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Designing an optometric curriculum

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Abstract

This project will design an optometric curriculum for a theoretical college of optometry. The curriculum will be constructed from a students point of view while conforming to real world limitations.

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DESIGNING AN OPTOMETRIC CURRICULUM

BY

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ABSTRACT:

This project will design an optometric curriculum for a theoretical college of optometry. The curriculum will be constructed from a students point of view while conforming to real world limitations.

ACKNOWLEDGEMENTS

We would like to thank our thesis adviser, Dr. Mark Williams for giving us creative freedom on this project. His unrestrictive guidance allowed us to express our views as student's without faculty intervention or bias.

In addition, we wish to express our appreciation to the students and faculty of Pacific University College of Optometry for sharing their views with us.

Lastly, we would like to thank Dr. Robert Yolton for the idea and inspiration behind this project.

INTRODUCTION:

One does not have to look far to see that optometry as a profession is changing. All fifty states have laws allowing doctors of optometry to use diagnostic pharmaceuticals, and a majority of states allow the use of therapeutic agents by optometrists. Insurance companies now recognize optometrists and reimburse for procedures performed on a routine basis. Meanwhile, the National Board of Examiners in Optometry is expanding the basic science section to reflect these changes. Optometry is indeed growing at a rapid pace.

Teaching institutions are now faced with decisions regarding their curricula. Optometry schools have an obligation to the students and to the profession to provide the most current "state of the art" education possible. This means that more material must now be taught in the same time frame. This creates a dilemma. Only a certain amount of new information may be added before existing courses must be reduced. The question then arises: How can the schools expand their curricula to stay on the forefront of optometry without making a large reduction in more traditional areas.

Another expectation placed on the schools is to produce clinicians who are competent in all areas of optometry. Therefore, the program must be broad based.

The intent of this paper is to develop a curriculum that will best serve these needs. We feel particularly qualified to provide useful input as we are currently nearing the end of our education and have seen firsthand where changes could and should be made. We understand the difficulty involved in increasing the amount of academic material being taught while also increasing the amount of time spent becoming a well-rounded clinician.

BODY:

The goal of our project was to provide our opinions and insight as to what we believe the curriculum of an "ideal" optometry school would be like. It was decided early on that we would conform to the guidelines and limitations placed on all optometry schools. This decision was made in order to allow our ideas to be applied by educators and administrators.

It has been our intent to gather information from as many sources as possible and from that create an "ideal" program. We have attempted to do this, but our experiences in optometry come solely from Pacific University. It is no surprise, then, that our

program shows a strong Pacific influence. Hopefully, some of our changes will be discussed at Pacific as they improve the existing curriculum.

The focus of our program is two-fold. The first is to provide a broad based educational background that reflects optometry's full-scope, primary care position in today's health care system. The second is to provide the student with enough patient exposure and clinical experience to be competent in all aspects of clinical optometry. In other words, we hope to produce proficient clinicians with a solid theoretical background.

Our approach is really quite simple. We have attempted to create a program that is clinically driven. The academic courses have been given a clinical emphasis wherever possible and the idea of "clinical thinking" is stressed throughout.

In creating a curriculum that is clinically driven, we have, in effect, streamlined the program. We are spending less time on theoretical constructs -- although they must not be left out entirely -- and spending more time on areas that more directly affect patient care. The goal of this was to make more efficient use of class time. One way of accomplishing this is by offering national board review courses. These courses allow instructors to better structure class time to benefit the students rather than adjusting the curriculum to prepare for the board exam. We feel this would be successful because our prerequisite requirements have been increased with regard to Pacific, as has our basic science course load.

Clinical thinking will be an integral part of our students' education. Students who are able to think clinically will be able to better apply the academic knowledge they learn in the classroom to the patient in the exam chair. In our education at Pacific, we experienced a sharp transition from students who thought academically to clinicians who must take years of classroom education and suddenly reapply it to a clinical situation. Because of our lack of significant patient exposure prior to our fourth year, a majority of our clinic time in our fourth year is spent learning how to interact with patients, instead of sharpening and developing our clinic skills. By making the transition from academician to clinician smooth and gradual, we hope to allow our students to more effectively and efficiently apply their didactic knowledge to their patients.

In order to aid in our instruction of clinical thinking, our courses are given a clinical emphasis wherever possible. Examples include studying ocular anatomy in labs with ophthalmic diagnostic equipment, presenting ocular or systemic diseases in a case format,

using case studies in all applicable courses, and chronologically coordinating theoretical and clinical courses.

Another important part of our program is very early exposure to patients. The amount of care the student will be able to give at first will obviously be limited. Students will gain invaluable experience in interpersonal relationships with patients by working in the dispensary, observing upperclassmen's examinations and possibly doing some pretesting in their first year.

Having first year students observe third and fourth year interns (preferably fourth year) would be very beneficial. First of all it increases overall patient contact for the students. This in itself is advantageous. However, the potential exists for the students to learn a great deal from this exercise. They will be taking procedures courses learning and practicing examination techniques. Observing exams will help them to learn and reinforce what they have learned. In addition, the students will learn about patient communication, not to mention anything of interest that may come up during the exam (disease, binocular problem, contact lens fit). By being part of the exam, the first year student would be given a clinical mindset and the foundation for clinical thinking would be laid.

There is also a benefit on the other end of the program. The older students would now become teachers (TA's). This would encourage a more thorough understanding of material so they would be comfortable explaining it to the first years.

Our students would see patients for full exams beginning in their second year for (approximately) one day per week. Time spent in clinic would then increase by the third year to two full days per week. By performing exams in their second year, our students become true clinicians very early in their education. This would be a sharp contrast to our current education at Pacific, in which learning during the first three years (seven years including undergraduate studies) is done exclusively in the classroom or laboratory. This allows us little direct patient exposure. Then in our final one year of study we are given clinical exposure and are expected to become proficient in our technical, interpersonal, analytical, diagnostic and therapeutic skills.

We propose to have our students perfecting examination procedures and decreasing examination length by the end of the third year. This would allow the entire fourth year to be concentrated on advanced patient care. We feel it is essential to give our students the responsibility of patient care early in their education. This will inspire them to excel in their academic

coursework as they would now have some experience to which they could apply what they have learned.

SUGGESTED CURRICULUM:

PREREQUISITES

BIOLOGICAL SCIENCES - (20 semester/30 quarter hours)
Must include one year of biology, complete courses with labs in Human Anatomy, Physiology, and Microbiology. The remaining credits can be obtained through courses in Genetics, Pathology and/or Embryology.

CHEMISTRY - (10 semester/15 quarter hours)
Includes one complete year of General Chemistry and a course in Organic Chemistry. All courses must include labs.

SOCIAL SCIENCES - (6 semester/9 quarter hours)
Courses should include General Pyschology and Sociology. A course in Developmental or Behavioral Pyschology may be substituted.

PHYSICS - (6 semester/9 quarter hours)
One year of General Physics with laboratories is required.

MATHEMATICS - (6 semester/9 quarter hours)
One course in Statistics or Statistics for non-math majors is required, other courses may include Analytical Geometry, Calculus or Trigonometry.

ENGLISH - (6 semester/9 quarter hours)
Courses should include a Speech course and a Composition course. Professional Writing course may be substituted for the Composition course.

ELECTIVES
Students are encouraged to enroll in courses with a Business background. Suggested courses include: General Business, Small Business, Economics, Marketing, Accounting and Personnel Management.

QUARTER SYSTEM CLASS SCHEDULE:

FIRST YEAR

FALL	Credit Hours
Ocular Anatomy, Physiology, and Biochemistry I	3 lect., 1 lab
Optics I - Geometrical and Physical Optics Theory	3 lect., 1 lab
Human Anatomy and Physiology I	2 lect., 1 lab
Procedures I/Dispensing	3 lect., 1 lab
Optometric Orientation	3 lect.
General Immunology and Cell Pathology	2 lect., 1 lab
*******	**********
TOTAL	21

WINTER	
Ocular Anatomy, Physiology, and Biochemistry II	3 lect., 1 lab
Optics II - Visual Optics	3 lect., 1 lab
Procedures II	3 lect., 1 lab
Dispensing/Observation	1 lab
Neuroanatomy and Physiology	3 lect.
General Pharmacology	2 lect.
*******	**********
TOTAL	18

SPRING	
Ocular Anatomy, Physiology, and Biochemistry III	3 lect., 1 lab
Optics III - Applied Visual Optics	3 lect., 1 lab
Procedures III	3 lect., 1 lab
Dispensing/Observation	1 lab
General Ocular Pharmacology	2 lect.
Neuroanatomy and Physiology	3 lect.
*******	**********
TOTAL	18

SECOND YEAR

FALL	Credit Hours
Ocular Disease and Pharmacology I	3 lect., 1 lab
Procedures IV	3 lect., 1 lab
Optometry I	3 lect.
Psychophysiology of Vision I	3 lect.
Applied Visual Optics	3 lect., 1 lab
Clinic (Includes Case Conference)	2 lab
*******	**********
TOTAL	20

WINTER	
Ocular Disease and Pharmacology II	3 lect., 1 lab
Contact Lens I	2 lect., 1 lab
Procedures V	2 lect., 1 lab
Optometry II	3 lect.
Psychophysiology of Vision II	3 lect.
Clinic (Includes Case Conference)	2 lab
Basic Science Board Review (Elective)	(1 lect.)
*******	**********
TOTAL	18(19)

SPRING	
Ocular Disease and Pharmacology III	3 lect., 1 lab
Contact Lens II	2 lect., 1 lab
Procedures VI	2 lect., 1 lab
Optometry III	3 lect.
Clinic (Includes Case Conference)	2 lab
Systemic Disease and Pharmacology	4 lect.
*******	**********
TOTAL	19

THIRD YEAR

FALL	Credit Hours
Ocular Disease and Pharmacology IV	3 lect., 1 lab
Contact Lens III	2 lect., 1 lab
Procedures VII	2 lect., 1 lab
Optometry IV	3 lect.
Clinic (Includes Case Conference)	4 lab
Geriatrics	2 lect.
Optometric Law	1 lect.
*******	**********
TOTAL	20

WINTER	
Procedures VIII	2 lect., 1 lab
Optometry V	3 lect.
Clinic (Includes Case Conference)	4 lab
Low Vision	2 lect., 1 lab
Strabismus and Amblyopia	2 lect., 1 lab
Vision Therapy I (GBD)	3 lect., 1 lab
*******	**********
TOTAL	20

SPRING	
Procedures IX	2 lect.
Clinic (Includes Case Conference)	4 lab
Practice Management	3 lect.
Visual Fields	2 lect., 1 lab
Public Health/Statistics	1 lect.
Professional Communication	2 lect.
Vision Therapy II (Strabismus)	2 lect., 1 lab
*******	**********
TOTAL	18

FOURTH YEAR

CLASS BLOCK	Credit Hours
Environmental Vision	3 lect.
Practice Management	3 lect.
Sports Vision (Elective)	(2 lect.)
Co-Management	3 lect.
Board Review (Elective)	(1 lect.)
Case Conference	1 lab
*******	**********
TOTAL	10(13)

CLINIC BLOCK	
Contact Lens	2 lab
Ocular Disease/Special Testing	2 lab
Low Vision	2 lab
Geriatrics	1 lab
Vision Therapy	2 lab
Pediatrics	1 lab
Primary Care	5 lab
*******	**********
TOTAL	15

EXTERNSHIP 1 - 11 weeks	15
EXTERNSHIP 2 - 11 weeks	15
**********	**********
TOTAL QUARTER HOURS(All four years)	227(231)

SEMESTER EQUIVALENT 151 hrs.

COURSE DESCRIPTIONS

BASIC SCIENCE

Ocular Anatomy, Physiology, and Biochemistry I - (3)
This course will explore the gross and fine anatomy of the eye and ocular adnexa. The physiology and biochemistry of the eye will be covered. Specific emphasis is placed on the relationship of structure to function.

Ocular Anatomy, Physiology, and Biochemistry II - (3)
This is a continuation of Ocular Anatomy, Physiology, and Biochemistry I.

Ocular Anatomy, Physiology, and Biochemistry III - (3)
The visual pathway's anatomy will be studied in depth. An emphasis will be on how the anatomy affects visual function. Embryology and development of the eye and visual pathway will be studied.

Ocular Anatomy, Physiology, and Biochemistry Labs - (1 each)
These labs will provide hands-on study of the structures studied in the respective lecture courses. Ophthalmic diagnostic equipment will be used extensively to study the anatomy.

Human Anatomy and Physiology - (2)
Gross human anatomy is reviewed, highlighting the structure and function of the major organ systems.

Human Anatomy and Physiology Lab - (1)
The lab for the course will provide further study of the human anatomy through hands-on experience.

Neuroanatomy and Physiology I - (3)
The general anatomy and physiology of the nervous system will be covered. Special attention will be given to the head and neck, especially the cranial nerves and visual pathway.

Neuroanatomy and Physiology II - (3)
The function of the nervous system will be emphasized. Neurological affects on pupils, eye movements, visual fields, and other ocular functions will be covered. Specific examples and clinical implications of neurological problems will be presented.

General Immunology and Cell Pathology - (2)
Covers the human immune system and its reactions with pathogens, allergens, and antigens. The microbiology, physiology, and genetics of the immune system will also be covered.

General Immunology and Cell Pathology Lab - (1)
Microscopic study of the immune system. The course includes culturing microorganisms in different media and identification using stains and other diagnostic methods. Emphasis of the course will be on relevant ophthalmic pathogens and how to properly culture and identify them.

General Pharmacology - (2)
This course discusses the basic pharmacologic principles of general diagnostic and therapeutic agents. Includes routes of administration, side effects, and toxicity. Also includes summary of commonly used systemic medications.

General Ocular Pharmacology - (2)
Pharmacologic actions and principles of ophthalmic pharmaceuticals are emphasized. Indications/contraindications, routes of administration, side effects and interactions with other drugs are covered.

Ocular Disease and Pharmacology I - (3)
This is the first of a four-course series. This course covers the detection, diagnosis, management and treatment of diseases and disorders found in the anterior segment of the eye.

Ocular Disease and Pharmacology II - (3)
The second course in this series continues the study of the anterior segment disorders and also covers diseases/disorders of the lens and vitreous.

Ocular Disease and Pharmacology III - (3)
Comprehensive study of the posterior segment using the format of the two previous Ocular Disease courses.

Ocular Disease and Pharmacology IV - (3)
Covers conditions of the visual pathways, the glaucomas, and ocular emergencies.

Ocular Disease and Pharmacology I - IV Labs - (1 each)
The lab courses will include hands-on practice of relevant diagnostic tests used in the differential diagnosis of the conditions currently being studied in the lecture course. Treatment and management techniques will be practiced and discussed.

Systemic Disease - (3)
Diseases/disorders of the major body systems will be discussed. Special attention will be given to diseases that have significant ophthalmic relationships.

Basic Science National Board Review - (1)
This optional course will serve as a structured review for students who are taking the National Board Exam. Basic science material from prerequesite courses will be emphasized.

VISUAL SCIENCE

Optics I - Theory of Geometrical and Physical Optics lect./lab- (4)
Principles of reflection and refraction at single spherical and plane surfaces, thin and thick lens systems, prisms, mirrors, aberrations, stops, pupils, optical and lens design. Also, principles of wave optics, interaction of light and matter, polarization, image quality, diffraction, scattering, dispersion, lasers, and basic photometry will be discussed.

Optics II - Visual Optics lect./lab- (4)
Principles of refractive conditions of the eye, optics of the corrected and uncorrected eye, schematic eye models, entoptic phenomenon, retinal image quality and radiation of the eye. Principles of accommodation and vergence.

Optics III - Visual Optics and Introduction to Applied Visual Optics lect./lab - (4)
Principles of sensory and motor fusion, stereoscopic depth perception, magnification and aniseikonia. Also principles of ophthalmic lenses including physical and optical characteristics, spectacle magnification, and correction of aniseikonia will be introduced.

Optics IV - Applied Visual Optics Continued lect./lab - (4)
Principles of spheric and aspheric lenses, prisms, multifocal lenses, tints, coatings, impact resistance, and tolerances. Also principles of optical equipment, contact lenses, and low vision aids will be introduced.

Contact Lens I - Soft Contact Lenses lect./lab - (3)
Principles of soft contact lens optics, design, and materials. Discussion of daily wear, extended wear, disposables and soft toric lenses. Potential soft contact lens candidates, basic fitting philosophies, care and handling, and possible complications will be discussed. Basic soft contact lens practice management will be introduced.

Contact Lens II - Rigid Gas Permeable Lenses lect./lab - (3)
Principles of corneal topography, lens materials, lens design, and fitting philosophies. Potential RGP candidates, fluorescein assessment of a fit, modifications, care and handling, and possible complications will be discussed. Basic RGP practice management will be introduced.

Contact Lens III - Advanced Contact Lenses lect./lab- (3)
Special designs and fits including the high astigmat, the presbyope, the aphake, the aniseikonic and keratoconic patient. Specialty lenses including tinted lenses and therapeutic lenses.

Psychophysiology I - (3)
The visual pathway will be discussed with emphasis on cellular physiology and how it affects space, form, motion, and temporal perception.

Psychophysiology II - (3)
A continuation on cellular physiology and perception of color and light. Also, principles of entoptic phenomenon and ocular photometry.

Low Vision lect./lab - (3)
Definition of blindness and the role of the optometrist for the partially sighted population. Epidemiology and etiologic diseases that cause significant vision loss will be discussed with emphasis on clinically managing the low vision patient. Methods of examination and a therapeutic regimen including specific aids will also be discussed. Further considerations will be given to the psychological and sociological factors associated with the low vision patient.

Geriatrics - (2)
Epidemiology and therapeutic treatments of common ocular problems that occur with the aging population. Discussion of special considerations necessary for elderly patients.

Environmental Vision - (3)
This course provides information about vision in the workplace, including visual demands of occupations and avocations. Influence of environmental changes on visual performance. Visual safety in industry and recreation. Federal and industry standards.

Sports Vision - (2)
Diagnosis and treatment of sports vision problems. Basic visual skills will be discussed for a variety of sports and the role of the optometrist as a consultant to enhance the athlete's performance by improving his/her visual system.

Optometry I - Theory and Methods of Refraction - (3)
Principles of the basic refraction will be discussed, including theory and techniques of visual acuity measurement, entrance skill testing, keratometry, static and dynamic retinoscopy, and the subjective refraction.

Optometry II - Analysis of the Analytical Exam - (3)
Formal approaches to the analysis of the analytical exam will be discussed, including OEP and graphical. Further considerations will be discussed regarding the analytical exam with emphasis on clinical diagnosis and cases.

Optometry III - Management of Refractive and Binocular Conditions - (3)
Principles of clinically managing ametropia, including myopia pseudomyopia, hyperopia, latent hyperopia, astigmatism, and presbyopia. Also, clinical management of accommodative and vergence problems will be discussed.

Optometry IV - Advanced Case Analysis - (3)
Principles of clinically managing anisometropia, aniseikonia, fixation disparity, nystagmus, eye movement problems, vertical problems, and advanced general binocular problems.

Optometry V - Patient Management - (3)
This course is designed to discuss principles of clinically managing the entire patient. It emphasizes moving the student from looking at one specific problem and treatment to cases in which patients may have more than one problem independent of each other. It includes discussion of treatment plans, proper follow-up and referrals.

Strabismus and Amblyopia lect./lab - (3)
Principles of epidemiology, etiology, classification and evaluation of the different types of strabismus and amblyopia.

Vision Training I - General Binocular Dysfunction lect./lab - (4)
Epidemiology of binocular dysfunction. Assessment of accommodative and vergence systems, ocular motilities, and binocular fusion. Discussion of visual-motor and perceptual deficits also included. Emphasis on training techniques and instrumentation.

Vision Training II - Strabismus and Amblyopia lect./lab - (3)
This course will discuss measurement and training techniques and the instrumentation used to train strabismus and amblyopia. Discussion of various therapies including prisms, lenses, training and surgery.

CLINICAL SCIENCE

Procedures I lect./lab - (4)
Basic optometric entrance testing. Includes case history, visual acuity, external exam, cover test, ocular motilities, color testing, stereopsis testing, pupil evaluation and blood pressure. Basic dispensing skills such as lens neutralization, frame and lens styling and minor adjustments will also be covered.

Procedures II lect./lab - (4)
Continuation of optometric testing. Basic theory and methodology of keratometry, retinoscopy, biomicroscopy, tonometry, and ophthalmoscopy.

Procedures III lect./lab - (4)
Techniques of subjective refraction. Measurements of accommodation and vergence. Basic exam sequence.

Procedures IV lect./lab - (4)
Advanced optometric procedures, including binocular indirect ophthalmoscopy, fundoscopy, gonioscopy, further evaluation of anterior and posterior segments. Basic visual field testing.

Procedures V lect./lab - (4)
Enhanced visual field testing. Covers different automated fields instruments. Discussion of different testing strategies and analysis of results.

Procedures VI lect./lab - (4)
Advanced refraction techniques including out of phoropter testing, cycloplegic, stenopeic slit and binocular methods. Accessory optometric testing such as dynamic retinoscopy, Keystone cards and Amsler grid.

Procedures VII lect./lab - (3)
Optometric diagnostic procedures, including anterior segment and fundus photography, photostress testing, exophthalmometry, ophthalmodynanometry, corneal sensitivity, corneal staining, Schirmer tests, Jones testing, dilation and irrigation of cannaliculi.

Procedures VIII lect./lab - (3)
Advanced diagnostic procedures including ultrasonography, fluorescein angiography, electroretinography, electrooculography, visual evoked response, neurological workups, biopsy, X-rays, conjunctival smear, testing of blood glucose, use of lasers.

Procedures IX lect./lab - (2)
Managing ocular emergencies such as burns, lacerations, blunt trauma, sudden vision loss, acute angle closure glaucoma. Basic first aid will be discussed and students will also be certified in CPR as a part of this course.

Optometric Orientation - (2)
Introduction of student to the profession. Basic optometric terminology, history of and predictions for the future of Optometry. Ethics, professional responsibility, state boards, malpractice. Government agencies that affect Optometry, optometric associations, different roles of the Optometrist.

Public Health Optometry - (1)
Review of statistics, epidemiology of visual conditions, role of Optometry in health care system. Research designs and analysis of literature. Health screening programs. Health care organizations and economics. Third party considerations. Federal health care system.

Optometric Law - (1)
Discussion of federal and state laws regarding the practice of Optometry. Licensure, professional liability, malpractice, confidentiality, landmark decisions. Also included in the course is a discussion of ethics.

Professional Communication - (2)
Interpersonal relationships and verbal/non-verbal communication. Communication between doctor and patient, doctor and staff, doctor and other professionals. Managing difficult patients. Written communication including referral letters, thank you letters, and informational letters to responsible parties. Dealing with special patients including pediatric, geriatric, and handicapped.

Practice Management I - (2)
First of two-course sequence discussing all aspects of practice management. Includes practice options, practice location and evaluation, practice entry techniques, practice marketing, office design, office management systems and standard office procedures, equipment selection, fee systems, personnel management. Basic finance and economics of a business, including banking, taxes, insurance, payroll, billing, inventory.

Practice Management II - (2)
Continuation of Practice Management I.

Visual Fields - (3)
Indepth study of visual field analysis. Discussion of testing strategies and interpretation of results. Emphasis of the course will be on case studies.

Co-Management - (3)
Discussion of when co-management is indicated and with whom it is appropriate. Topics covered include cataract pre- and post-operative workups, diabetes, hypertension, glaucoma therapy, systemic medications. Also includes ordering fluorescein angiograms, X-rays, CT Scans, MRIs. Specific cases will provide examples of each topic covered.

Clinical Science Board Review - (1)
This optional course will serve as a structured review for students who are taking the National Board Exam. Clinical science material from prerequesite courses will be emphasized.

Clinical Practice I - (1)
Students will gain "hands-on" experience working in the dispensary and observing exams in the clinic. Students are required to turn in a write-up of what they learned from observing each exam. Clinical application of didactic coursework will be achieved through discussion of cases involving material presently being covered.

Clinical Practice II - (1)
Continuation of Clinical Practice I.

Clinical Practice III - (2)
Students begin seeing patients in the clinic two afternoons per week under close supervision of staff optometrist. Also, as a part of this course, students will be given cases for which they must research possible diagnoses, further testing required for differential diagnosis, treatment or management strategies and appropriate referrals if necessary. The cases will then be presented and discussed within each group.

Clinical Practice IV - (2)
Continuation of Clinical Practice III.

Clinical Practice V - (2)
Continuation of Clinical Practice VI

Clinical Practice VI - (4)
Continuation of Clinical Practice V. Interns will now spend two days per week seeing patients. Case conference is also continued.

Clinical Practice VII - (4)
Continuation of Clinical Practice VI.

Clinical Practice VIII - (4)
Continuation of Clinical Practice VII.

Clinical Practice IX - (15)
Rotation of fourth-year interns through all specialty clinics including contact lens, ocular disease and special testing, low vision, geriatrics, vision therapy, pediatrics, primary care. Continuation of case studies.

Case Conference - (1)
Continuation of case studies from Clinical Practice courses. Also included in this course is a Grand Rounds, where all students receive exposure to actual patients with various ocular diseases of conditions.

Externship I - (15)
Students spend the quarter practicing optometry at a site away from the school. This internship is a more general, primary care experience.

Externship II - (15)
Another quarter at a site away from the school. This experience is more specialized. The student may choose any area in which s/he is interested.

SUGGESTED ACADEMIC AND CLINIC SCHEDULE
1992-93 QUARTER SYSTEM

Assumptions:
1. First through third year classes consist of three ten week quarters with one week of finals at the end of each term.
2. Fourth year consists of a ten week class block plus one week of finals, an eleven week clinic rotation, and two externships - eleven weeks each.

Fall Quarter:
September 8 - classes and clinics begin
November 13 - classes end
November 16 to November 20 - finals
November 20 - last day of clinic
Thanksgiving vacation following finals

Winter Quarter:
November 30 - classes and clinic begin
December 18 - classes and clinic end for Christmas vacation
Christmas vacation December 21 to January 1
January 4 - classes and clinics restart
February 19 - classes end
February 22 to February 26 - finals
February 26 - last day of clinic

Spring Quarter:
March 1 - classes and clinic begin
Spring Vacation April 12 to April 16 - no classes or clinic
May 14 - classes end
May 17 to May 21 - finals
May 21 - last day of clinic

Summer Quarter: (Fourth year only)
May 24 - classes and clinics begin
July 30 - classes end
August 2 to August 6 - finals
August 6 - last day of clinic

SUGGESTED ACADEMIC AND CLINIC SCHEDULE
1992-93 SEMESTER SYSTEM

Assumptions:
1. First through third year classes consist of two fifteen week semesters with one week of finals at the end of each term.
2. Fourth year consists of an eight week class block including one week of finals, a sixteen week clinic rotation, and a sixteen week externship.

Fall Semester:
August 31 - classes and clinics begin
December 11 - classes end
December 14 to December 18 - finals
December 18- last day of clinic
Christmas vacation following finals

Spring Semester:
January 4 - classes and clinic begin
Spring Vacation March 22 to March 26 - no classes or clinic
April 23 - classes end
April 26 to April 30 - finals
April 30 - last day of clinic

Summer Semester: (Fourth year only)
May 10 - classes and clinics begin
July 16 - classes end
July 19 to July 23 - finals
August 27 - last day of clinic

SEMESTER SYSTEM CLASS SCHEDULE:

FIRST YEAR

FALL	Credit Hours
Ocular Anatomy, Physiology and Biochemistry I	3 lect., 1 lab
Optics I, Geometric and Physical	3 lect., 1 lab
Optometric Orientation	2 lect.
Procedures I	3 lect., 1 lab
Human Anatomy and Physiology	2 lect., 1 lab
Public Health	1 lect.
General Immunology and Cell Pathology	1 lect., 1 lab
*******	**********
TOTAL	20

SPRING	
Ocular Anatomy II	3 lect., 1 lab
Optics II - Visual Optics	3 lect., 1 lab
Neuroanatomy and Physiology	4 lect.
Procedures II	3 lect., 1 lab
Dispensing/Observation	1 lect.
General Systemic and Ocular Pharmacology	3 lect.
*******	**********
TOTAL	20

SECOND YEAR

FALL

Contact Lenses I	3 lect.
Procedures III	3 lect., 1 lab
Optometry I	4 lect.
Optics III - Applied Visual Optics	2 lect., 1 lab
Ocular Disease and Pharmacology I	4 lect.
Clinic (Includes Case Conference)	2 lab
*******	**********
TOTAL	20

SPRING

Contact Lenses II	3 lect.
Procedures IV	2 lect., 1 lab
Optometry II	4 lect.
Clinic (Includes Case Conference)	2 lab
Ocular Disease and Pharmacology II	4 lect.
Psychophysiology of Vision	4 lect.
*******	**********
TOTAL	20

THIRD YEAR

Fall - 16 weeks

Procedures V	2 lect., 1 lab
Optometry III	3 lect.
Clinic (Includes Case Conference)	3 lab
Vision Therapy I	2 lect., 1 lab
Strabismus and Amblyopia	2 lect., 1 lab
Professional Communication	2 lect.
Ocular Disease and Pharmacology III	3 lect.
*******	**********
TOTAL	20

Spring - 16 weeks

Procedures VI	2 lect., 1 lab
Vision Therapy II	2 lect., 1 lab
Low Vision and Geriatrics	3 lect., 1 lab
Clinic (Includes Case Conference)	3 lect., 1 lab
Practice Management and Legal Aspects	2 lect.
Visual Fields	2 lect.
Public Health	1 lect.
*******	**********
TOTAL	19

FOURTH YEAR

Class Block - 8 weeks	
Environmental Vision	2 lect.
Practice Management	2 lect.
Co-management	2 lect.
Advanced Case Conference	1 lect.
Sports Vision (elective)	2 lect.
Board Review (elective)	0.5 lect.
*******	**********
TOTAL	7(9.5)

Clinic Rotation - 16 weeks	
Contact Lenses	2 lab
Ocular Disease and Special Testing	2 lab
Low Vision/Geriatrics	2 lab
Vision Therapy/Pediatrics	2 lab
Primary Care	6 lab
*******	**********
TOTAL	14

Externship - 16 weeks	15
**********	**********

TOTAL SEMESTER HOURS(All four years) 155 hrs.

DISCUSSION:

In order to assure a program which provides a broad background in optometric science yet also emphasizes clinical thinking, we attempted to follow a logical flow in designing this curriculum. The basic science courses provide the foundation for all other courses which follow. Therefore, it is important that these be covered within the first two years. The visual science courses then build on this foundation during the second and third years. For example, the contact lens classes are taught in the second year, after the student has had both anatomy and optics. Clinical science courses would be taught throughout all four years. This gives the program balance and provides the opportunity for students to gain a more clinical perspective on their other courses. It also teaches students to become problem solvers as early as their first year rather than waiting to do it in the last two years.

It was stated earlier that we designed this curriculum to be clinically driven. This includes the basic science courses. In addition to laying the groundwork for future courses, we have attempted to give each of these classes clinical applications. For example, our curriculum offers one year of ocular anatomy. However, in addition to teaching the structures of the eye, orbit and visual pathway, our class is designed to emphasize the relationship of the structures to oculomotor and visual function. Using ophthalmic diagnostic equipment in anatomy labs is another clinical application.

The human anatomy and neuroanatomy courses were scheduled to precede the ocular and systemic disease courses. However, we again strived to give these courses clinical applications. The neuroanatomy coursework, for example, includes an emphasis on neurological functions such as pupillary responses, eye movements and visual fields. These courses in the biological sciences gain importance as we see optometry becoming more involved with managing their patients' health care. We felt compelled to increase this portion of the curriculum with respect to Pacific's, as well as increasing prerequisite requirements.

In order to expand the curriculum, we have added the immunology class and split pharmacology into two separate courses - general pharmacology and general ocular pharmacology. These courses are all included within the first year in order to provide the fundamentals and a basic working knowledge of disease processes and pharmacologic principles before beginning the ocular disease and therapeutic pharmacology coursework. We feel comfortable starting the ocular disease courses later in the program because of this

foundation and the fact that students are then given time to understand the structure and function of the eye before concentrating on disease and treatment. Currently at Pacific, the ocular disease courses begin before the student has finished the ocular anatomy classes. It is important for the student to understand the healthy eye before learning to diagnose and treat a diseased eye.

The next logical step is to teach the ocular disease courses. We feel that by providing a solid background in anatomy, immunology and pharmacology the students should be well prepared to study ocular diseases and their treatments concurrently. Clinically speaking, once a diagnosis is made a treatment plan is formulated. By teaching the course in this fashion, we feel it will help students to put the information into a clinical context. Currently at Pacific, the therapeutics course is taught only after students have completed three semesters of disease classes. Treatments are discussed during the disease courses, but the students have not yet received the background supporting education to full comprehend the treatment and management plan.

We followed the same line of reasoning for our systemic disease course. This is one course that could use vast improvement in Pacific's program. In our experience, no attempt was made to relate this course to the optometric profession. This course, at the very least, should include a discussion of the ocular implications of systemic diseases and systemic treatments.

Our visual science courses have also been redesigned with regard to Pacific's program. We offer four quarters of optics. This is less than what is currently taught at Pacific, but we have attempted to maintain most of the theoretical basis. Compressing these courses encourages them to be taught with a more clinical emphasis, however. We must maintain the basic optometric science coursework, but not be limited by it. We have combined Pacific's geometrical and physical optics into a one quarter class, the physiological optics into two quarters and the ophthalmic optics into one quarter.

We also re-organized the contact lens courses. We teach the soft lens class first as it is generally recognized that they are easier to fit, or at least more fundamental. Again, it is a case of getting the basics down before moving on to more advanced material. This course would allow students to learn contact lens terminology and basic fitting principles before discussing rigid lens designs and modifications. Other areas in which our program differs from Pacific's is an increased amount of contact lens practice management and an increase in the number of fittings the student is exposed to.

The latter is partially achieved by getting the students into clinic much earlier thereby allowing more opportunities for seeing more contact lens patients.

Another area that has seen major revisions with respect to Pacific is the case analysis sequence. Again, we emphasized a logical progression of material. The first course provides the theory behind many optometric tests. The students will have spent much of their first year learning the technical aspects of the basic exam sequence. This course is offered at the beginning of the second year and backs up the technical skills with the theory behind the tests. We hope to have students seeing patients shortly after beginning this course so that the course becomes more "hands-on" (real world) versus just abstract theory. Following this is a course in analysis of the data obtained during the exam. This course also gains significance as students are already seeing patients in the clinic. The information covered is readily applicable to patients. The third course in this sequence discusses the management of refractive and binocular conditions. The fourth course continues with advanced case analysis, discussing such topics as managing aniseikonia or anisometropia. The fifth and final course in this sequence is called patient management. It is designed as the ultimate class in "real world" optometry. It teaches the student to handle a patient from the beginning of the exam to the end of the treatment period. This is an experience we rarely see in our clinical education.

There are some courses that remain essentially unchanged from Pacific's program. These include environmental vision, sports vision, psychophysiology and low vision. The major change in these courses is shifting them from semesters to quarters. Other courses are similar with some minor changes. The strabismus and amblyopia course in our program emphasizes evaluation and treatment more than what we received at Pacific. The courses in vision therapy emphasize management of conditions in addition to teaching training techniques. These changes have been included in an attempt to make the courses easier to apply clinically.

We have also added a separate geriatrics course. With the aging of the American population, it is very important that optometry as a profession be prepared to address the special needs of elderly patients.

The clinical science portion of the curriculum has seen the most change with regard to Pacific. This is evident immediately in the procedures courses. All of the testing necessary to complete an exam is covered within the first year. This allows the students to begin seeing patients for exams in their second year. A major change is

seen in the first procedures class alone. Basic dispensing skills are taught the first quarter the student is at the school. They are then able to work in the dispensary in subsequent quarters. This was done to provide the students with patient contact right away in the first year. Also included in the first year is observing upperclassmen's exams as was discussed earlier in the paper.

Our curriculum includes procedures courses continually throughout the first three years. We feel this will produce more technically skilled clinicians. This also allows for the instruction of more medical procedures, necessary due to the increasing scope of practice. Another important aspect of having more procedures classes is that students may gain exposure to other methods of examination in addition to the traditional twenty-one point exam. As with the rest of the program, a concerted effort has been made to chronologically match the procedures courses to corresponding didactic coursework. For example, ophthalmoscopy and biomicroscopy are taught in the second quarter procedures course of the first year which allows their use in studying ocular structures in the ocular anatomy labs.

The optometric orientation class was designed to provide an introduction of the student to the profession. Many new students lack an understanding of the profession and of basic optometric terminology. This course will give them the background which they will build upon during the rest of their education. It should be noted that a portion of this material is currently covered in Pacific's Behavioral Optometric Science class.

The public health course remains essentially similar to Pacific's. Once again, the largest change is in making it a one quarter class from a one semester class. This is one class that we feel easily lends itself to a quarter rather than a semester in length.

Optometric Law is a new course added to supplement the practice management courses and to help better prepare students for practice. The practice management courses are very similar to Pacific's. We have increased it from one semester to two quarters, providing more time to cover certain areas in greater depth.

The professional communication class is an expansion of Pacific's Patient Communication class. This course also includes interprofessional and intraprofessional communication as well as patient communication. Written communication includes topics such as patient reports and referral letters. There is no equivalent in Pacific's curriculum where this material is covered.

There are two other courses which Pacific currently offers as fourth year electives that we are making mandatory in the third

year. These are Visual Fields and Co-management. Both courses gain importance as optometry's scope of practice increases and with the increase in third party reimbursement. They are also extremely significant to optometry's role as primary care providers.

Our curriculum also offers elective National Board review courses. This was done to allow more class time to be structured toward patient care while still providing an adequate theoretical background.

The clinical experience of students graduating from our school would be significantly greater than those of us graduating from Pacific. This was accomplished with a variety of methods. First, the students start much earlier. We have them receiving patient exposure in their first year through working in the dispensary and observing exams. Then, they begin seeing patients for exams in their second year. At Pacific, no patient contact is made until the third year. Even then, it is only one patient per week. Also, our program includes a case conference (case presentations) throughout the entire program. Students would present cases only on material that they had covered in their lecture classes. Then as their knowledge grew, so would the variety of cases presented. If a case conference is used early in the program, we feel it would be a good idea to allow students to research the cases (ie. differential diagnoses, further testing required, management strategies) before presentation and group discussion. We feel this would help to develop clinical thinking much earlier. In the fourth year case conference course, we feel it would be a very good idea to include a Grand Rounds to ensure that all students are exposed to the more commonly occuring ocular conditions.

By starting clinic in the second year, we hope to have students prepared to spend their fourth year exclusively on advanced patient care. The fourth year clinic rotation is intended to provide equal exposure to all of optometry's specialties. Currently at Pacific, there is some discrepancy in this area. There is one day of vision therapy clinic per week, one-half day of contact lens clinic per week and one day of ocular disease clinic per semester. This distribution does not appear equitable when looking at a typical optometric practice.

Another tactic we employed to increase the amount and diversity of our students clinical experience was to have two separate externships, each one quarter long. The alternative was to have one externship two quarters in length. By having two, the student will receive a better variety of experiences. Also, if some sites are not as desirable as others, no one person will be forced to have that as their only experience.

The idea of using a quarter system is central to our whole program. It provides the flexibility necessary to rearrange the courses as we have as well as allowing more diverse clinical experience. As students at Pacific, we feel that many of our classes would have benefitted from being reduced in length. Others would benefit from being expanded. Using a quarter system allows us to do just that. Not including finals, ten week quarters provide thirty weeks of class time per year. Twenty-eight weeks are realized with fourteen week semesters while sixteen week semesters provide thirty-two weeks per year. Therefore, quarters allow a great deal of flexibility with no significant change in overall teaching time. Our fourth year clinical experience totals thirty-three weeks. At Pacific, thirty-two weeks are currently realized. Once again, much more diverse educational experiences are available in a very similar time frame. Another advantage of the quarter system that we projected is an opening of about four weeks in August that could very well be used as a summer clinic for second or third years.

We feel that Pacific could benefit from using a quarter system, although it would mean making significant adjustments to the present course content and sequencing. Since Pacific currently operates on a semester system, we have included a schedule for a potential semester-based curriculum.

One area that may appear conspicuously absent in our program is research. Our goal was to create a curriculum that would produce graduates whose strength would be clinical expertise. It is our opinion that the primary objective of optometry schools should be to educate students. Although it is essential that optometric research continue, it should be a secondary objective of schools. In our program, research would be left up to individual faculty members and students interested in pursuing it. Students would be receive elective credit for participating in research. We feel we cannot require this of all students, as we have significantly increased the amount of time they would spend in the classroom and clinic.

No program can be perfect. We realize that there are problems inherent in any curriculum. Many of these are universal problems, time and money to name but two. Other problems we came across include producing enough patients to fill all the clinic slots, needing to be able to modify the curriculum as time passes, and not covering certain areas enough to satisfy some students.

There are solutions to these problems, but some solutions do not fit into a university's plan or image. To increase patient numbers, evening or weekend hours could be made available. Electives could be offered each year to allow students the

opportunity to further study areas of interest, as could a summer clinic between the second and third year. Regardless, that is beyond the scope of this paper. The goal of this paper was to devise a curriculum that would produce proficient clinicians with a solid theoretical background. We feel we have done that.

CONCLUSION:

The problem put forth at the beginning of this project was to design a curriculum that reflects optometry's new position as a major player in the health care system without sacrificing areas that have traditionally been our strength. This has been accomplished by structuring courses in order to achieve a more efficient and effective overall flow. Also, by using a clinical approach to teaching and encouraging students to think clinically during their didactic coursework we have provided an improved transition from student to doctor.

We feel that this curriculum best serves the needs of the students. It provides them with a current, well-rounded education and enough clinical experience to confidently begin practicing optometry upon graduation. It also serves the needs of patients and optometry as a profession by producing competent, well rounded doctors.

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