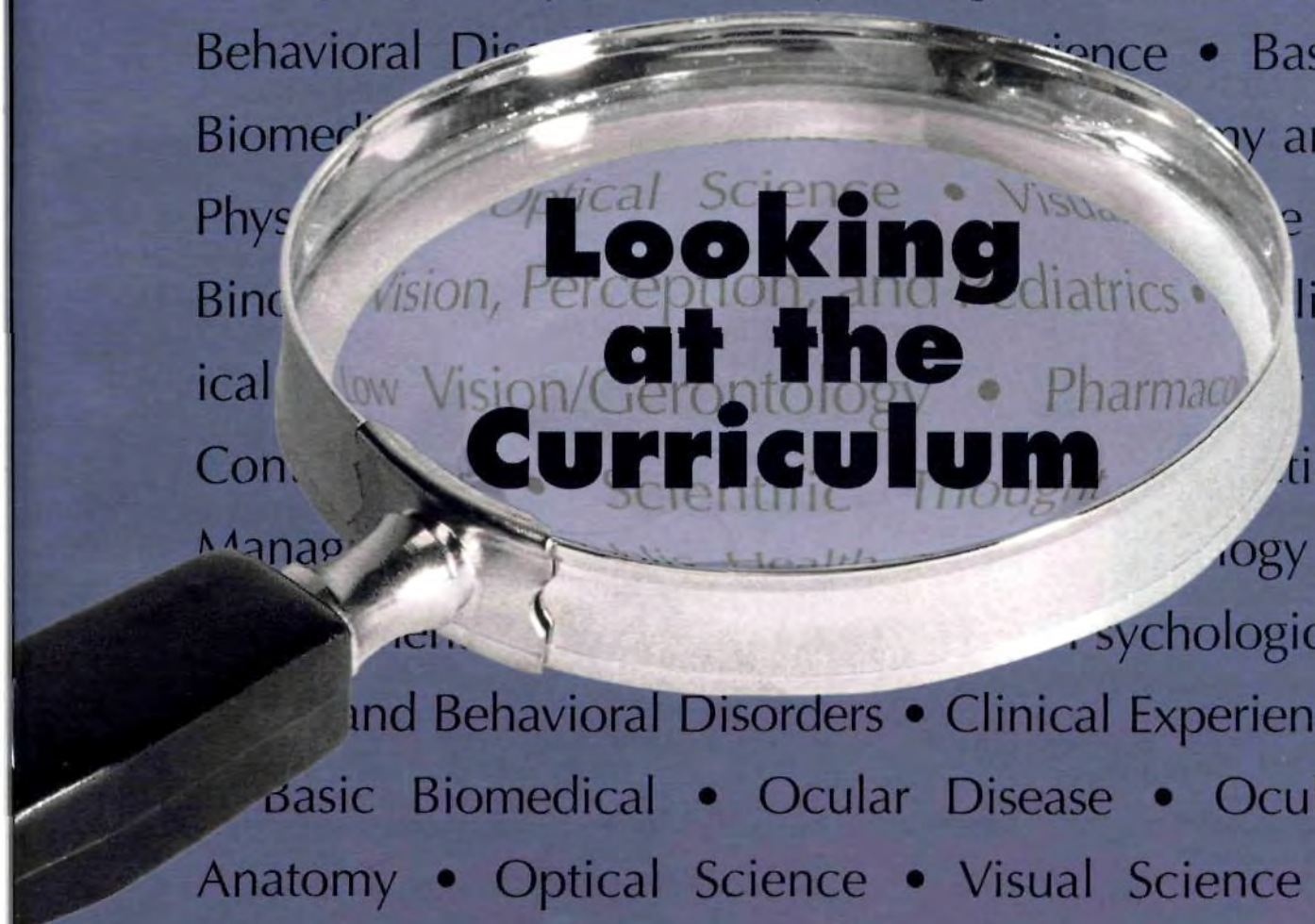

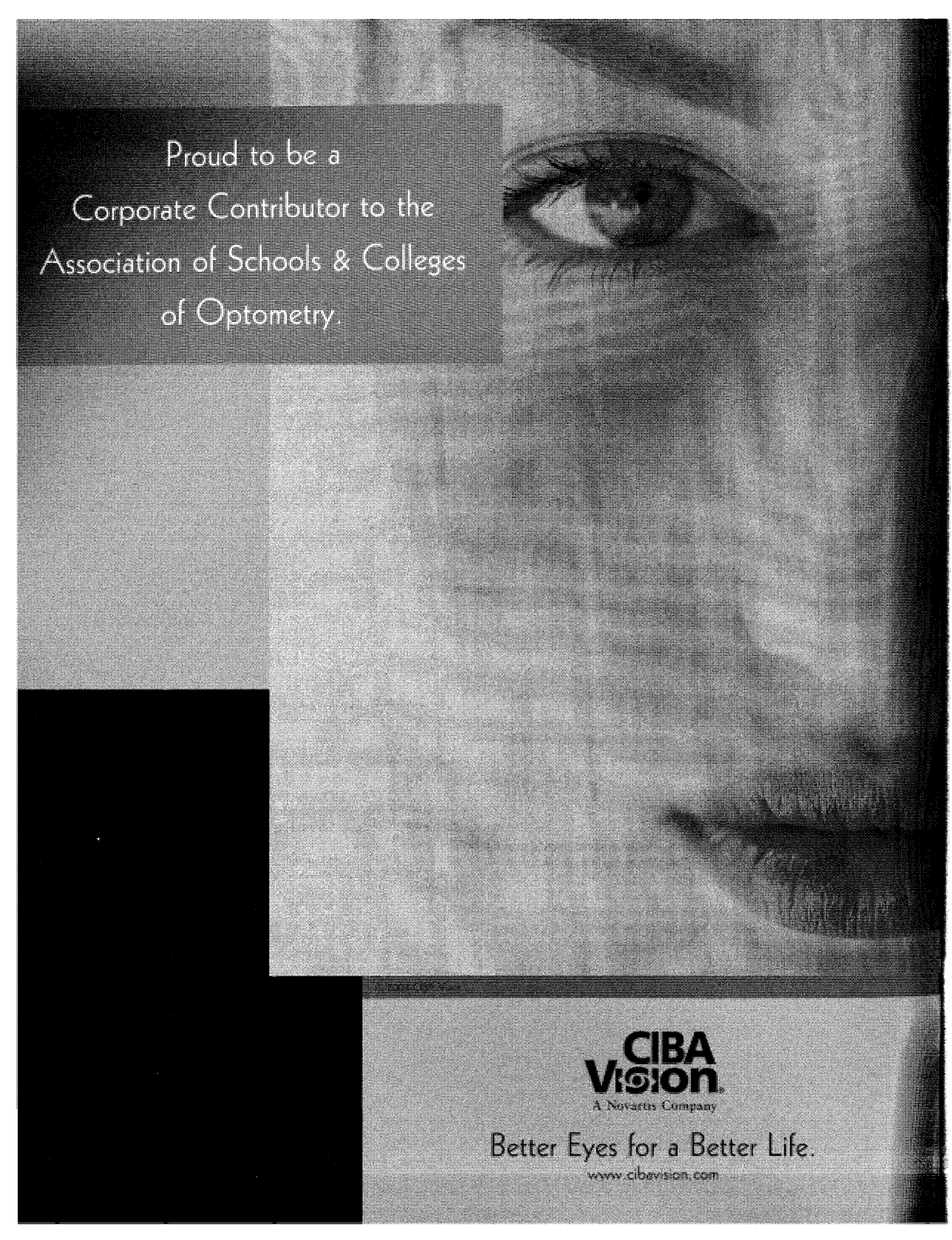
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EDITORIAL

Comparing Curricula — Looking Back, Looking Forward

Lester E. Janoff, O.D., M.S.Ed., F.A.A.O.

This issue of *Optometric Education* features an article that compares the curricula in schools and colleges of optometry based on the individual institutional catalogues for the academic year 2001-2002. *Optometric Education* published earlier comparisons in 1992 and again in 1998, so we now have quite a wealth of data over a number of years. These articles have analyzed the curriculum in terms of contact hours (clock hours) devoted to various subject groupings or tracks.

As the authors point out, the study does not intend to judge the relative quality of the programs or offer suggestions for their change. They also note that the number of hours derived from the catalogues cannot be considered an absolute measure of the actual time spent in the courses. Their goals were to demonstrate trends, to note the balance between clinical hours and didactic hours, and to explore the assumption of the shift away from traditional optometric subjects.

The study indicates that there appears less variability among school curricula, which may indicate a trend toward a core curriculum. The study also reveals that there has been a substantial increase since the last study (1998) in the hours devoted to clinical training, but not at a serious expense of didactic hours. The authors also feel that the hourly information provided in this study could aid curriculum planners.

I would recommend that the next comparison of the curriculum goes to a level beyond the three studies published over the last decade in our journal by asking the question of curriculum administrators, "Is the number of hours assigned to different subjects the correct metric to consider in curriculum planning?" Of interest in this article is the fact that the Pennsylvania College of Optometry is not included since its curriculum is entirely problem-based and therefore not amenable to the classic credit or contact hour paradigm. Shouldn't educational administrators be more interested in quality and quantity of learning than hours of teaching? Although we devote many hours in lecture and lab to a given subject, does the teacher provide an effective learning environment? Do students even attend class? Has the one school not included in this study discovered an effective way to prepare optometrists for the practice of their profession without listing more than four thousand contact hours of traditional curricular components? As a PCO graduate I sure wish they had when I went to school there.

My experience with curriculum planning in a number of optometric institutions has been tantamount to moving the bones in a graveyard. We just reposition those sacred subjects, but never ever throw them away. Faculty are always clamoring that they need more hours for lecture or lab while they cry, "Let's not spoon feed them." If you don't want to spoon feed students, why do you need to provide more time in class?

These common faculty and administrator complaints remind me of my former mentor's article on diseases of the curriculum1. Many schools suffer from Curricularsclerosis or "hardening of the categories." Our feature article indicates that programs did not necessarily make a trade off between clinic and didactic hours, and that there has not been a dramatic move toward subjects considered more medically than optometrically oriented. Clearly we can rule out Carcinoma of the Curriculum — the uncontrollable growth of one segment of the curriculum. I could continue, but I think you get my drift.

There has been a tremendous explosion of scientific and clinical knowledge, and certainly we can understand the need to be more efficient in our educational delivery system, especially given the fiscal pressures that plague almost every institution. Counting hours may be the simplest way to measure our output, but it certainly does not ensure meeting our exit level requirements, nor does it provide us with a measure of equivalency in programs.

1. Abrahamson S. Diseases of the curriculum. J Med Ed 1978; 53:951-57

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CIBA Vision Sponsors Residency Educators

Ciba Vision recently sponsored the 2004 ASCO Residency Educators' Special Interest Group Breakfast in Tampa, Florida. Approximately 60 residency educators gathered from the schools and colleges and from residency sites to participate in a program of updates from the VA, the National Board of Examiners in Optometry, the Accreditation Council on Optometric Education and the Optometry Residency Matching Service. A panel discussion entitled, "What are the responsibilities of the educational institution to its external residency affiliates?" followed.

Representing CIBA at the breakfast was Dr. Suzanne Nylander, Ciba's new director of academic development, professional services, North America.

Essilor of America Forms Independent Unit

Essilor of America (EOA) has formed an independent distribution division to serve the independent segment of the industry and has named an Essilor executive Bob Colucci as president. Colucci was previously senior vice president of national sales and labs and reports directly to Mike Daley, president, Essilor Lenses.

"Because of our commitment to independent distribution, we have created this division to help support the industry and continue our ophthalmic lens leadership among independent eye care providers. Bob is the best leader for this extended role and can help us get to the next level," said Daley.

Colucci's primary role will be to grow the anti-reflective and progressive lenses market by leveraging the strength of the independent distributors while helping them grow, using Essilor's Crizal Alize and Varilux lens product lines.

Volk Announces Manager For Research and Development

Volk Optical, the leader in aspheric optics, announced that Steve Cech has joined the company as manager of research and development. Steve will be responsible for all phases of product engineering for the company's line of diagnostic, therapeutic and surgical ophthalmic lenses, equipment and accessories. He will work with Volk's advisory panel of practicing physicians to conceptualize, prototype, test and refine cutting-edge optometric and ophthalmic lenses and accessories. In addition, Cech will manage the company's intellectual properties.

Cech was employed as director of product development for Pressco Technology, a manufacturer of automated visual inspection systems. He holds a Master of Science degree in Electrical Engineering from the University of Southern California and a Bachelor of Science degree in Engineering Physics from Ohio State University.

Volk Optical is an industry leader in the design and manufacture of aspheric optics. Glass lens construction and the company's patented double aspheric technology result in the highest quality imaging for precision diagnostic and laser work. Visit www.volk.com or phone Volk at 1-800-345-8655.

AMO Buying VISX

Advanced Medical Optics, Inc. and VISX, Incorporated, announced the acquisition of VISX by AMO. "The strategic combination, which was unanimously approved by both companies'

(Continued on page 56)

A Curriculum Comparison Of U.S. Optometry Schools: Looking Back Over the Decade

Heavin Maier, O.D.
Alex Smith, B.S.
Bradley Coffey, O.D., F.A.A.O.

Abstract

This study provides curriculum planners with a comparative look at the 2001-2002 curricula taught at U.S. optometric schools. To make the comparison, clock hours are divided into 17 categories and compared by both the number and proportion of clock hours dedicated to a particular category. A metastudy analysis enabled comparison with two previous studies published in 1992 and 1998. During the decade, total clock hours have increased 6.1% due primarily to a 21% increase in hours devoted to clinical education. Didactic hours have decreased 5.3%, although didactic hours related to pharmacology have increased 16%. Variability between programs based upon proportion of curriculum devoted to different content areas has decreased. Comparing metacategories over the decade shows increased curricular hours in clinical studies (increase of 355 hours, 21%), decreasing hours in medical topics (decrease of 103 hours, 14%), and relative stability in hours related to optometric topics and "other" topics (both decreased by 7 hours, <1%). These results reflect the dramatic shift in emphasis placed upon clinical education in the past decade. They do not seem to support the oft-repeated opinion that the curricula at schools and colleges of optometry have become more medically oriented during the past decade, at least in terms of clock hours devoted to medical topics.

Keywords: *Optometric Education, Optometry, Curriculum, Clock Hours, Clinical, Didactic*

Introduction

This study is designed to compare the curricular content at the seventeen schools and colleges of optometry in the United States and Puerto Rico using two techniques: 1) a comparative analysis of the curricular content of the different programs and 2) a comparative analysis of the prerequisites for each program.

Every school or college of optometry shares the overarching and unifying goal of preparing students to successfully treat and manage patients. Beyond this goal, and the intermediate step of preparing students to pass the National Board Exam (NBEO), no common denominator exists that mandates optometry curriculum content.

A handful of oversight bodies lend a measure of unity to optometric education without legislating curricular content or hours. In 1998, the Entry-Level/Curriculum Task Force, which was appointed by the Association of Schools and Colleges of Optometry (ASCO), developed the Model for Entry-Level Determination (MELD). The model was accepted by ASCO's Board. The task force's goal was to develop a nationally accepted model that describes entry-level (not to be confused with scope-of-practice) skills and knowledge for optometrists.[1] Earlier, in 1992, the Summit on Optometric Education: Conference on the Scope of Optometric Practice had stimulated discussion in this area by the National Board of Examiners in Optometry, the Accreditation Council on Optometric Education and ASCO.

The Accreditation Council on Optometric Education (ACOE) regulates the schools and colleges by way of accreditation. The accreditation process, however, does not set curriculum standards. To be accredited a school must measure up to its self-determined goals and mission. The ACOE also verifies that the school or college has a sound governing structure in place (lines of communication, standards for hiring and firing, policies of admission, etc.) and that the school or college has adequate resources (facility, equipment, financial, faculty, etc.) to support its mission. With regard to the curriculum, the ACOE requires that the school or college prepare its graduates for entry-level practice with the expectation that students know how to "identify, record, and analyze pertinent history and problems presented by the patient," and be able treat and manage the patients. All schools must operate programs of at least four academic years that have a foundation in physical, biological and behavioral sciences and have didactic, laboratory, and supervised clinical components. The school or college must also facilitate research and scholarly activity. These ACOE mandates in no way establish a core curriculum or define a minimum number of required hours.[2] The knowledge attained by optometry students upon graduation shapes the scope and future trend of our profession, just as the trajectory of the profession helps determine the educational content delivered to students. Therefore administrators and faculty, as well as our future practitioners, have an interest in knowing whether the various institutions offer relatively equivalent curricula.

National uniformity is potentially beneficial in three ways. First, maintaining national uniformity ensures

Dr. Maier graduated in 2004 from Pacific University College of Optometry. She is in the process of starting her own private practice, Eyes for Life, in Spokane, Washington. Mr. Smith is a third year optometry student at Pacific University. Dr. Coffey is a professor at Pacific University where he teaches and conducts research related to binocular vision and visual performance. He has been involved with curriculum review and evaluation for many years.

that graduates may attain licensure in any state of their choosing. Second, it enables more consistent disclosure of information by state and national optometric organizations. Third, a common curriculum provides assurances about the equivalency between programs, something prospective students cannot obtain from the NBEO under the current rules.

Perhaps the greatest service a curriculum comparison provides is an understanding of the different emphases at the various schools and colleges. This can serve as a critical tool for curriculum developers at each school, both for ensuring that their school is maintaining common standards with the other programs and for enabling them to differentiate their program from other schools by offering alternative emphases.

Undoubtedly optometric educators have some sense of the curricula at other institutions; however, a broad objective view demands a more formal study. A comparison study of the curricula has not been published since 1998, when Bamberg and others published "An Evaluation of U.S. Optometry School Curricula."[3] This article followed the methodology established by Rousseau and Shiroma's 1992 study entitled "U.S. Optometry Schools: A Curriculum Comparison."[4] Both these studies compared the curricula at the schools and colleges by determining clock hours in various categories called "tracks." Both concluded that great variability exists in both the didactic and clinical curricula. Rousseau and Shiroma expressed concern that "all schools do not equally prepare students for all aspects of optometric practice."[4]

The 1998 curriculum review saw an average increase of 200 additional hours over the previous five-year period, with most of these hours added to clinical education. The authors noted a 140-clock hour decrease in the total hours devoted to basic science, with an equivalent 142 hours added to the area of ocular disease. The authors attributed these changes to a "shift in our profession from the vision science model to a more medical model" and to shifting the basic science courses to prerequisites. They interpreted this shift to represent the "advancing role of optometrists to a primary health care provider."[3]

Our study follows their lead by using a similar methodology to examine courses listed in the 2001-2002 catalogs. Refer to Appendix A for the listing of each school included in our study and the abbreviation by which it will henceforth be referred.

While our study does draw comparisons with the previous studies, it must be noted that the 1992[4] study compared all seventeen schools, whereas the 1998[3] study did not include Inter American University at Puerto Rico (IAUPR). Our study has included IAUPR, but excludes Pennsylvania College of Optometry (PCO) due to their unique and unfortunately incomparable modular curriculum structure.

In 2000 PCO radically revamped its curriculum resulting in increased clinical experience and students' accelerated entry into clinical services. Its distinctive features include an interdisciplinary modular approach aimed at providing concurrent interdisciplinary instruction, the immediate introduction of clinical concepts and skills during the first year, expedited entry into patient care, and an expanded clinical training program with a month of summer clerkship after first year and 17 months of externships. This 50% increase in extern clinic time came by way of a 15-20% reduction in traditional lecture and lab time.[5] The exclusion of PCO from our study in no way indicates a rejection of its approach, but simply an inability to incorporate it into our methodology.

Without comparison data, each school's curriculum committee acts as an island, basing critical decisions on its own tradition, history, input from alumni, and internal review. We aim to equip curriculum planners with a data set that presents the nationwide picture of optometric curricula. This study does not intend to judge the relative quality of the programs or proffer suggestions for change, but rather to highlight the trends as revealed by the clock hours devoted to different areas of study. Our data reveal the relative emphases of the different schools by presenting the distribution of each school's total hours in curriculum categories, assessing the differences in clinical experience time, and looking for trends over the last decade. We are particularly interested in the trend of variability among schools, the change in overall required course load, and the balance between clinical hours and didactic hours. We also explore the broadly held assumption that the curricula are shifting away from traditional optometry toward a medical model. Focusing on pharmacology, we look at how legislation may be influencing the hours devoted to this topic. Additionally we have examined prerequisites to optometry school as a way of assessing the expectations schools have of their entering students and how this influences the curriculum.

Methods

Comparison of Curricula

We used each school's 2001-2002 course catalog to determine the course content and clock hours of required coursework in the optometric curriculum. Clock hours refer to the time spent in the classroom, lab, or clinic (internal and external). These clock hours were then distributed into one or more content categories (see Appendix B) based on the description given in the catalog. When more than one category seemed appropriate for a course, the hours were evenly divided among the appropriate categories for that course.

In some cases the course catalogs provided credit hours and not clock hours, in which case we converted them as accurately as possible from credit hours to clock hours. Where credits only were provided, we determined the clock hours based on the length of the term and the hours per week spent in lecture, lab, or clinic. We determined term length by looking at the academic calendar and subtracting vacation days and then rounding to the nearest whole week. In several instances, where the course catalog was unclear, we telephoned an administrator at the school for information regarding term length, and/or interpretation of the catalog regarding the lab/lecture breakdown for each class.

When converting from credit hours to clock hours we found it necessary to split lecture hours from lab hours because the credit hour listing undervalues the time spent in lab. For example, although a course may be assigned only four credit hours, it actually meets for five total clock hours, with three hours in lecture and two in laboratory. We also specifically adjusted the length of the term for those hours spent in lab, because the number of weeks for lab does not necessarily equal the weeks spent in lecture. Unless the exact number of weeks for a lab was specified, we assumed that the labs ran two weeks less than the total number of weeks in the term (based on the assumption that most

labs do not meet the first and last weeks of a term).

Classes listed as "seminars" or "discussions" were treated as lecture time. Unless otherwise stated, lecture times were assumed to run the full term. Term length encompasses only time in class; vacation time was subtracted from the length.

This study's methodology roughly follows that of the two previous studies that analyzed the curricula by dividing the courses into "tracks" or categories.[3,4] While many of the categories are the same, we have added five additional categories to avoid an overly large "Other" category. We established 17 categories listed with their abbreviations in Appendix B. The categories and the guidelines for dividing courses were determined by test sampling of eight catalogs to establish key words that would indicate appropriate categories.

Clinical Experience (CE)

Our study looks year by year at clinical experience to assess how soon in their optometric education students are exposed to patients, through direct care or observation. The credit hours for clinical experience (as listed in the catalogs) use different clock hour conversions than do the didactic courses. These conversion rates were determined either directly from the course catalog or by multiplying the length of the 4th year clinical term by 40 hours per week. We then applied this 4th year clinical conversion rate to the previous three years, unless otherwise specified. All courses with a clinical experience component were placed solely into this category regardless of supplemental lecture time. Specialty clinics were listed solely in this category rather than giving credit to another relevant category. For example, hours in a contact lens clinic were given to "Clinical Experience" and not to "Contact Lens." In Tables 1-4, Clinical Experience is listed for each year of the curricula (CE 1-4), as well as the four-year total (Total Clinic).

Basic Biomedical (BB)

This category encompasses foundational science courses and disease courses that are not directly related to the eye. These include general anatomy and physiology, neuroanatomy, microbiology, histology, embryology, immunology, biochemistry, and systemic disease.

Ocular Disease (OD)

This category includes courses dealing primarily with diseases of the eye and adnexa.

Ocular Anatomy and Physiology (OA)

This category is used for classes teaching fundamental structure and function of the eye and visual system.

Optical Science (OS)

This category includes geometric optics, physical optics, photometry, entopic phenomena, the functional role of the pupil, and ophthalmic material (lenses, frames, prisms, and dispensary).

Vision Science (VS)

This category deals with the basic science of how vision normally functions. Topics included are: visual optics, refractive anomalies, monocular sensory processing, binocularity, sensory fusion, ocular motility, psychophysics and testing, neurophysiology of vision, and color vision.

Binocular Vision, Perception, and Pediatrics (Vision Therapy, VT)

This category is more applied than the Visual Science category. Many of its courses include intervention strategies for visual abnormalities or dysfunctions. Key words used to identify courses in this category include: vision therapy and rehabilitation, strabismus, amblyopia, pediatrics, eye movements, perception, and learning.

Pre-clinical (PC)

This category encompasses the instruction of clinical procedures, case analysis, patient communications, emergency care, grand rounds, and the use of lasers.

Low Vision/Gerontology (LV)

These courses instruct on devices and strategies used for low vision, as well as courses distinctly geared toward care of the elderly.

Pharmacology (Rx)

This category includes instruction related to both ocular and systemic pharmaceuticals.

Contact Lens (CL)

This category includes didactic instruction of contact lens design, fitting, and care.

Scientific Thought (ST)

Courses associated with a thesis project or analysis of scientific literature are designated by this category. The hours associated with a thesis project are not meant to estimate the time put into thesis work, but simply the hours spent in the course.

Practice Management (PM)

Courses in this category instruct on business aspects and practice development.

Public Health and Epidemiology(PH)

Courses in this category instruct on health care policy formation and the epidemiology of eye related diseases.

Environmental/Occupational/ Sports (EO)

Courses in this category instruct on optometry's consulting role with industry and sports teams, the use of safety eye wear, and environmental adjustments that facilitate improved vision.

Psychological Issues/ Behavioral Disorders (PS)

These courses prepare students for the psychological issues and disorders that they may encounter with patients.

Other (O)

This category includes all required elective hours, as well as any course that does not fit well in another category. The following key words are associated with courses in this category: optometric orientation, history, public speaking, cultural awareness, computer use, ethics, and legal limitations.

After assigning all courses to categories, distributing the credits accordingly and making all necessary conversions to clock hours, we summed the clock hours for each school by category. For comparison purposes we found the mean, standard deviation, and median for each category. We also calculated the percent each category contributes to the school's total clock hours. We performed two rankings, one based on total hours and one based on percent. We also determined which schools fall within one standard deviation of the mean for each category.

For the purpose of comparing our data to the previous two studies, we combined our categorical data into four broader metacategories: Medical Model, Optometric Model, Clinical Model, and Other. The Medical Model includes: Basic Biomedical, Ocular Disease, Ocular Anatomy, and Pharmacology. The Optometric Model

includes: Optical Science, Vision Science, Vision Therapy, Low Vision, Environmental/Occupational, and Contact Lens. The Clinical Model includes total clinical experience. Other includes: Pre-clinical, Scientific Thinking, Practice Management, Public Health, and Other. These broader categories were also analyzed in terms of total hours and percent of the total curriculum with the mean, the median, and standard deviations calculated. We performed the same analysis on the data given in the two previous studies. Because IAUPR was not analyzed in the 1998 study, we were not able to include it in our metacategory comparison and, as mentioned previously, PCO is also not represented in this meta-study. *It is very important to keep these two excluded programs in mind when comparing the meta-study descriptive data to the previously published data. Since these two programs are not included in the meta-study, the descriptive data reported here for the previous two studies will differ from those originally published.*

Prerequisite Study

The 2002 prerequisites for each school or college of optometry were found on each school's Web site. Prerequisites were provided in multiple formats, so we converted them into semesters by course title so that they could be analyzed uniformly. Additionally, we grouped several course titles related to our optometry curriculum category, Basic Biomedical. Courses that were grouped as biomedical preparatory instruction included General Chemistry, Organic Chemistry, Biochemistry, General Biology, Advanced Biology, Microbiology, Human Anatomy, Human Physiology, and each course's associated lab. Other classes analyzed were Physics, Calculus, Statistics, English, Psychology, Social and Behavioral Sciences, and Liberal Arts and Humanities. While the categories may appear overly specified, this was necessary to tease out potential differences among different courses within the same department or course prefixes that could be deemed lower level or less difficult than others.

Results

2001-2002 Analysis of Each Program's Clock Hours By Category and Relative Emphasis

Table 1 presents clock hours per category for each optometric program as well as the total hours of didactic study and the total clinical hours. The rankings based on clock hours are shown in Table 2. Table 3 presents the same data as Table 1, but shows the category clock hours as a proportion of each school's total clock hours. This provides a measure of each school's relative emphasis. The data in Table 4 correspond to the data in Table 3 by ranking the schools and colleges based on the proportion of a school's hours that are devoted to that particular category.

Change in Total Hours

The 2001-2002 data show that optometric students spend an average of 4,154 combined hours in lecture, lab, and clinic. This may be noted as the average given in Table 1. The total hours range from a high of 4,642 for UH to a low of 3,405 for UMSL. In 1991-1992 the reported total average hours was 3,894[4]. In 1995-1996 the reported total average hours was 4,103[3]. The standard deviation for total average hours (representing inter-program variability) was 465 for the academic year 1991-1992[4], 497 for 1995-1996[3], and 387 for 2001-2002.

Comparison of Didactic and Clinical Hours

On average, students in 2001-2002 spent an equal amount of time in clinic as they did in their didactic studies, with 2077 hours in both categories. The 1991-1992 averages show 1,713 hours of clinic;[4] 1995-1996 data show 1,910 clinic hours.[3] Average total clinic hours ranged from 2,554 for NEWENCO to 1,479 for UMSL. On average, reported didactic hours were 2,180 in 1991-1992[4] and 2,187 in 1995-1996[3]. In 2001-2002, NOVA had the most didactic hours with 2,484 and MCO showed the fewest didactic hours with 1,728.

Meta-study Analysis

Tables 5, 6, and 7, and Figures 1,2, and 3 present the results of the meta-study that combined the 17 categories into four broader metacategories (Medical Model, Optometric Model, Clinical Model and Other), enabling us to compare our data to the two previous studies and examine the shifts in curricular focus with regard to the Medical Model versus the Optometric Model. The results are also useful for comparing the trend in variability. Keep in mind that the meta-study results DO NOT include data from PCO and IAUPR, so the reported descriptive data will differ slightly from previously published values, and from the values shown in Table 1.

Table 5 displays the metastudy data for each program. Table 6 represents the data from Table 5 as rankings of each school in each model for each of the three studies. We can see that over the years the rankings have shifted significantly. For example, in 1991-1992 PUCO ranked first in the Optometric Model based on hours. In the 1995-1996 study PUCO fell to last, but by 2001-2002 its position rose back to fifth.

Comparison of Variability Over Time

Table 7 shows a summary of the mean and standard deviations for each metacategory in each study year. Comparing the standard deviations from study to study allows us to evaluate the change in variability among programs over the past decade. Figure 1 shows how this variability has changed over the years. In terms of clock hours, the Medical Model shows a lower standard deviation since 1995-1996, but a slightly higher standard deviation since 1991-1992. The Optometric Model shows an increasing standard deviation over the years. The Clinical Model shows a decreasing standard deviation over the years. In terms of percentages, the Medical Model, the Optometric Model and the Clinical Model each show reductions in variability between programs over the years.

Comparison of Model Emphasis Over Time

The percentage means given in Table 7 show how the hours have shifted over the decade. Clinic is now nearly 50% of the curriculum. This is up from 43% in 1992[4] and 46% in 1996.[3] Figure 2 shows that there has been a decline in the percent of time spent on Medical Model curriculum. The Medical Model accounted for 19.3% in 1991-1992, 18.8% in 1995-1996, and 16.9% in 2001-2002. The percent of the curricular hours devoted to the Optometric Model was 22.7% in 1991-1992, 21.5% in 1995-1996, and 21% in 2001-2002. The percent of hours falling into the remainder category, "Other," declined from 14.9% in 1991-1992 to 13.8% in 1995-1996 to 12.5% in 2001-2002.

Figure 3 shows the mean clock hours for each metacategory for each of the three studies. We can see that the medical hours have decreased by 103 (14%) over the decade, the optometric hours and other hours have

Table 1: Total Clock Hours in Each Category Are Compiled for Each Program

School	BB	OD	OA	OS	VS	VT	PC	LV	Rx	CL	ST	PM
IAUPR	312	90	142	239	217	101	340	0	135	157	38	38
ICO	380	170	120	225	275	205	225	40	120	110	250	20
IU	331	193	98	363	185	96	338	64	143	119	46	30
MCO	214	178	103	165	243	168	226	56	98	118	0	33
NEWENCO	429	225	75	168	207	190	230	15	70	120	20	40
NOVA	450	189	72	342	198	252	405	90	126	144	0	72
NSUCO	253	214	99	310	236	210	258	60	105	157	75	90
OSU	274	130	137	286	304	167	304	108	90	148	0	45
PUCO	122	170	159	213	318	258	396	30	137	127	30	60
SCCO	265	170	100	220	300	210	358	70	120	150	43	38
SCO	278	171	112	194	181	138	295	51	143	92	60	80
SUNY	440	220	107	215	201	221	434	40	88	130	26	58
UAB	566	183	155	140	230	170	440	60	95	120	0	75
UCB	115	154	73	251	95	172	481	45	115	94	90	10
UH	225	195	126	349	161	368	211	45	105	129	0	90
UMSL	262	142	86	224	273	142	282	71	90	101	0	75
Mean	307	175	110	244	226	192	326	53	111	126	42	53
St. Dev	121	34	28	68	59	66	86	26	22	21	62	25
Median	276	175	105	225	224	181	321	54	110	124	28	52

School	PH	EO	PS	O	CE1	CE2	CE3	CE4	Total	Total Clinic	Total Didactic
IAUPR	38	0	0	45	0	0	630	1600	4120	2230	1890
ICO	30	0	10	20	0	0	576	1584	4360	2160	2200
IU	45	0	0	38	0	104	384	1920	4494	2408	2086
MCO	42	33	19	33	0	84	448	1680	3940	2212	1728
NEWENCO	30	29	35	40	0	90	280	2184	4475	2554	1921
NOVA	90	18	0	36	0	32	80	1968	4564	2080	2484
NSUCO	60	15	0	15	15	63	528	992	3753	1598	2155
OSU	30	46	0	25	0	0	240	1560	3894	1800	2094
PUCO	45	30	15	60	37	37	204	1628	4075	1906	2170
SCCO	55	15	0	25	20	40	540	1824	4562	2424	2138
SCO	20	23	20	23	0	94	460	1440	3875	1994	1881
SUNY	43	0	6	73	0	30	210	1750	4294	1990	2304
UAB	40	20	0	5	0	296	720	1160	4475	2176	2299
UCB	10	8	0	64	0	0	554	1214	3543	1768	1775
UH	45	28	0	105	0	180	780	1500	4642	2460	2182
UMSL	60	30	38	51	0	0	412	1067	3405	1479	1926
Mean	43	18	9	41	5	66	440	1567	4154	2077	2077
St. Dev	18	14	13	25	11	79	198	334	387	313	207
Median	43	19	0	37	0	39	454	1592	4207	2120	2116

remained relatively stable (each decreasing by 7 (<1%)), and the clinical hours have made the major change, increasing by 355 (21%).

Change in Pharmacology Requirements Over Time

With regard to our specific interest in how pharmacology hours have changed, the 2001-2002 data (excluding IAUPRand PCO) show an average of 110 hours, a 16% increase in clock hours over the decade. The average 1991-1992 curriculum (excluding IAUPR and PCO) had 95 hours while the average 1995-1996 curriculum (excluding PCO) had 99 hours.

Prerequisite Study

The difference in required semester hours among programs for each course title in the basic biomedical, mathematical, and physics categories differed by one semester or less, with few exceptions. The remaining titles had wider variations, but lacked a discernable pattern. Refer to Table 8 for these findings. Comparing total required hours, we see a range of 31 semesters at MCO to 17 semesters at IU. Grouping the prerequisites that are in the basic biomedical category, we see a range of 18 semesters at UH

Table 2: Each Program Is Ranked in Each Category According to Total Clock Hours

BB	OD	OA	OS	VS	VT	PC	LV	Rx	CL	ST	PM
UAB	NEWENCO	PUCO	IU	PUCO	UH	UCB	OSU	SCO*	IAUPR*	ICO	NSUCO*
NOVA	SUNY	UAB	UH	OSU	PUCO	UAB	NOVA	IU*	NSUCO*	UCB	UH*
SUNY	NSUCO	IAUPR	NOVA	SCCO	NOVA	SUNY	UMSL	PUCO	SCCO	NSUCO	SCO
NEWENCO	UH	OSU	NSUCO	ICO	SUNY	NOVA	SCCO	IAUPR	OSU	SCO	UAB*
ICO	IU	UH	OSU	UMSL	SCCO*	PUCO	IU	NOVA	NOVA	IU	UMSL*
IU	NOVA	ICO	UCB	MCO	NSUCO*	SCCO	NSUCO*	ICO*	SUNY	SCCO	NOVA
IAUPR	UAB	SCO	IAUPR	NSUCO	ICO	IAUPR	UAB*	SCCO*	UH	IAUPR	PUCO
SCO	MCO	SUNY	ICO	UAB	NEWENCO	IU	MCO	UCB	PUCO	PUCO	SUNY
OSU	SCO	MCO	UMSL	IAUPR	UCB	OSU	SCO	NSUCO*	NEWENCO*	SUNY	OSU
SCCO	ICO*	SCCO	SCCO	NEWENCO	UAB	SCO	UCB‡	UH*	UAB*	NEWENCO	NEWENCO
UMSL	PUCO*	NSUCO	SUNY	SUNY	MCO	UMSL	UH‡	MCO	IU	MCO*	IAUPR*
NSUCO	SCCO*	IU	PUCO	NOVA	OSU	NSUCO	ICO*	UAB	MCO	NOVA*	SCCO*
UH	UCB	UMSL	SCO	IU	UMSL	NEWENCO	SUNY*	OSU*	ICO	OSU*	MCO
MCO	UMSL	NEWENCO	NEWENCO	SCO	SCO	MCO	PUCO	UMSL*	UMSL	UAB*	IU
PUCO	OSU	UCB	MCO	UH	IAUPR	ICO	NEWENCO	SUNY	UCB	UH*	ICO
UCB	IAUPR	NOVA	UAB	UCB	IU	UH	IAUPR	NEWENCO	SCO	UMSL*	UCB

PH	EO	PS	O	CE1	CE2	CE3	CE4	Total	Total Clinic	Total Didactic
NOVA	OSU	UMSL	UH	PUCO	UAB	UH	NEWENCO	UH	NEWENCO	NOVA
NSUCO*	MCO	NEWENCO	SUNY	SCCO	UH	UAB	NOVA	NOVA	UH	SUNY
UMSL*	PUCO*	SCO	UCB	NSUCO	IU	IAUPR	IU	SCCO	SCCO	UAB
SCCO	UMSL*	MCO	PUCO	IAUPR*	SCO	ICO	SCCO	IU	IU	ICO
IU*	NEWENCO	PUCO	UMSL	ICO*	NEWENCO	UCB	SUNY	NEWENCO*	IAUPR	UH
PUCO*	UH	ICO	IAUPR	IU*	MCO	SCCO	MCO	UAB*	MCO	PUCO
UH*	SCO	SUNY	NEWENCO	MCO*	NSUCO	NSUCO	PUCO	ICO	UAB	NSUCO
SUNY	UAB	IAUPR*	IU	NEWENCO*	SCCO	SCO	IAUPR	SUNY	ICO	SCCO
MCO	NOVA	IU*	NOVA	NOVA*	PUCO	MCO	ICO	IAUPR	NOVA	OSU
UAB	NSUCO*	NOVA*	MCO	OSU*	NOVA	UMSL	OSU	PUCO	SCO	IU
IAUPR	SCCO*	NSUCO*	OSU	SCO*	SUNY	IU	UH	MCO	SUNY	UMSL
ICO*	UCB	OSU*	SCCO	SUNY*	IAUPR*	NEWENCO	SCO	OSU	PUCO	NEWENCO
NEWENCO*	IAUPR*	SCCO*	SCO	UAB*	ICO*	OSU	UCB	SCO	OSU	IAUPR
OSU*	ICO*	UAB*	ICO	UCB*	OSU*	SUNY	UAB	NSUCO	UCB	SCO
SCO	IU*	UCB*	NSUCO	UH*	UCB*	PUCO	UMSL	UCB	NSUCO	UCB
UCB	SUNY*	UH*	UAB	UMSL*	UMSL*	NOVA	NSUCO	UMSL	UMSL	MCO

Note: Successive * or ‡ marks indicate a tie between the schools bearing the individual symbols.

to 10 semesters at NEWENCO and NSUCO.

The prerequisite course that has the largest variation among optometry programs is biochemistry, with seven schools that do require it and nine that do not. The next largest differentiation is human physiology with five schools that require it as a prerequisite. The category of Other Social and Behavioral Sciences (other than psychology) also shows high variation with a high of five semesters required at NOVA to none, including no psychology courses, at IU and OSU.

Discussion

The curricula at optometry schools and colleges today demonstrate commitment to a strong biomedical foundation as well as the specialties, such as low vision, contact lens, and vision therapy. The body of knowledge necessary for treating and managing patients continues to grow. The programs have met this demand by increasing the required clock hours 6.1% over the past decade.

General Observations

As schools craft their curricula to optimize available hours in the four-year program, the curricula at the various schools are becoming more similar. There appears to be a movement toward a "core curriculum," evidenced by both the similarity in total hours and the decrease in variability for each category. Another indicator of increased similarity of the total course load is decreased variance in total hours between the programs with the highest and lowest total hours, compared to the variance in the previous studies. There is a difference of 1,237 total hours between UH and UMSL, the programs with the highest and

Table 3: Total Clock Hours in Each Category as a Proportion of the Total Clock Hours in the Curriculum Are Compiled for Each Program

School	BB	OD	OA	OS	VS	VT	PC	LV	Rx	CL	ST	PM
IAUPR	7.6%	2.2%	3.4%	5.8%	5.3%	2.5%	8.2%	0.0%	3.3%	3.8%	0.9%	0.9%
ICO	8.7%	3.9%	2.8%	5.2%	6.3%	4.7%	5.2%	0.9%	2.8%	2.5%	5.7%	0.5%
IU	7.4%	4.3%	2.2%	8.1%	4.1%	2.1%	7.5%	1.4%	3.2%	2.6%	1.0%	0.7%
MCO	5.4%	4.5%	2.6%	4.2%	6.2%	4.3%	5.7%	1.4%	2.5%	3.0%	0.0%	0.8%
NEWENCO	9.6%	5.0%	1.7%	3.7%	4.6%	4.2%	5.1%	0.3%	1.6%	2.7%	0.4%	0.9%
NOVA	9.9%	4.1%	1.6%	7.5%	4.3%	5.5%	8.9%	2.0%	2.8%	3.2%	0.0%	1.6%
NSUCO	6.7%	5.7%	2.6%	8.3%	6.3%	5.6%	6.9%	1.6%	2.8%	4.2%	2.0%	2.4%
OSU	7.0%	3.3%	3.5%	7.3%	7.8%	4.3%	7.8%	2.8%	2.3%	3.8%	0.0%	1.2%
PUCO	3.0%	4.2%	3.9%	5.2%	7.8%	6.3%	9.7%	0.7%	3.4%	3.1%	0.7%	1.5%
SCCO	5.8%	3.7%	2.2%	4.8%	6.6%	4.6%	7.8%	1.5%	2.6%	3.3%	0.9%	0.8%
SCO	7.2%	4.4%	2.9%	5.0%	4.7%	3.6%	7.6%	1.3%	3.7%	2.4%	1.5%	2.1%
SUNY	10.2%	5.1%	2.5%	5.0%	4.7%	5.2%	10.1%	0.9%	2.1%	3.0%	0.6%	1.4%
UAB	12.6%	4.1%	3.5%	3.1%	5.1%	3.8%	9.8%	1.3%	2.1%	2.7%	0.0%	1.7%
UCB	3.2%	4.4%	2.0%	7.1%	2.7%	4.8%	13.6%	1.3%	3.2%	2.6%	2.5%	0.3%
UH	4.8%	4.2%	2.7%	7.5%	3.5%	7.9%	4.5%	1.0%	2.3%	2.8%	0.0%	1.9%
UMSL	7.7%	4.2%	2.5%	6.6%	8.0%	4.2%	8.3%	2.1%	2.6%	3.0%	0.0%	2.2%
Mean	7.3%	4.2%	2.7%	5.9%	5.5%	4.6%	7.9%	1.3%	2.7%	3.0%	1.0%	1.3%
St. Dev	2.6%	0.8%	0.7%	1.6%	1.6%	1.4%	2.3%	0.7%	0.6%	0.5%	1.5%	0.6%
Median	7.3%	4.2%	2.6%	5.5%	5.2%	4.4%	7.8%	1.3%	2.7%	3.0%	0.7%	1.3%

School	PH	EO	PS	O	CE1	CE2	CE3	CE4	Total Clinic	Total Didactic
IAUPR	0.9%	0.0%	0.0%	1.1%	0.0%	0.0%	15.3%	38.8%	54.1%	45.9%
ICO	0.7%	0.0%	0.2%	0.5%	0.0%	0.0%	13.2%	36.3%	49.5%	50.5%
IU	1.0%	0.0%	0.0%	0.8%	0.0%	2.3%	8.5%	42.7%	53.6%	46.4%
MCO	1.1%	0.8%	0.5%	0.8%	0.0%	2.1%	11.4%	42.6%	56.1%	43.9%
NEWENCO	0.7%	0.6%	0.8%	0.9%	0.0%	2.0%	6.3%	48.8%	57.1%	42.9%
NOVA	2.0%	0.4%	0.0%	0.8%	0.0%	0.7%	1.8%	43.1%	45.6%	54.4%
NSUCO	1.6%	0.4%	0.0%	0.4%	0.4%	1.7%	14.1%	26.4%	42.6%	57.4%
OSU	0.8%	1.2%	0.0%	0.6%	0.0%	0.0%	6.2%	40.1%	46.2%	53.8%
PUCO	1.1%	0.7%	0.4%	1.5%	0.9%	0.9%	5.0%	40.0%	46.8%	53.2%
SCCO	1.2%	0.3%	0.0%	0.5%	0.4%	0.9%	11.8%	40.0%	53.1%	46.9%
SCO	0.5%	0.6%	0.5%	0.6%	0.0%	2.4%	11.9%	37.2%	51.5%	48.5%
SUNY	1.0%	0.0%	0.1%	1.7%	0.0%	0.7%	4.9%	40.8%	46.3%	53.7%
UAB	0.9%	0.4%	0.0%	0.1%	0.0%	6.6%	16.1%	25.9%	48.6%	51.4%
UCB	0.3%	0.2%	0.0%	1.8%	0.0%	0.0%	15.6%	34.3%	49.9%	50.1%
UH	1.0%	0.6%	0.0%	2.3%	0.0%	3.9%	16.8%	32.3%	53.0%	47.0%
UMSL	1.8%	0.9%	1.1%	1.5%	0.0%	0.0%	12.1%	31.3%	43.4%	56.6%
Mean	1.0%	0.5%	0.2%	1.0%	0.1%	1.5%	10.7%	37.5%	49.8%	50.2%
St. Dev	0.4%	0.4%	0.3%	0.6%	0.3%	1.8%	4.7%	6.2%	4.4%	4.4%
Median	1.0%	0.4%	0.0%	0.8%	0.0%	0.9%	11.9%	39.4%	49.7%	50.3%

lowest total hours in the current study. This disparity is primarily the result of variation in clinical time. The high and low schools in 1992 differed by 1,492 hours (UH and IU)[4] The 1996 data showed a range that differed by 1,605 (SUNY and UMSL).[3]

Clinical Emphasis

The most significant trend revealed in this study is the commitment to increased clinic time. These results indicate that educators believe classroom education cannot match the lessons learned through direct interaction with patients. Over the past decade, the average of total clinic hours has increased 21%. This has

Table 4: Each Program Is Ranked in Each Category According to the Percentage of Curriculum in Each Category

BB	OD	OA	OS	VS	VT	PC	LV	Rx	CL	ST	PM
UAB	NSUCO	PUCO	NSUCO	UMSL	UH	UCB	OSU	SCO	NSUCO	ICO	NSUCO
SUNY	SUNY	OSU*	IU	OSU*	PUCO	SUNY	UMSL	PUCO	IAUPR*	UCB	UMSL
NOVA	NEWENCO	UAB*	UH*	PUCO*	NSUCO	UAB	NOVA	IAUPR	OSU*	NSUCO	SCO
NEWENCO	MCO	IAUPR	NOVA*	SCCO	NOVA	PUCO	NSUCO	UCB*	SCCO	SCO	UH
ICO	SCO*	SCO	OSU	ICO*	SUNY	NOVA	SCCO	IU*	NOVA	IU	UAB
UMSL	UCB*	ICO	UCB	NSUCO*	UCB	UMSL	IU*	NSUCO‡	PUCO	IAUPR*	NOVA
IAUPR	IU	UH	UMSL	MCO	ICO	IAUPR	MCO*	NOVA‡	SUNY*	SCCO*	PUCO
IU	UH*	NSUCO*	IAUPR	IAUPR	SCCO	SCCO*	UAB‡	ICO‡	MCO*	PUCO	SUNY
SCO	PUCO*	MCO*	ICO*	UAB	MCO*	OSU*	SCO‡	UMSL*	UMSL*	SUNY	OSU
OSU	UMSL*	UMSL‡	PUCO*	SUNY*	OSU*	SCO	UCB‡	SCCO*	UH	NEWENCO	IAUPR*
NSUCO	NOVA‡	SUNY‡	SCO‡	SCO*	NEWENCO‡	IU	UH	MCO	NEWENCO*	MCO*	NEWENCO*
SCCO	UAB‡	SCCO*	SUNY‡	NEWENCO	UMSL‡	NSUCO	SUNY*	OSU*	UAB*	NOVA*	MCO‡
MCO	ICO	IU*	SCCO	NOVA	UAB	MCO	ICO*	UH*	IU‡	OSU*	SCCO‡
UH	SCCO	UCB	MCO	IU	SCO	ICO	PUCO	UAB‡	UCB‡	UAB*	IU
UCB	OSU	NEWENCO	NEWENCO	UH	IAUPR	NEWENCO	NEWENCO	SUNY‡	ICO	UH*	ICO
PUCO	IAUPR	NOVA	UAB	UCB	IU	UH	IAUPR	NEWENCO	SCO	UMSL*	UCB

PH	EO	PS	O	CE1	CE2	CE3	CE4	Total Clinic	Total Didactic
NOVA	OSU	UMSL	UH	PUCO	UAB	UH	NEWENCO	NEWENCO	NSUCO
UMSL	UMSL	NEWENCO	UCB	SCCO	UH	UAB	NOVA	MCO	UMSL
NSUCO	MCO	SCO*	SUNY	NSUCO	SCO	UCB	IU	IAUPR	NOVA
SCCO	PUCO	MCO*	UMSL*	IAUPR*	IU	IAUPR	MCO	IU	OSU
PUCO*	NEWENCO*	PUCO	PUCO*	ICO*	MCO	NSUCO	SUNY	SCCO	SUNY
MCO*	UH*	ICO	IAUPR	IU*	NEWENCO	ICO	OSU	UH	PUCO
UH‡	SCO*	SUNY	NEWENCO	MCO*	NSUCO	UMSL	SCCO*	SCO	UAB
IU‡	NSUCO‡	IAUPR*	IU*	NEWENCO*	PUCO*	SCO	PUCO*	UCB	ICO
SUNY‡	UAB‡	IU*	MCO*	NOVA*	SCCO*	SCCO	IAUPR	ICO	UCB
IAUPR*	NOVA‡	NOVA*	NOVA*	OSU*	NOVA‡	MCO	SCO	UAB	SCO
UAB*	SCCO	NSUCO*	OSU‡	SCO*	SUNY‡	IU	ICO	PUCO	UH
OSU	UCB	OSU*	SCO‡	SUNY*	IAUPR*	NEWENCO	UCB	SUNY	SCCO
ICO*	IAUPR*	SCCO*	SCCO*	UAB*	ICO*	OSU	UH	OSU	IU
NEWENCO*	ICO*	UAB*	ICO*	UCB*	OSU*	PUCO	UMSL	NOVA	IAUPR
SCO	IU*	UCB*	NSUCO	UH*	UCB*	SUNY	NSUCO	UMSL	MCO
UCB	SUNY*	UH*	UAB	UMSL*	UMSL*	NOVA	UAB	NSUCO	NEWENCO

Note: Successive * or ‡ marks indicate a tie between the schools bearing the individual symbols.

been made possible both by increasing overall hours, as discussed, and by reducing total didactic hours by 5.3%.

Currently most schools have struck a balance between didactic hours and clinic hours. On average, students today spend an equal amount of time in clinic and in the classroom. In order to assess whether programs that have a large clinical component sacrifice hours in their didactic curriculum or vice versa, we determined which schools or colleges fall one standard deviation above or below the mean for the categories of "Total Clinic" and "Total Didactic." We then sought to determine if any of the schools that were on the extreme high end in one category tended to be on the extreme low end in the other. The results of this analysis showed that programs do not necessarily make a trade-off between clinic and didactic time. In their curricula NOVA, SUNY, and UAB stand out for having didactic hours greater than one standard deviation above the mean; however these schools are not remarkably low for total clinical. Also, UCB and MCO stand out for having a low number of didactic hours without a correspondingly higher number of clinical hours. In the clinical curricula, IU, NEWENCO, SCCO, and UH's hours exceed the average by greater than one standard deviation without having extremely low hours in their didactic curricula. We also see that NSUCO and UMSL's clinical hours are greater than one standard deviation below the mean without

Table 5: Metacategory Results Are Compiled for Each Program and Presented Both in Terms of Clock Hours and as Percentages of the Curriculum. Results Are Given for Each Study Year

Table 5a: 'Medical' Metacategory

By Total Hours	1991-92	1995-96	2001-02	By Percentages	1991-92	1995-96	2001-02
ICO	730	770	690	ICO	19.8%	21.6%	18.1%
IU	830	870	651	IU	27.6%	19.7%	17.0%
MCO	560	690	528	MCO	14.1%	16.2%	15.1%
NEWENCO	878	853	768	NEWENCO	23.8%	21.9%	17.8%
NOVA	1110	1078	783	NOVA	24.8%	22.3%	18.3%
NSUCO	662	642	655	NSUCO	16.8%	17.9%	17.9%
OSU	700	598	586	OSU	21.0%	16.9%	16.2%
PUCO	525	575	511	PUCO	15.7%	15.7%	14.4%
SCCO	640	620	573	SCCO	16.3%	13.6%	14.4%
SCO	870	780	641	SCO	20.6%	18.4%	18.2%
SUNY	819	904	825	SUNY	18.0%	19.6%	19.9%
UAB	845	1127	979	UAB	23.1%	26.8%	22.3%
UCB	719	615	352	UCB	15.9%	14.7%	12.9%
UH	720	720	636	UH	14.3%	16.2%	14.0%
UMSL	675	705	565	UMSL	18.1%	21.2%	17.0%
Mean	752	770	649	Mean	19.3%	18.8%	16.9%
Std. Dev	146	169	149	Std. Dev	4.1%	3.5%	2.5%
Median	720	720	641	Median	18.1%	18.4%	17.0%

Table 5b: 'Optometric' Metacategory

By Total Hours	1991-92	1995-96	2001-02	By Percentages	1991-92	1995-96	2001-02
ICO	750	830	855	ICO	20.4%	23.3%	19.6%
IU	885	838	826	IU	29.4%	19.0%	18.4%
MCO	900	1005	783	MCO	22.6%	23.6%	19.9%
NEWENCO	607	683	728	NEWENCO	16.5%	17.5%	16.3%
NOVA	900	1053	1044	NOVA	20.2%	21.8%	22.9%
NSUCO	932	945	987	NSUCO	23.6%	26.5%	26.3%
OSU	930	1020	1059	OSU	27.9%	28.8%	27.2%
PUCO	975	620	976	PUCO	28.9%	16.9%	24.0%
SCCO	960	970	965	SCCO	24.2%	21.3%	21.2%
SCO	800	790	679	SCO	19.0%	21.1%	17.5%
SUNY	875	895	808	SUNY	19.2%	19.5%	18.8%
UAB	880	770	740	UAB	24.0%	18.4%	16.5%
UCB	958	856	663	UCB	21.1%	20.5%	18.7%
UH	960	795	1080	UH	20.8%	17.8%	23.3%
UMSL	825	870	841	UMSL	22.2%	26.3%	24.7%
Mean	876	863	869	Mean	22.7%	21.5%	21.0%
Std. Dev	98	123	140	Std. Dev	3.8%	3.6%	3.5%
Median	900	856	841	Median	22.2%	21.1%	19.9%

the counterbalance of an excessively high number of didactic hours.

We wondered if the schools with the most clinic hours achieve this by placing students in clinic sooner. This does not appear to be the case with respect to starting clinic in the first year. Only three schools offer opportunities for first year clinical experience. These are NSUCO, PUCO, and SCCO. Of these, only SCCO is in the top five for total clinical experience. However, three of the schools that were in the top five for second year clinic came out in the top five for total

Table 5: Metacategory Results Are Compiled for Each Program and Presented Both in Terms of Clock Hours and as Percentages of the Curriculum. Results Are Given for Each Study Year (continued).

Table 5c: 'Clinic' Metacategory

By Total Hours	1991-92	1995-96	2001-02	By Percentages	1991-92	1995-96	2001-02
ICO	1660	1512	2160	ICO	45.1%	42.4%	49.5%
IU	864	2125	2408	IU	28.7%	48.2%	53.6%
MCO	2040	2160	2212	MCO	51.1%	50.5%	56.1%
NEWENCO	1730	1826	2554	NEWENCO	47.0%	46.8%	57.1%
NOVA	1910	2143	2080	NOVA	42.6%	44.4%	45.6%
NSUCO	1525	1283	1598	NSUCO	38.6%	36.0%	42.6%
OSU	1190	1476	1800	OSU	35.7%	41.5%	46.2%
PUCO	1200	1940	1906	PUCO	35.7%	52.9%	46.8%
SCCO	1816	2479	2424	SCCO	46.0%	54.6%	53.1%
SCO	1940	1864	1994	SCO	45.9%	44.0%	51.5%
SUNY	2160	2240	1990	SUNY	47.6%	48.6%	46.3%
UAB	1427	1788	2176	UAB	38.8%	42.5%	48.6%
UCB	2308	2133	1768	UCB	50.8%	50.9%	49.9%
UH	2268	2160	2460	UH	49.1%	48.5%	53.0%
UMSL	1636	1215	1479	UMSL	44.0%	36.5%	43.4%
Mean	1712	1890	2067	Mean	43.1%	45.9%	49.6%
Std. Dev	419	373	321	Std. Dev	6.4%	5.5%	4.4%
Median	1730	1940	2080	Median	45.1%	46.8%	49.5%

Table 5d: 'Other' Metacategory

By Total Hours	1991-92	1995-96	2001-02	By Percentages	1991-92	1995-96	2001-02
ICO	540	458	655	ICO	14.7%	12.7%	12.7%
IU	436	572	609	IU	14.3%	13.1%	11.0%
MCO	494	420	417	MCO	12.2%	9.7%	8.9%
NEWENCO	470	542	425	NEWENCO	12.7%	13.8%	8.8%
NOVA	560	548	657	NOVA	12.4%	11.5%	13.2%
NSUCO	828	692	513	NSUCO	21.0%	19.6%	13.3%
OSU	510	460	449	OSU	15.4%	12.8%	10.4%
PUCO	660	531	683	PUCO	19.7%	14.5%	14.9%
SCCO	536	474	601	SCCO	13.5%	10.5%	11.4%
SCO	620	800	561	SCO	14.5%	16.5%	12.9%
SUNY	680	570	672	SUNY	15.2%	12.3%	14.9%
UAB	528	522	580	UAB	14.1%	12.3%	12.5%
UCB	556	585	760	UCB	12.2%	13.9%	18.5%
UH	672	780	466	UH	15.8%	17.5%	9.7%
UMSL	585	540	520	UMSL	15.7%	16.0%	14.8%
Mean	578	566	571	Mean	14.9%	13.8%	12.5%
Std. Dev	100	112	104	Std. Dev	2.5%	2.7%	2.6%
Median	556	542	580	Median	14.5%	13.1%	12.7%

clinic. These schools are UH, IU, and NEWENCO. Four programs, UMSL, SCO, IAUPR and SUNY, do not offer clinic in the summer after the second year.

Pharmacology Emphasis

Optometry political lobbyists, having made great legislative gains in the

Table 6: The Metacategory Data Give Rise to Ranking the Programs in Each Metacategory. Rankings Are Presented Both According to Clock Hours and Percentage.

Table 6a: 'Medical' Metacategory

By Total Clock Hours			By Percentage of Curriculum		
1991-92	1995-96	2001-02	1991-92	1995-96	2001-02
NOVA	UAB	UAB	IU	UAB	UAB
NEWENCO	NOVA	SUNY	NOVA	NOVA	SUNY
SCO	SUNY	NOVA	NEWENCO	NEWENCO	NOVA
UAB	IU	NEWENCO	UAB	ICO	SCO
IU	NEWENCO	ICO	OSU	UMSL	ICO
SUNY	SCO	NSUCO	SCO	IU	NSUCO
ICO	ICO	IU	ICO	SUNY	NEWENCO
UH	UH	SCO	UMSL	SCO	UMSL
UCB	UMSL	UH	SUNY	NSUCO	IU
OSU	MCO	OSU	NSUCO	OSU	OSU
UMSL	NSUCO	SCCO	SCCO	MCO	MCO
NSUCO	SCCO	UMSL	UCB	UH	PUCO
SCCO	UCB	MCO	PUCO	PUCO	SCCO
MCO	OSU	PUCO	UH	UCB	UH
PUCO	PUCO	UCB	MCO	SCCO	UCB

Table 6b: 'Optometric' Metacategory

By Total Clock Hours			By Percentage of Curriculum		
1991-92	1995-96	2001-02	1991-92	1995-96	2001-02
PUCO	NOVA	UH	IU	OSU	OSU
SCCO	OSU	OSU	PUCO	NSUCO	NSUCO
UH	MCO	NOVA	OSU	UMSL	UMSL
UCB	SCCO	NSUCO	SCCO	MCO	PUCO
NSUCO	NSUCO	PUCO	UAB	ICO	UH
OSU	SUNY	SCCO	NSUCO	NOVA	NOVA
MCO	UMSL	ICO	MCO	SCCO	SCCO
NOVA	UCB	UMSL	UMSL	SCO	MCO
IU	IU	IU	UCB	UCB	ICO
UAB	ICO	SUNY	UH	SUNY	SUNY
SUNY	UH	MCO	ICO	IU	UCB
UMSL	SCO	UAB	NOVA	UAB	IU
SCO	UAB	NEWENCO	SUNY	UH	SCO
ICO	NEWENCO	SCO	SCO	NEWENCO	UAB
NEWENCO	PUCO	UCB	NEWENCO	PUCO	NEWENCO

past decade, continue to work for a broad scope of prescriptive authority across the country. The optometry schools and colleges have responded by increasing pharmacology hours 16% over the past decade. In 1991-1992, when the mean number of pharmacology hours was reported at 944, optometrists in 12 states had authority to use oral medications. In 1995-1996, when the mean number of pharmacology hours was reported at 973, 32 states had orals. Currently 39 states plus DC and Guam have orals and the mean number of pharmacology hours is 111. According to Sherry Cooper, American Optometric Association's state legislative analyst, this number matches closely the pharmacology hours required in dentistry and medical schools.[6]

We examined whether the current size of the pharmacology curricula relates to legislated scope of practice in the home states and territories of the optometry programs. Of these states and territories, only four lack prescriptive authority for orals: Massachusetts, New York, Florida, and Puerto Rico. SUNY in New York and NEWENCO in Massachusetts fall below the mean in pharmacology hours. NEWENCO has the fewest pharmacology hours in the study with 70 (compared to the mean of 111), and optometrists in the state of Massachusetts lack authority for glau-

Table 6: The Metacategory Data Give Rise to Ranking the Programs in Each Metacategory. Rankings Are Presented Both According to Clock Hours and Percentage (continued).

Table 6c: 'Clinic' Metacategory

By Total Clock Hours			By Percentage of Curriculum		
1991-92	1995-96	2001-02	1991-92	1995-96	2001-02
UCB	SCCO	NEWENCO	MCO	SCCO	NEWENCO
UH	SUNY	UH	UCB	PUCO	MCO
SUNY	MCO	SCCO	UH	UCB	IU
MCO	UH	IU	SUNY	MCO	SCCO
SCO	NOVA	MCO	NEWENCO	SUNY	UH
NOVA	UCB	UAB	SCCO	UH	SCO
SCCO	IU	ICO	SCO	IU	UCB
NEWENCO	PUCO	NOVA	ICO	NEWENCO	ICO
ICO	SCO	SCO	UMSL	NOVA	UAB
UMSL	NEWENCO	SUNY	NOVA	SCO	PUCO
NSUCO	UAB	PUCO	UAB	UAB	SUNY
UAB	ICO	OSU	NSUCO	ICO	OSU
PUCO	OSU	UCB	OSU	OSU	NOVA
OSU	NSUCO	NSUCO	PUCO	UMSL	UMSL
IU	UMSL	UMSL	IU	NSUCO	NSUCO

Table 6d: 'Other' Metacategory

By Total Clock Hours			By Percentage of Curriculum		
1991-92	1995-96	2001-02	1991-92	1995-96	2001-02
NSUCO	SCO	UCB	NSUCO	NSUCO	UCB
SUNY	UH	PUCO	PUCO	UH	SUNY
UH	NSUCO	SUNY	UH	SCO	PUCO
PUCO	UCB	NOVA	UMSL	UMSL	UMSL
SCO	IU	ICO	OSU	PUCO	NSUCO
UMSL	SUNY	IU	SUNY	UCB	NOVA
NOVA	NOVA	SCCO	ICO	NEWENCO	SCO
UCB	NEWENCO	UAB	SCO	IU	ICO
ICO	UMSL	SCO	IU	OSU	UAB
SCCO	PUCO	UMSL	UAB	ICO	SCCO
UAB	UAB	NSUCO	SCCO	SUNY	IU
OSU	SCCO	UH	NEWENCO	UAB	OSU
MCO	OSU	OSU	NOVA	NOVA	UH
NEWENCO	ICO	NEWENCO	MCO	SCCO	MCO
IU	MCO	MCO	UCB	MCO	NEWENCO

coma treatment as well as for oral medications. NOVA in Florida and IAUPR in Puerto Rico are above the mean for pharmacology hours, possibly reflecting a push to achieve legislative gains in these geographic regions.

Trend Toward Uniformity

Assuring national uniformity assists the legislative cause of the AOA by confirming that graduates from any school will practice with the same competency in all areas of optometry's practice scope. Although the first two studies concluded that great variability exists, our study reveals a trend toward a more common curriculum. Excluding those schools that fall beyond one standard deviation in numerous categories enabled us to establish which programs have curricula that represent a possible "core curriculum." The following three schools do not fall outside one standard deviation in more than three categories; therefore we would consider their curricula the most similar: MCO, SCCO, and UMSL.

Our metastudy data indicate that this decrease in variability holds true when comparing the different models. Comparing the percentages for the metacategories (Table 7) we see decreased variance among schools over the past decade. This indicates that, overall, schools are evolving to

Table 7: A Summarized Amalgamation of the Programs for Each Study Year Is Provided for Each Metacategory Showing Mean Clock Hours, Mean Percentage, and the Standard Deviations for Both.

	Medical	Optometric	Clinical	Other
2001-02 Mean in Clock Hours	649	869	2067	571
1995-96 Mean in Clock Hours	770	863	1890	566
1991-92 Mean in Clock Hours	752	876	1712	578
2001-02 Mean in %	16.9%	21.0%	49.6%	12.5%
1995-96 Mean in %	18.8%	21.5%	45.9%	13.8%
1991-92 Mean in %	19.3%	22.7%	43.1%	14.9%
2001-02 Std Dev for Clock Hours	149	140	321	104
1995-96 Std Dev for Clock Hours	169	123	373	112
1991-92 Std Dev for Clock Hours	146	98	419	100
2001-02 Std Dev for %	2.5%	3.5%	4.4%	2.6%
1995-96 Std Dev for %	3.5%	3.6%	5.5%	2.7%
1991-92 Std Dev for %	4.1%	3.8%	6.4%	2.5%

greater similarity between emphases in these different models.

Medical Model vs. Optometric Model

Practitioners and educators often debate whether our profession is on a trajectory toward becoming more similar to general practice ophthalmology at the expense of our visual science roots. The trends in optometry curricula over the past ten years do not seem to support this assertion. The proportion of total curriculum hours assigned to the Optometric Model has declined from 22.7% to 21% over the decade, while the proportion assigned to the Medical Model has similarly declined from 19.3% to 16.9% during the same period. We would caution against reading too much into this shift. A decrease in the percent of hours can either indicate a de-emphasis or a more time-efficient approach given to medically related topics. In either case, it appears that a trade-off in hours has not been made between "optometric" and "medical" courses. As we discussed earlier, the greatest trend is toward more clinical experience.

Stereotypes exist as to which schools operate with more weight given to the Medical Model or to the Optometric Model. These perceptions are undoubtedly based on factors such as faculty personalities rather than the amount of time devoted to certain categories. Based on which schools are more than one standard deviation from the percentage average in the models, our data suggest that UAB and SUNY emphasize Medical Model studies and OSU, NSUCO, and UMSL emphasize Optometric Model studies.

The tendency for programs to switch their focus indicates that labels should not be taken too seriously. The percent rankings shown in Table 6 indicate that few programs show a sustained history of ranking high for a given model. Only NOVA and UAB have remained in the top five spots for the Medical Model over the course of the decade. Only OSU has consistently remained among the top five Optometric Model rankings. MCO is the only school to hold onto a high

Figure 1: The Average Standard Deviation of Each Metacategory as a Proportion Of Each Program's Total Curriculum Is Graphed Relative to the Academic Period That Each Study Used to Compile Data.

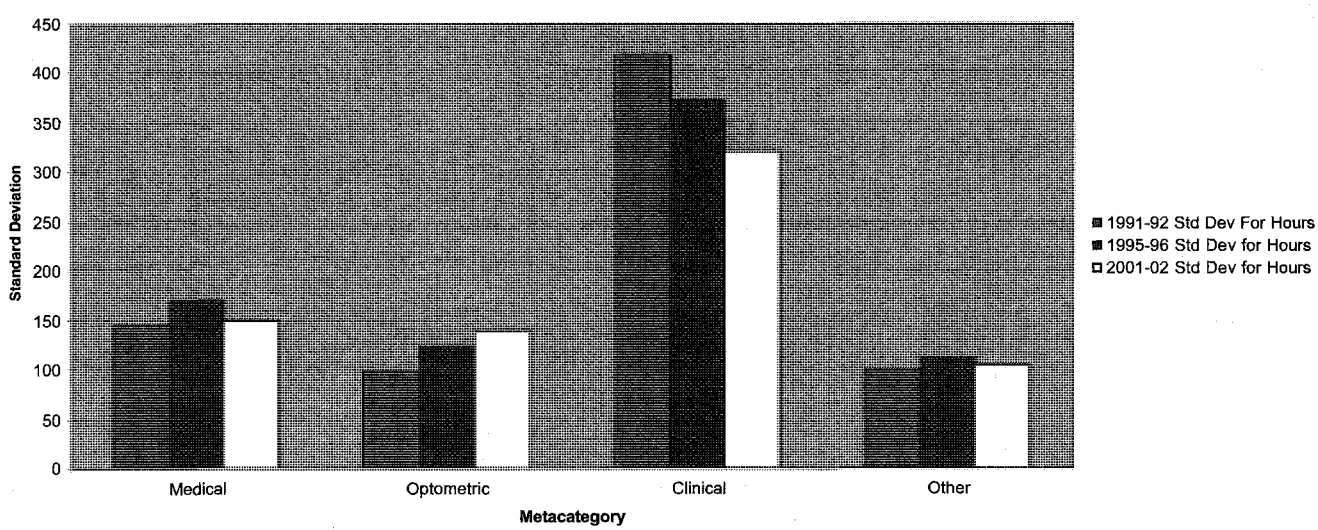


Figure 2: The Mean of Each Program's Proportion of Total Hours Allotted to Each Metacategory Is Charted Relative to The Academic Period That Each Study Used To Compile Data.

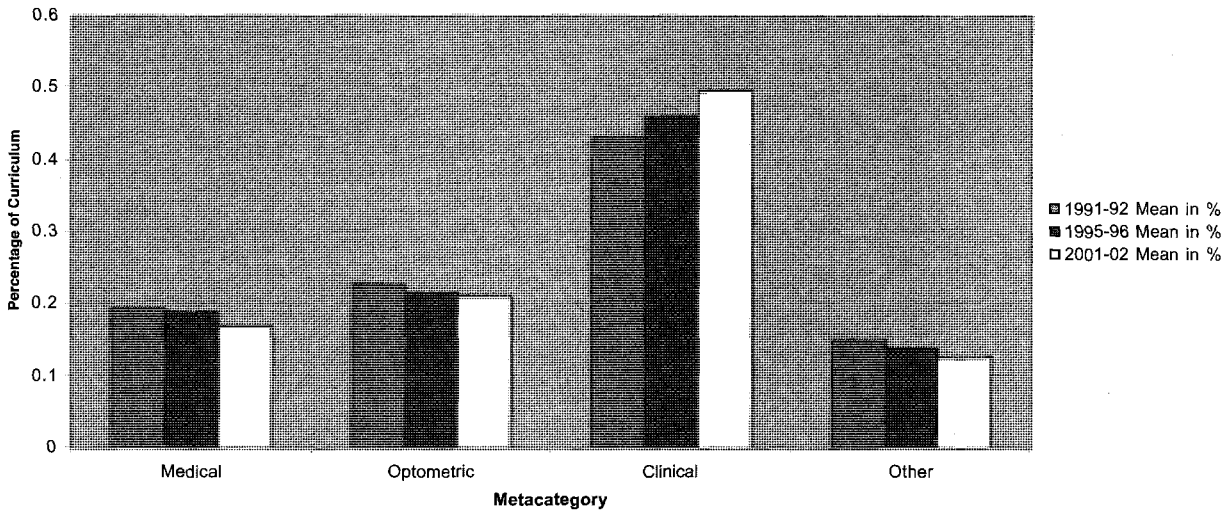
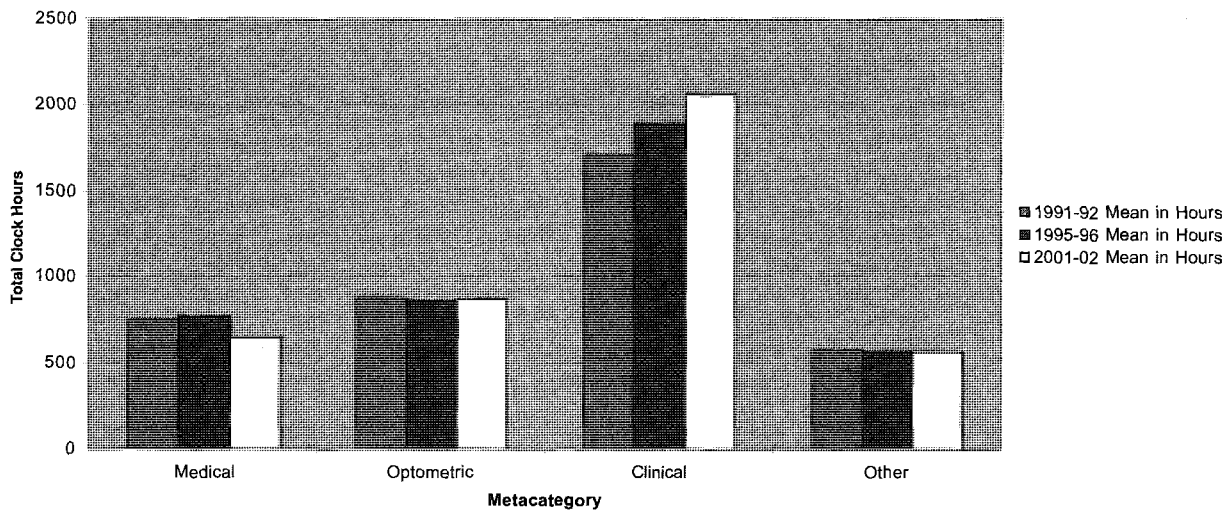


Figure 3: The Mean of Each Program's Total Clock Hours Allotted to Each Metacategory Is Shown Relative To The Academic Period That Each Study Used To Compile Data.



ranking spot for the clinical model for the entire decade. Frequently schools overcorrect to shift focus to the lagging model and later recorrect. These recurrent shifts in the rankings indicate that few schools adhere tightly to one model of education.

Basic Biomedical Emphasis

Significant variation still exists in the category of Basic Biomedical Sciences. We looked to the prerequisites to account for this disparity and found that extra prerequisite hours may account for UCB's low standing in this category. PUCO's low standing in this category cannot be attributed to its prerequisite burden. The schools that do not emphasize this area may expect their students to have retained their undergraduate science knowledge, whereas the other programs revisit the basic science material.

Study Methodology Considerations

Our study and the studies before it have endeavored to find trends in the optometric curricula by assigning hours to categories and looking at averages. This technique tends to obscure the fine details that must be considered when an individual school assesses its own curriculum. Ideally the nuances of each school's individual courses would be considered when categorizing; unfortunately omniscient familiarity with each program was not available, therefore each study, including our own, has relied upon the subjective and less refined key word methodology, which regrettably is bound to have introduced some error.

Our numbers cannot be considered as the absolute measure of the time spent in courses on each subject because when more than one category seemed appropriate we divided the hours for that course evenly among these categories. This introduces error because the categories were not necessarily evenly represented by that course. However, short of collecting and analyzing all the syllabi, we could not have accomplished the task of assigning categories in any other way. The previous studies did not divide

Table 8: Prerequisite Classes Are Compiled for Each Optometry Program. The CourseWork Is Presented as Semesters Required. The Data Are Then Filtered into a 'Total' Requirement, as well as a Grouping of Prerequisite Classes That Can Be Considered 'Basic Biomedical' in Their Nature.

School:	IAUPR	ICO	IU	MCO	NEWENCO	NOVA	NSUCO	OSU
Semesters of:								
General Chemistry	2	2	2	2	2	2	2	2
Gen Chem Lab	2	2	2	2	2	2	2	2
Organic Chemistry	1	1	1	2	1	1	1	1
O. Chem Lab	1	0	1	2	1	1	1	0
Biochemistry	1	0	0	1	0	1	1	1
Biochem Lab	0	0	0	0	0	1	0	0
General Biology	2	2	1	2	2	2	1	2
Gen Bio Lab	2	2	1	2	2	2	1	2
Advanced Biology	0	0	1	0	0	0	0	0
Advanced Bio Lab	0	0	0	0	0	0	0	0
Microbiology	1	1	1	1	0	1	1	1
Micro Lab	1	1	1	1	0	1	0	1
Human Anatomy	0	0	0	0	0	0	0	0
Anatomy Lab	0	0	0	0	0	0	0	0
Human Physiology	0	0	0	1	0	0	0	1
Physiology Lab	0	0	0	1	0	0	0	0
General Physics	2	2	2	2	2	2	2	2
General Physics Lab	2	2	2	2	2	2	2	2
Calculus	1	0	1	1	1	1	1	1
Statistics	1	1	1	1	0	0	1	0
English	2	2	0	2	2	2	2	0
Psychology	1	1	0	0	1	0	1	0
Additional Social & Behavioral Science	2	1	0	3	0	5	0	0
Liberal Arts and Humanities	2	0	0	3	0	0	0	0
Spanish	2	0	0	0	0	0	0	0
Other Foreign Language	0	0	0	0	0	0	0	0
Total	28	20	17	31	18	26	19	18
Total BB	13	11	11	17	10	14	10	13

course credits into more than one category. We believe that without doing so more error is introduced. To determine hours, unless otherwise stated, we assumed that labs ran for two weeks less than the term. We believe this assumption corrects for over-inflation of the numbers. Our study also recognized that many schools offer classes that do not run the full length of the quarter or semester, and that the length of academic terms for the various schools does not necessarily fall neatly into the 15 week, 10 week, and 6 week model assumed by the previous studies. Each course's hours were determined by the specific length of that course. We believe that this is a significant improvement over the methodology used by the previous two studies.

The other major difference between our methodology and that used by the previous studies was our introduction of five new categories: scientific thinking (ST), environmental/occupational (EO), psychological issues and behavioral disorders (PS), ocular anatomy and physiology (OA), and public health (PH). We wanted to avoid a large "other" category, which acts like a black hole for useful information. The 1998 study had a mean of 154 hours for the "other" category. In contrast, our "other" category had a mean of 41.1 hours.

Letters to the editor following the 1998 study complained that public health and ethics had been relegated to the "other" category.[7] Our study recognizes public health on its own; however we too assigned ethics into "other" because in our preliminary study it did not seem to warrant its own category.

Table 8: Prerequisite Classes Are Compiled for Each Optometry Program. The CourseWork Is Presented as Semesters Required. The Data Are Then Filtered into a 'Total' Requirement, as well as a Grouping of Prerequisite Classes That Can Be Considered 'Basic Biomedical' in Their Nature (continued).

School:	PUCO	SCCO	SCO	SUNY	UAB	UCB	UH	UMSL
Semesters of:								
General Chemistry	2	2	2	2	2	1	2	2
Gen Chem Lab	2	2	2	2	2	1	2	2
Organic Chemistry	1	1	2	2	1	2	1	1
O. Chem Lab	1	0	2	2	1	2	1	1
Biochemistry	0	0	0	0	0	1	1	0
Biochem Lab	0	0	0	0	0	1	1	0
General Biology	0	2	2	2	2	2	2	2
Gen Bio Lab	0	2	2	2	2	2	2	2
Advanced Biology	0	0	0	0	0	0	0	1
Advanced Bio Lab	0	0	0	0	0	0	0	1
Microbiology	1	1	1	0	1	1	1	0
Micro Lab	1	1	1	0	1	0	1	0
Human Anatomy	1	0	0	0	0	1	1	0
Anatomy Lab	1	0	0	0	0	1	1	0
Human Physiology	1	0	0	0	0	1	1	0
Physiology Lab	1	0	0	0	0	1	1	0
General Physics	2	2	2	2	2	2	2	2
General Physics Lab	2	2	2	2	2	2	2	2
Calculus	1	1	1	1	1	2	1	1
Statistics	1	1	1	1	1	1	1	1
English	3	2	2	2	2	2	0	2
Psychology	1	2	1	1	2	1	1	2
Additional Social & Behavioral Science	0	0	2	2	2	0	0	0
Liberal Arts and Humanities	0	0	0	0	0	0	0	2
Spanish	0	0	0	0	0	0	0	0
Other Foreign Language	0	0	0	0	0	0	0	0
Total	22	21	25	23	24	27	25	24
Total BB	12	11	14	12	12	17	18	12

Applicability of Study

It is our hope that this study might serve as a useful tool for optometric curriculum planners. Informed by these data each school should decide whether its curriculum delivers the intended emphasis.

Our findings for pharmacology may serve to substantiate lobbyists' claims that optometric education adequately prepares its students to treat patients using a wide range of pharmaceuticals, which might include oral and injectable medications. Administrators who are concerned with the battle to increase optometry's prescriptive authority will want to adjust the time devoted to pharmacology if the need exists at their school or college.

Our study has maintained five-year intervals for curriculum comparison. According to administrators we surveyed from various schools, within a five-year period major revisions in the curriculum are made at nearly every institution. Therefore, ideally another curriculum comparison study will be conducted within the next five years. If PCO's new curriculum garners acclaim, other schools may undertake major restructuring of their curricula, necessitating an updated curriculum review. Already other programs are looking at incorporating elements of the modular approach.

In this study we have made reference to schools whose curriculum might most closely resemble a core curriculum. At this time a core curriculum has not been recognized. Rather than simply looking at hours, as our study has done, another study

should attempt to define a core curriculum. This may be a useful step to improve national uniformity, should administrators deem that an important goal. Although schools may want to retain their uniqueness, one might argue that national uniformity lends credibility to optometry's legislative efforts.

Summary

Our study has shown a trend toward increasing clinical experience in optometric education. This is achieved by increasing overall hours and reducing classroom time. Over the past decade we have seen a trend toward less variability among optometric programs. The number of hours spent on pharmacology has increased over the past decade, either keeping pace with the changing scope of practice or driving this change. Although there is the perception that the profession is moving toward a medical model, our data suggest that the proportion of didactic hours devoted to both models has decreased slightly over the past ten years. Average classroom time devoted to the medical model has decreased by approximately 100 hours over the past decade, while average classroom time devoted to the optometric model has remained fairly constant, decreasing by only seven hours.

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Appendix A

Abbreviation	Name
IAUPR	Inter American University of Puerto Rico
ICO	Illinois College of Optometry
IU	Indiana University
MCO	Michigan College of Optometry
NEWENCO	New England College of Optometry
NOVA	Nova Southeastern College of Optometry
NSUCO	Northeastern State University College of Optometry
OSU	The Ohio State University
PUCO	Pacific University College of Optometry
SCCO	Southern California College of Optometry
SCO	Southern College of Optometry
SUNY	State University of New York State College of Optometry
UAB	University of Alabama
UCB	University of California at Berkeley
UH	University of Houston
UMSL	University of Missouri- St. Louis

Appendix B

Category	Abbreviation
Clinical Experience	CE
Basic Biomedical	BB
Ocular Disease	OD
Ocular Anatomy and Physiology	OA
Optical Science	OS
Visual Science	VS
Binocular Vision, Perception, and Pediatrics	VT
Pre-clinical	PC
Low Vision/ Gerontology	LV
Pharmacology	Rx
Contact Lens	CL
Scientific Thought	ST
Practice Management	PM
Public Health and Epidemiology	PH
Environmental/Occupational/Sports	EO
Psychological Issues and Behavioral Disorders	PS
Other	O

boards, will bring together two highly complementary companies with a broad range of superior technologies and a singular focus on serving the vision care needs of practitioners and patients around the world," according to a news release.

Upon completion of the transaction, AMO's stockholders will own about 58.5 percent of the combined company. VISX's stockholders will own approximately 41.5 percent.

Marchon Supports AOA Medicare Manual

A grant from Marchon Eyewear and OfficeMate Eyecare Vbusiness Solutions made possible the recent publication of the AOA Medicare Compliance Manual for Optometric Practices.

According to AOA President Wesley E. Pittman, O.D., "Even though the rules that cover Medicare are complex, the AOA guidelines simplify the process. The manual has charts, including a review of applicable federal laws and regulations, instructions on appointing a practice compliance leader and model policies."

Marchon Eyewear, headquartered in Melville, NY, is one of the world's largest, privately owned designers, manufacturers and distributors of fashion and technologically advanced eyewear and sunwear (Contact: 631-755-2020; www.marchon.com)

Transitions Announces Healthy Change Winners

Transitions Optical, Inc., awarded $25,000 to both the eyecare practice Eye Health of Fort Myers and patient Mr. William Smith from Cape Coral, Fla. They were the final grand prize winters of the Transitions Healthy Change Sweepstakes

The Healthy Change Sweepstakes, which began on February 1 and ended on September 30, engaged nearly 9,000 eyecare professionals in the United States, almost doubling participation from last year's program.

"The fact that participation increased so significantly tells us that the program was a success and that eyecare professionals are seizing opportunities to discuss the need for healthy vision," said Rose Wallace, senior manager, trade marketing and education, Transitions. "We plan on continuing this momentum in 2005 by launching a new initiative that will offer more incentives for eyecare professionals to discuss healthy vision options with their patients."

For information related to the Transitions Clear Lens Challenge, the new program for 2005 that rewards eyecare professionals for demonstrating the benefits of Transitions Lenses over regular, clear lenses, contact Transitions Optical Customer Service at (800) 848-1506.

Safilo Offers 2005 Sunwear Styles

Safilo's high fashion designer brands such as Boucheron, Dior, Emporio Armani, Gucci, Ralph Lauren and Yves Saint Laurent are all playing the name game for the spring 2005 season with unique new logo variations on its latest sunwear offerings. Designers reinvent themselves each season to broaden their customer base. New logo designs not only offer innovative new ways of presenting a sunwear collection but additionally serve as a sales generator as the savvy fashion consumer knows that he/she must buy the newest logo to appear current and in fashion.

Safilo Group, headquartered in Padova, Italy, is one of the world's leaders in the design, production and distribution of high quality eyeglass frames, fashion sunglasses and sports eyewear. Collections produced under license include Alexander McQueen, Boucheron, Bottega Veneta, Burberry, Diesel, Dior, Dior Homme, Emporio Armani, Giorgio Armani, Gucci, Marc Jacobs, MaxMara, Polo Ralph Lauren, Stella McCartney, Valentino and Yves Saint Laurent. In addition, Safilo has a number of its own proprietary brands including Carrera, Smith and Safilo Elasta. On the American market, Safilo distributes with exclusive license, collections for Liz Claiborne, Fossil, Nine West, Kate Spade and Saks Fifth Avenue, Safilo USA.

Alcon Submits Drug Applications

Alcon has submitted the third and final reviewable unit of its New Drug Application (NDA) for **RETAANE®** 15 mg (anecortave acetate for depot suspension) to the U.S. Food and Drug Administration (FDA). The application is subject to formal acceptance by the FDA, which could take up to 45 days from the date of submission. Alcon also has submitted its European Marketing Authorisation Application (MAA) for **RETAANE®** suspension. Alcon is seeking approval of the drug as a treatment for patients with subfoveal choroidal neovascularization due to age-related macular degeneration.

In the U.S., **RETAANE®** depot is being reviewed under the FDA's new Pilot 1 Continuous Marketing Application (CMA) program for fast track designated products, which allows designated NDAs to be submitted in specified reviewable units as each is completed, with each one assigned its own six-month review target.

Alcon, which has been dedicated to the ophthalmic industry for over 50 years, develops, manufactures and markets pharmaceuticals, surgical equipment and devices, contact lens solutions and other vision care products that treat diseases, disorders and other conditions of the eye. Alcon has been conducting retinal research for more than 15 years and is the world's leading provider of surgical equipment used by vitreoretinal specialists who treat patients with AMD and other retinal diseases.

A Comparison of Personality-Type Among Seven Health Professions: Implications for Optometric Education

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Abstract

Educational research and development efforts are most often directed at the improvement of teaching while neglecting students' learning styles. Besides being marginally effective, an exclusive focus on improving teaching methods may lead to reinforcement of inappropriate and nontransferable learning strategies. As such, this study is undertaken to determine if differences in learning style exist among health profession students. This retrospective-descriptive study tested the null hypothesis "there is no difference in learning styles among osteopathic medicine, pharmacy, physical therapy, physician assistant, dental medicine, optometry and occupational therapy students." Differences as well as similarities were discovered across all seven professions. Implications for instruction, student retention and practice are provided.

Introduction

Educational research and development efforts are most often directed at the improvement of teaching while neglecting students' learning styles.[1] Besides being marginally effective, an exclusive focus on improving teaching methods may lead to reinforcement of inappropriate and nontransferable learning strategies. This has important considerations in the education of health professionals given the importance of transferring classroom knowledge and skills to job situations.

Learning style is best understood as the composite characteristic cognitive, affective and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment. Learning style is a structure of neural organization and personality which both molds and is molded by human development and the learning experiences of home, school and society.[2]

Studies have demonstrated a relationship between academic performance and students who were taught in their preferred learning style.[3] For example, Nelson et al., found that college students who were assessed on their learning styles received an interpretation of their strengths and weaknesses, and were provided instructional sessions on applying these strengths and weaknesses, achieved significantly higher grade-point averages and higher retention rates than those students: (a) who were assessed on their learning styles and only received an interpretation of their strengths and weaknesses, and (b) those who received no learning style intervention.[4]

A strong association exists between personality and learning styles. In the area of Myer-Briggs Type research, there are distinct ways that different personality types learn[5]. For example, the difference in standard educational achievement measures and drop out rates between learners can be attributable to differences in Type.[5]

Research has also demonstrated that students with specific personality styles, a basic structure of learning style, tend to choose particular professions[6,7]. Mathews found that mathematics and humanities students were more independent and applied while education majors preferred social and conceptual situations[7]. Even within a discipline, differences in personality traits are evident. Stewart discovered a significant difference in personality between undergraduate marketing students pursuing degrees in sales or advertising and undergraduate marketing students pursuing degrees in marketing management[6].

The health professions are no different. Research indicates a dominant personality style among students enrolled in medicine, nursing, pharmacy, physical therapy and dentistry programs[8-12]; however we could find no published data for optometry. In addition, research demonstrates that personality styles among health profession students tend to remain constant over time[13].

With differences in personality styles reported in other professions the question arises, "are there differences in personality styles among the health professions?" For example, is there a dominant personality style among optometry students that differs from that of pharmacy students? A review of the literature would indicate that differences in personality styles exist; however, different instruments with varying psychometric qualities were used making strong comparisons diffi-

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Table I.
Chi-Square Analysis For Groups: MBTI Personality Preferences

EXTROVERT vs. INTROVERT

PROFILE	Medicine n = 1838	Pharmacy n = 912	P.A. n = 452	P.T. n = 377	Optometry n = 207	Dental n = 139	O.T. n = 70
Extrovert	1073	466	277[a]	238[a]	106	83	44
Introvert	765	446	175	139	101	56	26

[a]Significant at p<.01

SENSING vs. INTUITION

PROFILE	Medicine n = 1838	Pharmacy n = 912	P.A. n = 452	P.T. n = 377	Optometry n = 207	Dental n = 139	O.T. n = 70
Sensing	1020	607[a]	323	245	138	108[a]	42
Intuition	818[a]	305	129	132	69	31	28

[a]Significant at p<.01

THINKING vs. FEELING

PROFILE	Medicine n = 1838	Pharmacy n = 912	P.A. n = 452	P.T. n = 377	Optometry n = 207	Dental n = 139	O.T. n = 70
Thinking	985	492	223	161[a]	91	92[a]	34
Feeling	853	420	229	216[a]	116	47	36

[a]Significant at p<.01

JUDGING vs. PERCEIVING

PROFILE	Medicine n = 1838	Pharmacy n = 912	P.A. n = 452	P.T. n = 377	Optometry n = 207	Dental n = 139	O.T. n = 70
Judging	1086	577	284	236	132	95	34
Perceiving	752	335	168	141	75	44	36[a]

[a] Significant at p<.05

P.A. = Physician Assistant P.T. = Physical Therapy O.T. = Occupational Therapy

cult. As such, this study is undertaken to determine if differences in personality style exist between optometry and other health profession students. Such information would be valuable to educators and counselors who guide students and to instructors who should adapt teaching methods to fit students' learning styles.

Methodology

This retrospective-descriptive study was designed to assess the personality traits of health profession students. The null hypothesis tested was, "there is no difference in personality traits among osteopathic medicine, pharmacy, physical therapy, physician assistant, dental medicine, optometry and occupational therapy students."

The instrument used to survey the students was the Myers-Briggs Type Indicator (MBTI). The MBTI is a forced-choice, self-report personality inventory developed to measure variables in Carl Jung's theory of psychological type. The MBTI consists of 166

Table II.
Chi-Square Analysis For Groups: MBTI Profiles

PROFILE	Medicine n = 1838	Pharmacy n = 912	P.A. n = 452	P.T. n = 377	Optometry n = 207	Dental n = 139	O.T. n = 70
ISTJ	201	141[b]	59	40	17	19	5
ISFJ	129[c]	100[c]	40	30	30[b]	9	6
INFJ	77	27	4[b]	8	11	5	0
INTJ	68	32	9	10	7	3	3
ISTP	63	46	20	6[c]	10	8	2
ISFP	49	32	16	21	12	7	2
INFP	95[c]	30	12	12	6	3	4
INTP	74	34	15	12	8	2	4
ESTP	105	51	26	17	11	9	5
ESFP	81	48	26	25	9	0[b]	7
ENFP	145	58	44	31	14	6	8
ENTP	126[b]	40	9[a]	17	5	9	4
ESTJ	233	101	72	41	24	40[a]	6
ESFJ	161[b]	93	64	65[a]	25	16	9
ENFJ	111	37	23	24	9	1	0
ENTJ	120[c]	42	13	18	9	2	5

[a]Significant at p<.01
[b]Significant at p<.05
[c]Significant at p<.10

P.A. = Physician Assistant P.T. = Physical Therapy O.T. = Occupational Therapy

questions representing four underlying bipolar constructs[14]: Extraversion-Introversion (E/I), Sensing-Intuition (S/N), Thinking-Feeling (T/F), and Judgment-Perception (J/P). The four constructs are combined into a 'profile' of which 16 possibilities exist. For example, a person can have a profile type of ESTJ. Research has established evidence of the MBTI validity and reliability[14].

The bipolar constructs are defined as follows: Extroverts (E) tend to focus on the outer world of people and things while introverts (I) focus on the inner world of ideas and impressions. Sensors (S) focus on the present and on concrete information gained from senses while intuitives (N) focus on the future with an emphasis on patterns and possibilities. Thinkers (T) base their decisions on logic and objective analysis while feelers (F) base decisions primarily on values and subjective evaluations of person-centered concerns. Judgers (J) prefer a planned and organized approach to life while perceptors (P) enjoy a flexible and spontaneous approach to life.

As part of a southern health science school's core curriculum, the MBTI is administered to dental medicine, optometry, physician assistant, physical therapy and occupation therapy students during the first semester of their first professional year. The MBTI is administered to osteopathic medicine and pharmacy students during the first semester of their second professional year. The purpose of administering the MBTI is to give students insight into their specific learning and personality styles. Students are given class time to complete the MBTI. The University's Institutional Review Board approved this study.

Explanations of the MBTI as well as an opportunity to ask questions are

presented to students before the MBTI is administered. Participation is voluntary and the results are confidential. After students have completed the MBTI, results are scored and returned to them with explanations; again, class time is used to present the results. For this study, 12 years of data from osteopathic medicine students (1989-2000), 9 years of data from pharmacy students (1990-2000), 4 years of data from physician assistant students (1997-2000), 3 years of data from physical therapy and occupational therapy students (1998-2000), and 2 years of data for dental medicine and optometry students (1999-2000) were used in the analysis. Chi-square analysis was conducted to see if differences exist among the seven health profession students exist by type.

Results

The MBTI was completed by 1,838 osteopathic medicine, 912 pharmacy, 377 physical therapy, 452 physician assistant, 207 optometry students, 139 dental, and 70 occupational therapy students and their scores were used in the analysis. To answer the hypothesis: "there is no difference in personality traits between osteopathic medicine, pharmacy, physical therapy, physician assistant, dental medicine, optometry and occupational therapy students" chi-square analyses were conducted. The analyses were calculated on the four bipolar constructs as well as the 16 profile types. Results are presented in Tables II and III respectively. The relatively small number of occupational therapy students resulted in frequencies less than five for some of the profile types. This made statistical inference in some cases difficult.

A significant difference was found on the E/I dimension with physician assistant and physical therapy students ($p<.01$) more likely to be extroverts. A significant difference ($p<.01$) was found on the S/N dimension. Pharmacy and dental students ($p<.01$) preferred the S dimension while osteopathic medicine students ($p<.01$) prefer to use intuition to a greater degree than what would be expected given the distribution. A statistically significant difference was discovered on the T/F dimension. A greater proportion of physical therapy students ($p<.01$) report a preference for the feeling dimensions while dental students ($p<.01$) reported using the thinking dimensions more. A significant difference ($p<.10$) was discovered on the J/P dimensions with occupational therapy students showing a strong J preference.

The chi-square analysis calculated on the 16 profile types (chi-square = 135. 77, df = 60, $p<.005$) indicated the distribution of profile types was not homogenous across disciplines. To identify specific differences, the chi-square analysis was decomposed to inspect for cell-specific contributions. The decomposed chi-square analysis indicated the following:

(1) osteopathic medical students are more likely to be INFP ($p<.10$), ENTJ ($p<.10$), ENTP ($p<.05$), and less likely to be ISFJ ($p<.10$), ESFJ ($p<.05$)

For example, it is neither better nor worse to be a thinking or feeling type. In certain situations or contexts, however, each function possesses various advantages and disadvantages.

(2) pharmacy students are more likely to be ISTJ ($p<.05$) and ISFJ ($p<.10$)

(3) physical therapy students are more likely to be ESFJ ($p<.01$) and less likely to be ISTP ($p<.10$)

(4) physician assistant students are less likely to be ENTP ($p<.01$) and INFJ ($p<.05$)

(5) optometry students are more likely to be ISFJ ($p<.05$)

(6) dental students are more likely to be ESTJ ($p<.01$) and less likely to be ESFP ($p<.05$).

Discussion

It is important to say clearly that there is no value judgment about any of the functions. For example, it is neither better nor worse to be a thinking or feeling type. In certain situations or contexts, however, each function possesses various advantages and disadvantages. The key is in recognizing this fact. Students or practicing health professionals who are misplaced may find themselves suffering dissonance and/or high anxiety.

Comparing the extrovert/introvert dimension reveals that a larger percentage of physical therapy (63%) and physician assistant (61%) students prefer the extrovert dimension. According to McCaulley about 75% of the population in the United States are extroverts; so it is not surprising to find the majority of students enrolled in the health science programs to be extroverts[15]. These findings are also consistent with Jones, Courts, Sandow, and Watson who discovered that most dental students are extroverts[16]. Research examining the relationship between academic achievement and the introvert/extrovert dimension are mixed.

Lowenthal and Meth found that introverts do not perform any better in school than extroverts[17]. Rezler et al., however, reported that high achievers prefer the introvert dimension[18]. Borg and Shapiro discovered that introverts possess a greater probability of achieving a higher grade than extroverts[19]. Research focusing specifically on dental education also provides mixed conclusions.

Jones et al. discovered that introverts performed better on the National Dental Board examination but experienced progressively lower course grades over four years[16]. Westerman et al found no correlation with the E/I dimensions and academic performance[20]. Myers and McCaulley demonstrated a consistent pattern of aptitude for introverts. They measured strong correlations between introversion and IQ (a traditional measure of intelligence)[5]. However, they note that extroverts are not less intelligent, but rather, that introverts perform better on tests that measure work important to academia[5]. Most intelligence or aptitude tests do not measure practical or applied intelligence.

A significant difference was discovered on the sensing/intuition dimension. Pharmacy, medical and dental stu-

dents were more inclined to use the sensing function than would be expected. In terms of school performance, pharmacy students who prefer the intuitive function have a tendency to score higher on timed multiple choice tests — SAT, PCAT, and the NABPLEX[16]. On the other hand, medical students who prefer the sensing function have an easier time passing the NBME exams and in-service training exams. Research with dental students indicates that sensors were found to earn a higher class rank than intuitives[16].

Nationally, Myers and McCaulley discovered that intuitives consistently scored higher than sensors on all aptitude tests. These disparate results may be a result of a need by sensors to grasp the concrete world[5]. Sensors tend to perform better on objective measures while intuitives display a greater proclivity for theoretical constructs. For example, research indicates that sensors perform better in lecture-discussion formats[21]. Furthermore, Myers notes that intuitives define intelligence as 'quickness of understanding' while sensors define intelligence as 'soundness of understanding'[5].

Examining the five health science disciplines reveals two significant differences across the thinking/feeling dimension. More dental students are 'thinkers' and more physical therapy students are 'feelers' than would be expected. Past research demonstrates that in education, thinking preferences tend to perform better in math and science courses[22]. For instance, O'Donnell discovered that in medicine feelers were less likely to pass the NBME exams and that they drop out at a greater rate[23]. Myers, McCaulley, Quenk, and Hammer also found in their research that thinkers' outscore feelers on mean grades[24]. However, additional research argues that students who are in the minority (MBTI Type minority) tend to drop out[25-27]. This would imply that dental students who are feelers might be at a higher risk of dropping out of the program.

All disciplines preferred the judging dimension with the sole exception of occupational therapy students. Research indicates that judgers perform better in science-based courses and exams[25]. Myers, McCaulley, Quenk, and Hammer demonstrated in their research that judging types possess both higher mean grades and higher mean IQ than perceivers; however, they also presented evidence that perceivers perform better on standardized tests[24]. They hypothesize that the open-minded curiosity of perceivers leads to the theoretical prediction of their advantage in aptitude.

Conclusion

This study was undertaken to see if there was a difference in personality traits between dental medicine, optometry, pharmacy, osteopathic medicine, physical therapy, physician assistant and occupational therapy students. Results indicate significant differences across all dimensions. Data also indicate a logical trend in profiles. Reported below is the most frequently reported Type for students in the study:

The challenge for teachers is to find effective ways to share technical information so that all students regardless of style can understand and apply that information.

(1) the dominant profile for osteopathic medicine, physician assistant, and dental students was ESTJ — meaning they are practical, realistic, with a natural head for business or mechanics
(2) the dominant profile for physical and occupational therapy students was ESFJ — meaning they are warm-hearted, talkative, whose main interest is in things that affect people's lives
(3) the dominant profile for pharmacy students was ISTJ — meaning they are serious, thorough, logical and realistic
(4) the dominant profile for optometry students was ISFJ — meaning they rely on facts to make judgments, tend to be organized and offer strong warmth and sympathy.

To help guide prospective students or counsel current students who are having a difficult time completing the curriculum, optometric educators can use this information. In addition, this information can help enlighten all health profession students about the differences in personality and how these differences may manifest themselves in the workplace. While our data identifies dominant learning styles in respective programs, it also appears that there is a mixture of learning styles in every class. The challenge for teachers is to find effective ways to share technical information so that all students regardless of style can understand and apply that information.

Unfortunately, teacher skills that can create a sense of excitement out of complex scientific subject matter are really foreign to many health professional instructors. Such skills are not part of their own learning experiences. The notion that the teaching art is simply the transference of knowledge dictated by the discipline is erroneous. Much of what is taught is not needed for the students' future real world use. So the initial steps are to re-examine content, identify what needs to be included in each program, determine what not to teach, and simplify complex concepts. Simplification is especially important for strong Sensing learners so they can focus on essential information. Given the exponential expansion of scientific knowledge it is simply not possible for one human being to be familiar with all there is to know in a particular field.

We need to create a learning environment where many styles of learning can be employed. Teaching methodologies other than the standard sixty-minute lecture with slide show presentation need to be considered. Putting students into a teaching mode enhances their own learning. This can be accomplished by having students act as tutors for other students; having students teach certain areas to the class; having open inquiry discovery groups; and creating small research groups charged with the responsibility of reading, interpreting and presenting results of research that will grab other students' interest. Well presented current research findings can inspire the learners to get out of their mental boxes and

discover new pathways. Other possibilities for different modalities include: dividing large classes at times into workable small groups with facilitators, grouping students using similar learning styles, computer assisted programs that are tailored to specific learning styles, problem based case studies with practical applications (especially helpful for strong Sensors), and simulated program instruction.

Ultimately, restricting teaching presentations to one modality, no matter how good it might be, will not be successful for all students with their many different learning styles. Many get bored, lose focus, and become passive learners. Frequent changes of modality can help to avoid this outcome. The faculty are the only ones who can effect a significant change in the learning environment. Change can be risky and threatening to us all, but the positive possible outcomes make it worthwhile. What better outcome could there be than improvement of student learning?

Nevertheless, results also bring with them some difficult questions. The MBTI is based on the hypothesis that personality type is inborn. With research demonstrating a relationship between certain personality types, aptitude, performance, IQ and attrition, the natural question is "are people pre-destined to fail certain programs?" Myers, McCaulley, Quenk, and Hammer argue that even if the MBTI measures innate ability, biology is not destiny[24]. They also noted that all types could and do perform in varying ways, depending upon the situation, the opportunity and motivation to do so.

This study was conducted in a large, urban, southern setting. Differences may exist in other locales. Nevertheless, the findings are notable and supported by past research. Future research in health-profession education and practice should concentrate on the effect personality has on each profession. Such questions as which MBTI profile defines the most satisfied practicing optometrists, and does the admission process filter-out excellent candidates or are they self-selecting, need to be answered. Insightful and reasoned analysis will help make the profession stronger.

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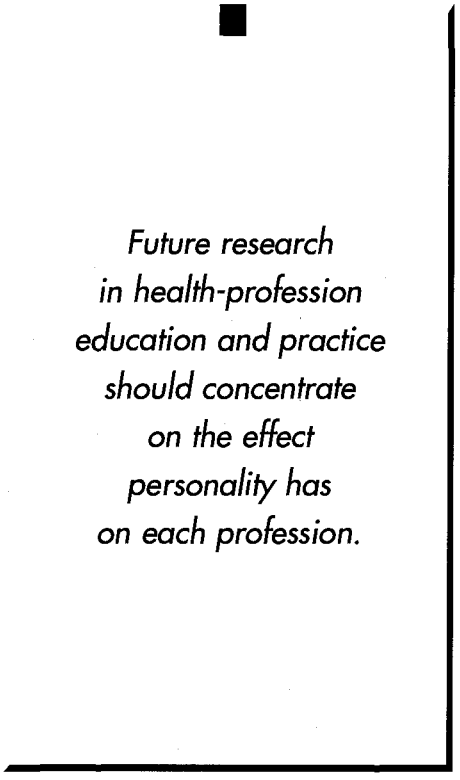

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ASCO Meetings Calendar

ASCO EXECUTIVE CMTE. & BOARD OF DIRECTORS MEETINGS

March 18 – 20, 2005
Tulsa, Oklahoma
Renaissance Tulsa Hotel and Convention Center
Contact: Mary Eastman

ASCO PRACTICE MANAGEMENT EDUCATORS SIG MEETING

April 14-17, 2005
Ft. Worth, Texas
Contact: David Kirschen, O.D. (SCCO)

ASCO GENOMICS SUMMIT

April 28-29, 2005
St. Louis, Missouri
Contact: Mary Eastman

ASCO CHIEF ACADEMIC OFFICERS MEETING

June 20, 2005
Dallas, Texas
Contact: Mary Eastman

ASCO STUDENT AFFAIRS OFFICERS MEETING

June 20, 2005
Dallas, Texas
Contact: Enid-Mai Jones

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

ASCO STUDENT AFFAIRS COMMITTEE MEETING

June 21, 2005
Dallas, Texas
Contact: Enid-Mai Jones

ASCO EXECUTIVE COMMITTEE MEETING

June 21, 2005
Dallas, Texas
Contact: Marty Wall

ASCO ANNUAL MEETING

June 21 – 22, 2005
Dallas, Texas
Contact: Mary Eastman

ASCO ANNUAL LUNCHEON

June 22, 2005
Dallas, Texas
Contact: Mary Eastman

ASCO CORPORATE CONTRIBUTORS ADVISORY BOARD BREAKFAST

June 24, 2005
Dallas, Texas
Contact: Pat O'Rourke

ASCO OPHTHALMIC OPTICS EDUCATORS SIG MEETING

July 28 – 30, 2005
Hotel to be determined
Birmingham, Alabama (UAB)
Contact: Mary Eastman

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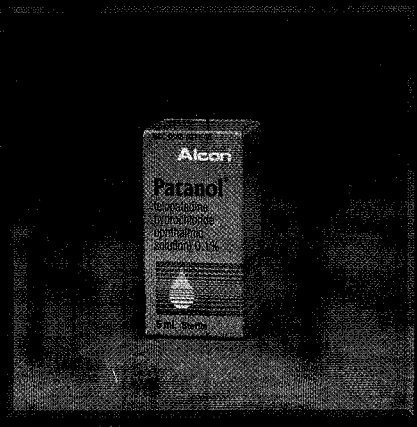

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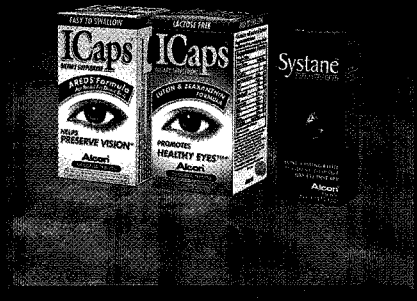

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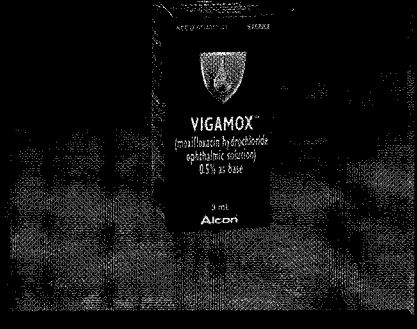

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