The Journal of the Association of Schools and Colleges of Optometry

OPTOMETRIC EDUCATION

Volume 39, Number 1 Fall 2013

A Novel Approach to Bridge the Gap Between Didactic and Clinical Education

Also Inside:

Optometric Education in Trinidad and Tobago: Developing a New Program in the West Indies

Traditional vs. Blended Learning of Pharmacology

NEW IN THIS EDITION:
Educator's Podium: an opinion-based, non-peer-reviewed forum that provides an opportunity for optometric educators to share, think and question within any area related to the educational process or improving patient care. This forum opens an exchange among educators and can be thought of as a preliminary step in the development of scholarly work. A summary of each Educator's Podium will be posted on Facebook to enable immediate dialogue between its author and colleagues.

Association of Schools and Colleges of Optometry

The Association of Schools and Colleges of Optometry (ASCO) represents the professional programs of optometric education in the United States. ASCO is a nonprofit, tax-exempt professional educational association with national headquarters in Rockville, MD.

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The Journal of the Association of Schools and Colleges of Optometry

FEATURES AND DEPARTMENTS

Now Indexed on Google Scholar!
Optometric Education is now indexed on Google Scholar. Current indexing at http://scholar.google.com/ is from 2009 to the current edition, with the goal of eventually indexing back to 1998.
The current edition of the journal, as well as all past editions, can be found on the ASCO Web site at www.opted.org/newsroom-media/optometric-education.
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ARTICLES

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INDUSTRY NEWS

The following companies support ASCO's national programs and activities benefiting the schools and colleges of optometry in the U.S. and Puerto Rico.*

Patrons ($50,000 - $90,000)

Alcon Laboratories

Benefactors ($25,000 - $49,999)

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HOYA Free-Form Company
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Accutome, Inc.
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International Vision Expo
Keeler Instruments
M & S Technologies, Inc.
Marco
Oculus, Inc.
Optos North America
Volk Optical

Contributors ($5,000 – $9,999)

CooperVision
LasikPlus / Visium Eye Institute
Review of Optometry
Safilo Group
TLC Vision

As of October 1, 2013

Company Accepting Research Proposals

VISTAKON® Division of Johnson & Johnson Vision Care, Inc.

Johnson & Johnson Vision Care Inc. (JJVCI) is now accepting research proposals related to ultraviolet (UV) radiation and the human eye. Areas of interest include: eye health including photoageing; epidemiology of UV-induced ocular disease; and assessing the protective effect of UV-blocking contact lenses on human ocular tissue. Proposals must be written in English and submitted through the JJVCI Investigator Initiated Study (IIS) application process by e-mailing or calling the clinical research administrator at RA-VISUS-IISRequests@its.jnj.com or (904) 443-1525. Find more information on the IIS process and policy at www.acuvueprofessional.com/investigator-initiated-studies.

Also: Laura Angelini has been appointed President, North America, Johnson & Johnson Vision Care Inc. In her new role, she is responsible for the Vistakon U.S. and Canadian businesses.

Laura Angelini

Scholarship Contest Open Until Nov. 30

Transitions

Optical students have until Nov. 30 to enter to win the 2013 Students of Vision Scholarship, a program supported by the Transitions Healthy Sight for Life Fund. This year's Share Your Impact theme encourages students to explain how they will use their professional expertise to make a difference in the lives of others. Entries can be submitted as a video, photograph, poster, drawing, painting, illustration or short story. Complete details, including contest rules and prizes, can be found at the Share Your Impact tab on the Transitions Lenses: Healthy Sight Professionals Facebook page.

Also: Transitions Optical and its trade public relations agency, Havas PR, have been honored by the International Public Relations Association with a Golden World Award for their campaign to raise eye health awareness in African-American communities.

Scholarship Program to Give 40 Awards/Year

vspglobal™ SHARING YOUR VISION

VSP Global has partnered with the American Optometric Foundation to provide scholarships to students at every school and college of optometry in the United States. Continuing the scholarship support VSP has provided to optometry students for the past 10 years, the partnership will award scholarships to 40 students for a total of $160,000 annually. The awards now include a travel grant to attend the annual meeting of the American Academy of Optometry and a networking reception.

Each school of optometry will select two fourth-year students who are in the top half of their class academically, perform at or near the top of their class in clinical skills, and are preparing for a career in private-practice optometry.

Two CLs, One for Presbyopes, Debut

Bausch + Lomb introduced PureVision2 Multi-Focal contact lenses for presbyopia. The new silicone hydrogel (balafilcon A) lenses are tinted for visibility and indicated for daily or extended wear for up to 30 nights between removals. Featuring 3-Zone Progressive technology, they are designed to improve near and intermediate vision while providing excellent distance clarity.

Also, the FDA granted marketing clearance for the company's newest frequent replacement silicone hydrogel contact lenses made with MoistureSeal Technology. The lenses combine an innovative material with new manufacturing processes to offer superior comfort and vision.

New Site Supports Glaucoma Patients

A new resource created by Alcon, www.MyGlaucomaSupport.com, aims to educate glaucoma patients and their families and caregivers on all aspects of the disease. The Web site is designed to help at-risk and newly diagnosed patients better understand their condition, clarify uncertainty and confusion, provide patients with greater control, support them throughout treatment by managing expectations, provide information about medication and surgical products available from Alcon, and offer materials to foster compliance with treatment.

Octopus Family of Perimeters Expands

The new Octopus 600 perimeter from Haag-Streit USA combines glaucoma detection and monitoring of progression in one compact unit. In addition to standard white-on-white perimetry, it features Pulsar, a patented flicker stimulus designed to detect disease early. For patient comfort it includes large trial lenses, built-in correction for presbyopia and a newly reconfigured response button. The Octopus 600 operates via touchscreen, keyboard or mouse and functions as a stand-alone unit or as part of a network.

Redesigned Web Site Refines Navigation

Oculus launched a new, easier-to-navigate company Web site. It is designed to allow users to find comprehensive information on all Oculus products with just two clicks. The homepage contains the latest news and events together with an overview of featured products at the top. By clicking on their continent in the distributor locator, users can see a complete list of distributors in their country in alphabetical order. Visit the new site at www.oculus.de/en.

Upgrades Added to Portable Imager

Volk Optical upgraded its portable Pictor digital imaging device with Wi-Fi connectivity for uploading images to a computer even if it is in another room and nine fixation points for achieving central retinal and wider-field views. The Pictor enables capture of high-resolution images of retinal and external eye structures in-office as well as in settings where it would be difficult with a traditional fixed system, such as on non-ambulatory patient visits, at off-site clinics and for pediatric exams. The device weighs just one pound and fits easily with its accessories into a small briefcase.

Details Coming Soon on Student Programs

In mid-November, International Vision Expo will release information about optometry student programs to be offered at Vision Expo East in New York City, March 27-30, 2014. In addition, two travel grants per school will be awarded for attending the 2014 Vision Expo East or West. Information on how to apply for the grants will be posted online, and the deadline to apply will be Jan. 7, 2014.

Company Enters Femto-Cataract Arena

Expanding its vision care business into the femtosecond laser-assisted cataract surgery market, Abbott completed its acquisition of OptiMedica Corporation, developer of the Catalys Precision Laser System. The image-guided Catalys has both CE Mark in Europe and FDA clearance in the United States.

Season's Eyewear Collections Unveiled

Several lines of eyewear produced and distributed by Safilo Group unveiled their newest collections. The Marc Jacobs Fall/Winter 2013/2014 eyewear collection draws its inspiration from old Hollywood. The new sunglasses and optical frame models feature classic shapes and luxurious details to evoke a refined elegance. The Tommy Hilfiger Fall 2013 optical frames for men and women, "Back to University," are inspired by the brand's preppy, collegiate heritage and include a unisex frame.

EDITORIAL

Introducing Educator's Podium: A New Forum for Sharing, Thinking and Questioning

Aurora Denial, OD, FAAO

This edition of the journal contains an exciting new feature, the Educator's Podium. The Educator's Podium is an opinion-based, non-peer-reviewed forum that provides an opportunity for optometric educators to share, think and question within any area related to the educational process or improving patient care. This new forum is a way of sharing and brainstorming with colleagues. Appropriate articles for this forum include descriptions of creative or innovative teaching methods, programs and curricula. Innovative ideas related to patient care may also be included as a means of supporting clinical educators. The new forum is meant to be inspirational and to showcase educators' creativity. In addition to showcasing information, Educator's Podium provides an opportunity to think out loud and present educational challenges and dilemmas. Success in optometric education often involves mentorship and learning from colleagues. This forum opens an exchange among educators to help support and guide colleagues.

The Educator's Podium was conceived by myself and colleague Dr. Erik Weissberg. Dr. Weissberg is a member of the Scientific Program Committee of the American Academy of Optometry. As a committee member, he is responsible for reviewing poster and paper submissions for the annual meeting. Discussions related to our experiences in reviewing revealed that many faculty have great ideas about educational activities that have not been formally tested, but they have no outlet for sharing these thoughts. Our discussions also revealed that many faculty have difficulty distinguishing a scholarly article from one that is mainly descriptive.

What constitutes a scholarly article or scholarship? Scholarship can be defined as the "creation, discovery, advancement or transformation of knowledge."[1] The knowledge is then evaluated by peer review and made public.[1] Ernest Boyer's broader concept of scholarship identifies several categories.[2] These categories include the scholarship of discovery (original research); integration (novel insights, interpreting themes in discoveries, identifying connections between discoveries, e.g., literature synthesis, conceptual framework); application (building bridges between theory and practice, e.g., teaching case reports); and teaching (communicating one's knowledge, facilitating students' learning, enhancing self-directed learning, e.g., comparison of teaching methodologies, development of new pedagogy).[2]

The scholarship of discovery (original research) is driven by a research question or hypothesis, a specific scientific methodology and assessment of outcomes. Faculty are most familiar with this type of scholarship. The scholarship categories of integration, application and teaching are often less familiar and more at risk for misunderstanding. These types of manuscripts must contain scholarly elements, such as novel insights, interpreting themes in discoveries, identifying connections between discoveries, linking theory and practice, comparisons or analysis of teaching methodologies, etc., to be considered scholarly. All types of scholarship should reflect a clear understanding of the current literature and contain links to past scholarly work. Articles that are merely descriptive and lacking in scholarly components may be valuable but do not fit into the categories of scholarship.

The Educator's Podium can be thought of as a preliminary step in the development of scholarly work. The table on the next page provides an example of how an article for Educator's Podium could be further developed into a formal study for peer review and publication.

Educator's Podium	Scholarly Study
Describes challenges with current program	Describes challenges with the current program and provides evidence to support the challenges such as faculty or student surveys, clinical grades, or observations, and/or provides current educational literature regarding the challenges
Provides expectations and beliefs for future programs	Expectations and beliefs are translated into a formal hypothesis or research question
Describes how the program currently operates	Describes how the program currently operates and includes educational theory or pedagogy to support the design of the program and outcomes
Provides anecdotal information on the experience	Provides data from a formal assessment of the program and learning

The first Educator's Podium contribution, which was submitted by Dr. Weissberg and appears in this edition, focuses on "TEST" (The Enhanced Student Training). The article describes a new and innovative program designed to enhance the clinical component of the second-year curriculum at the New England College of Optometry (NECO). At this time, 25% of the second-year class at NECO is assigned to the "TEST" program and the remainder of the class participates in the traditional "clerkship program." The article clearly identifies the challenges associated with the clerkship program and the expectations and goals of TEST. The article further describes the experiences so far with the new program and plans for future outcome assessment and determination of success.

Dr. Weissberg and I envision this new forum as an outlet for showcasing ideas, discussing challenges and brainstorming with colleagues. A brief summary of the content from the Educator's Podium will be posted on ASCO's Facebook page. This will enable an immediate dialogue between the author of the podium article and colleagues. The process for submission and publication is below. I invite all faculty to submit to this new forum.

References

1. Kennedy RH, Gubbins PO, Luer M, et al. Developing and sustaining a culture of scholarship. AM J Phar Educ. 2003;67(3):Article 92.
2. Boyer EL. Scholarship reconsidered: priorities of the professoriate. The Carnegie Foundation for the Advancement of Teaching. Princeton, NJ. 1990.

Educator's Podium Submission Guidelines

Contributions to the Educator's Podium should be submitted to journal Editor Dr. Aurora Denial at deniala@neco.edu. The editor will review the submission and determine if it is appropriate for the forum. The submission may be returned to the author for minor revisions or comments.

Submissions should be a minimum of 500 words and a maximum of 1,500 words. They should include a brief synopsis of the article (maximum of 150 words) for posting on Facebook.

Suggestions for inclusion:

- traditional teaching method vs. a new, innovative method
- identified problem and intervention
- expectations for a new method, lessons learned, recommendations to others
- potential for future scholarship

Educational challenges, dilemmas or problems to be solved:

- what has already been tried?
- implications of success or failure
- impact of the issue

The Enhanced Student Training Program (TEST)

Erik Weissberg, OD, FAAO

Dr. Weissberg is the Director of Clinical Education and a Professor of Optometry in the Department of Specialty and Advanced Care at the New England College of Optometry. He is also a Clinical Instructor at the South End Community Health Center in Boston.

The "clerkship program" at the New England College of Optometry is the clinical component of the second-year curriculum. The primary goal of the program is to involve the second-year students in patient care with specific responsibility for basic testing skills, ultimately preparing them to enter the third-year clinical assignment where they will have full patient care responsibilities. A major challenge in developing a robust second-year clinical program is offering the evolving student a meaningful clinical experience without negatively impacting the efficiency of patient care. This is especially true at the New England College of Optometry, where local external affiliates often provide the patient care experience for our students. As part of the clerkship assignment, second-year students are typically assigned to work alongside other students or provide support through ancillary testing. Although considered generally successful, the clerkship program suffered from a lack of uniformity. These inconsistencies typically resulted from the second-year student being an "add on" to the clinical session and the student-to-student and preceptor-to-student synergy. The end result was that students were not being held to uniform expectations nor were they being offered a uniform clinical experience from clinical site to clinical site. An additional concern was that the model of this program made it possible for weaker students to deflect their clinical responsibilities. This brought into question the ability of the program to function as an early identifier of students who might run into clinical performance issues in the third and final years of their optometric education.

The Enhanced Student Training (TEST) program is a modified version of the clerkship program that aims to both increase and standardize the clinical responsibility of second-year students across a wide range of clinical sites without negatively impacting patient flow and satisfaction. It is our belief that increased responsibility will result in increased motivation, enhanced self-learning and ultimately second-year students who can function in a clinical setting at a higher level. For AY 2013-2014, the TEST program accounts for 25% of our second-year clinical assignments, and plans to expand for all second-year students by 2015 are in motion.

There are several subtle but impactful differences between the clerkship program and the TEST program. First, second-year students are assigned their own room and work directly with the clinical preceptor. This places the responsibility of clinical care directly on the shoulders of the second-year student, which we believe increases motivation for independent learning. Additionally, documents outlining the goals and expectations for the program are communicated to students and preceptors simultaneously so that each knows the other is well versed in the expectations for the program. This dispels any possible confusion over what the students are capable of doing and what the students should be prepared to do. Lastly, students in the TEST program are given the same clinical assignment with the same preceptor for the entire second year instead of different assignments each semester. This creates a more obvious clinical mentor relationship between the preceptors and students and increases the accountability of the preceptors to prepare the students for the third year or identify them through the grading process as in need of additional tutoring.

TEST students can be expected to perform a set of defined clinical procedures within an allotted time. Furthermore, it can be expected that proficiency and efficiency will increase throughout the assignment and additional responsibilities may be added. The basic and additional responsibilities will change depending on the fall or spring assignment, and a general guideline is provided to both the student and the preceptor. **(Table 1)** Although the emphasis is on clinical skill development, it is expected that the attending eyecare professional will incorporate case discussion and review into the experience at a level consistent with the student's developing knowledge base.

The basic premise of the TEST program is to allow students no more than 20-30 minutes with the patient before the preceptor finishes the exam. Preceptors should consider this a teaching moment and an opportunity to model proficient clinical testing for techniques that are required for the student to

achieve the next level of expectations. We believe this paradigm allows ample time for teaching and an opportunity for the student to accomplish meaningful clinical testing, but will keep the overall exam time within a reasonable time frame. Students should progressively be able to accomplish more in the allotted time frame with guidance from the preceptor, increased clinical exposure, observing preceptors perform clinical techniques and additional didactic training throughout the year.

The end goal of the TEST program is to have second-year students performing complete eye exams up to the dilated fundus evaluation by the middle of the spring semester. Although anecdotal, our experience thus far with the program has been overwhelmingly positive according to reports from clinical preceptors and participating students. In most cases, second-year students are functioning at the level of third-year students by March of the second year. In many cases, students are self-learning and receiving instruction from the preceptors that allows them to perform techniques not yet formally presented in the didactic curriculum and achieving the goal of performing full eye exams earlier than expected. Furthermore, students who have finished the TEST program and are now in their third year are standing out for their confidence and efficiency.

We are encouraged by the preliminary results of the TEST program. We feel confident that we have demonstrated the feasibility of this model and are actively looking into more objective outcome measures to better understand the long-term impact this program may offer. Student evaluations, performance on clinical proficiencies, national board test scores and customized surveys are all being considered as the students advance through this new model of second-year clinical education.

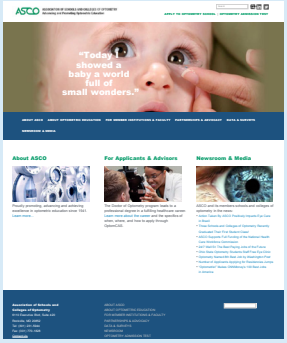
Table 1
Clinical Expectations for Fall Semester TEST Program

Time Frame	Techniques to be Completed in < 30 Minutes*	Comments and Skills Preparation
Fall Semester Day 1	Section 1: 5 minutes • greet patient, review initial case history • lensometry Section 2: 15 minutes • visual acuity, EOMS, CT, pupils, FCF • color vision, stereopsis testing, amsler testing Section 3: 10 minutes • keratometry, retinoscopy**	During the semester, students should be invited to observe the preceptor complete the examination and interact with the patient Additional skills students are prepared to perform: automated refraction, alternative VA testing (i.e., LEA, LogMAR, Feinbloom, ETDRS), non-contact tonometry, direct ophthalmoscopy, phoria and vergences, Bruchner/Hirschberg and Worth 4 Dot
Fall Semester Midterm	Section 1: 5 minutes • greet patient, review initial case history • lensometry Section 2: 10 minutes • visual acuity, EOMS, CT, pupils, FCF • color vision, stereopsis testing, amsler testing Section 3: 15 minutes • keratometry, retinoscopy and subjective refraction	It is expected that more "difficult" refractions may take more time, and students may need assistance from their preceptors It is expected that more "difficult" refractions may not be completed in the allotted time or with consistent accuracy
Fall Semester Final	Section 1: 5 minutes • greet patient, review initial case history • lensometry Section 2: 10 minutes • visual acuity, EOMS, CT, pupils, FCF • color vision, stereopsis testing, amsler testing Section 3: 10 minutes • keratometry, retinoscopy and subjective refraction Section 4: 5 minutes • check cornea, angles, tonometry, dilation	Preceptor should encourage student to complete as much of the exam as possible; after 30 minutes, if student is not up to dilation, preceptor should step in (and help the student to understand what slowed them down) Additional skills students are prepared to perform: lacrimal testing and pachymetry

*Timing is suggested only; exact tests and order of testing may differ from site to site.

**Some sites may require additional skills such as tonometry and drop instillation. Students assigned to these sites will receive additional training in tonometry, and all students will be provided with a drop instillation summary sheet that they will be expected to learn.

ASCO recently redesigned its Web site to reflect the association's long-term goals, which include promoting Doctor of Optometry degree programs to a broad range of audiences, increasing awareness and understanding of the profession and ASCO, and increasing the number, quality and diversity of applicants to the schools and colleges. In addition to a more modern, clean and dynamic design, the site illustrates diversity and communicates that Doctors of Optometry improve the lives of real people. To navigate from the new home page to the journal, click on Newsroom & Media and then ASCO's Online Journal: Optometric Education in the drop-down menu.



The home page of the redesigned ASCO Web site.

Invitation to Participate: Interprofessional Education

Optometric Education is announcing a future theme edition, which will focus on all aspects of interprofessional education (IPE). The deadline to submit articles for this theme edition is June 30, 2014. The theme edition is tenatively scheduled for publication in November 2014. For additional information, contact Dr. Aurora Denial at deniala@neco.edu.

A Novel Approach to Bridge the Gap Between Didactic and Clinical Education

Elizabeth Wyles, OD, FAAO
Heather McLeod, OD, FAAO
Geoffrey Goodfellow, OD, FAAO

Abstract

Purpose: *Primary Care Conference is a hybrid project-based approach to learning that utilizes clinical cases to help bridge the gap between what happens in the classroom and the expectations of clinical performance.*
Methods: *Timed and image-rich clinical cases are presented to students via a learning management system and then later in class with discussion.*
Discussion: *Primary Care Conference provides benefits to both students and faculty members.*
Outcomes: *These cases appear to assist with clinical thinking development.*
Conclusions: *Primary Care Conference is a novel format that provides the benefits of problem-based learning but in a large class setting.*

Key Words: *learner-centered, problem-based learning, critical thinking*

Dr. Wyles is an Associate Professor and was the Primary Care Educational Coordinator for 5 years at the Illinois College of Optometry. She received her optometry degree from the Southern California College of Optometry and completed a residency in hospital-based primary care optometry at the Crownpoint Indian Health Care Facility in Crownpoint, N.M. Dr. Wyles is an attending optometrist in the Primary Care Service of the Illinois Eye Institute and teaches several didactic and elective courses.

Dr. McLeod is an Assistant Professor at the Illinois College of Optometry (ICO). She received her optometric degree from ICO and completed a residency in ocular disease and special testing at the State University of New York, State College of Optometry. Dr. McLeod is an attending optometrist in the Primary Care Service, Urgent Care Service and Advanced Ophthalmic Care Service of the Illinois Eye Institute. In addition, she serves as a Laboratory Coordinator in the optometry sequence for second-year students.

Dr. Goodfellow is an Associate Professor and Assistant Dean for Curriculum and Assessment at the Illinois College of Optometry (ICO). He received his optometry degree from ICO and completed a residency in pediatrics/binocular vision at ICO. Dr. Goodfellow is an attending optometrist in the Pediatrics/Binocular Vision Service of the Illinois Eye Institute, teaches physiological optics and coordinates the Private Practice Clerkship.

Background

Traditional problem-based learning (PBL) is a learner-centered educational pedagogy in which students learn through the experience of problem-solving in small collaborative groups. The teacher acts as a facilitator to guide students in their self-directed learning rather than as lecturer providing content. During the process, students identify deficiencies in their own knowledge base, acquire new knowledge, and apply the new knowledge to the problem. Because the student is managing his/her own learning goals, he/she is developing skills needed for lifelong learning.[1,2] This is in stark contrast to traditional teaching and learning, which is often lecture-based. PBL was originally developed for medical schools by Howard Barrow and his colleagues at McMaster University. Barrow's taxonomy reflects a spectrum of PBL based on the amount of self-directed learning and problem structure. True PBL requires students to use a high degree of self-directed learning and solve ill-structured problems, those without a single correct solution. On the spectrum of PBL are hybrid models, such as project-based learning, that use a more well-structured case where learning is partially self-directed and partially instructor-led in small groups.[3,4]

The goals of PBL in optometry school are to develop knowledge that is adaptable to a variety of clinical presentations, effective problem-solving skills, self-directed learning and intrinsic motivation. Unfortunately, traditional problem-based learning is faculty intensive with one faculty member instructing a small group of students. This can act as a financial burden on the institution and prohibits its widespread adoption.[5,6] The Illinois College of Optometry (ICO) has developed Primary Care Conference (PCC), a didactic course to supplement third-year clinical patient care, which takes a novel approach by allowing a single instructor to act as a facilitator for a class size exceeding 150 students. The purpose of developing PCC is to provide our students with the benefits of PBL in a large class setting. Additionally, PCC offers many benefits to participating faculty by offering experience as a lecturer and improving their skills as clinical preceptors.

Primary Care Conference is a hybrid project-based approach to learning that utilizes well-structured clinical cases to help bridge the gap between what happens in the classroom and the expectations of clinical performance. Much like traditional PBL, PCC uses a learner-centered method of teaching where students are asked to solve cases independently. This type of self-directed education fosters lifelong learning and develops clinical thinking.[7] The clinical cases help students to identify their weak areas and promote independent research of these topics. The students develop their clinical reasoning by attempting to solve the cases by applying knowledge from their didactic coursework.

Methods

Every academic quarter in PCC, the third-year students at ICO are provided with multiple clinical cases that are followed by a series of 6-7 questions. A clinical faculty member writes each image-rich case, provides case questions and leads an in-class discussion.

Faculty

Clinical faculty are approached by the PCC coordinator 2-4 months in advance to request their participation in PCC. Once they agree, they are scheduled a specific date for their case, and a topic is chosen. Based on their presentation date, deadlines for submission are established. Sixteen faculty members each present one case during the academic year with four cases delivered every academic quarter. Faculty are deliberately chosen from a variety of subspecialty areas to ensure selection of a broad range of clinical case types. Although the specific cases and order of presentation will vary with each academic year, it is desirable for students to experience as many different case types as possible with minimum repetition. **Table 1** lists the various case types that are typically targeted.

Cases

The clinical case information is presented using the National Board of Examiners in Optometry (NBEO) Part II format **(Figure 1)**. The template for this format is available for download at http://www.optometry.org/part_2_pam.cfm.

Most of the cases are based on actual Illinois Eye Institute patients and generally include refractive and ocular or systemic health components. The NBEO template includes a comprehensive case history following the standard history of present illness (HPI) format. Additionally, a complete review of systems is included. The examination data vary from case to case; however, all the elements of the NBEO template are included regardless of the relevance. It is common to include additional template elements to present a thorough clinical scenario.

Each case must contain images, but the number varies depending on the topic(s) being covered. For example, the sample glaucoma case presented within this paper includes optic nerve photos and visual fields. When photos are included, the description of the structure is omitted so that the student has to make the assessment.

The authoring faculty submits the completed case to the PCC coordinator for an initial review. The coordinator makes edits as necessary to further refine the case. The case is often presented to a third faculty member for additional input. Frequently, the four faculty presenting in a given academic quarter are the ones involved in the editing process. The participating faculty serve as a "mini-committee" to ensure the quality of the cases. Additionally, this review process assists in producing multiple choice questions that are error-free.

Questions

The cases are selected specifically to challenge the student's ability to analyze complex clinical data. Based on the case data, 12-14 multiple choice questions are generated. **(Figures 2 and 3)** If the multiple response question format is used, no indication is given to the student as to how many options are correct. The question is simply labeled "Select All that Apply." Two to three of the 12-14 questions are aimed at reviewing straightforward information previously presented in the didactic curriculum in the given clinical context. These straightforward questions will have partnered questions that are more complex and aimed at requiring the student to consider special circumstances and use an enhanced level of clinical decision-making. Simple fact recall questions are avoided in favor of questions that require data assimilation. The question topics cover procedural skills, expected data, differential diagnoses, diagnoses, treatment and management, clinically applicable basic science, billing-coding, etc. Frequently, the case author includes questions that emphasize topics that tend to confound students regularly in clinic. After the questions are finalized, they are divided into two groups based on level of difficulty. One group will be presented on the learning management system (LMS) and the other group will be presented in class.

Case presentation: learning management system version

The finalized case along with the 6-7 lower-level questions is posted to the LMS. The students are notified via e-mail that the case is available for completion. Each case is timed. During the first academic quarter of the third year, the students have 16 minutes to complete the case. The time is reduced by 2 minutes each subsequent quarter with a final time of 10 minutes during the final quarter of the third year. The students are allowed to use reference material while completing the case; however, they are encouraged to work independently. Upon completion of the case, the students are shown their score and allowed to review the case. They are shown the correct responses but no justification is given for the correct answers. The onus is on the student to investigate and fully understand the reasoning behind the answers to the questions, which will ultimately assist with completing the in-class portion of the case. The case posted to the LMS is set to close the morning of the in-class case presentation date. The LMS case is not a required component of PCC but instead a highly recommended component, and thus the scores achieved on the LMS case do not contribute to the final PCC grade.

Case presentation: in-class version

The same finalized case is printed in color with the remaining 6-7 higher level questions. The case is distributed in class following the standard examination protocol (assigned seating and pre-labeled Scantron forms). The students are allowed to begin the case

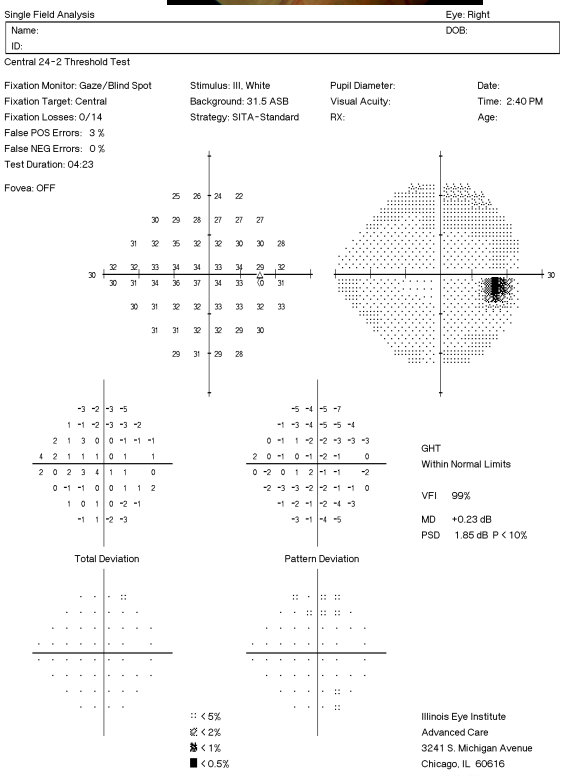
Figure 1

The Case Information Posted to the Learning Management System and Printed for the In-Class Version of the Case

Demographics:
42-year-old African American male; curator of Chicago Art Institute
Chief complaint: blurry vision
History of present illness:
- **Character/signs/symptoms:** near blur
- **Location:** OD<OS
- **Severity:** moderate
- **Nature of onset:** gradual
- **Duration:** past two years
- **Frequency:** every day
- **Exacerbations/remissions:** none
- **Relationship to activity or function:** noticed when reading the newspaper

Accompanying signs/symptoms: none
Secondary complaints/symptoms: left eye doesn't see as well as right at distance
Patient ocular history: blunt trauma OS x 20 years ago; no surgeries; herpetic eye infection doesn't remember which eye x 3 years ago
Patient medical history: hypertension x 4 years ago, BP average 140/80
Medications: "water pill"
Patient allergy history: sulfa
Family ocular history: father has GLC and cataracts
Family medical history: mother has HTN
Review of systems:
- **Constitutional/general health:** denies
- **Ear/nose/throat:** denies
- **Cardiovascular:** hypertension
- **Pulmonary:** denies
- **Endocrine:** denies
- **Dermatological:** denies
- **Gastrointestinal:** denies
- **Genitourinary:** denies
- **Musculoskeletal:** denies
- **Neurologic:** denies
- **Psychiatric:** denies
- **Immunologic:** denies
- **Hematologic:** denies

Mental status
- **Orientation:** oriented to time/place/person
- **Mood:** appropriate
- **Affect:** appropriate

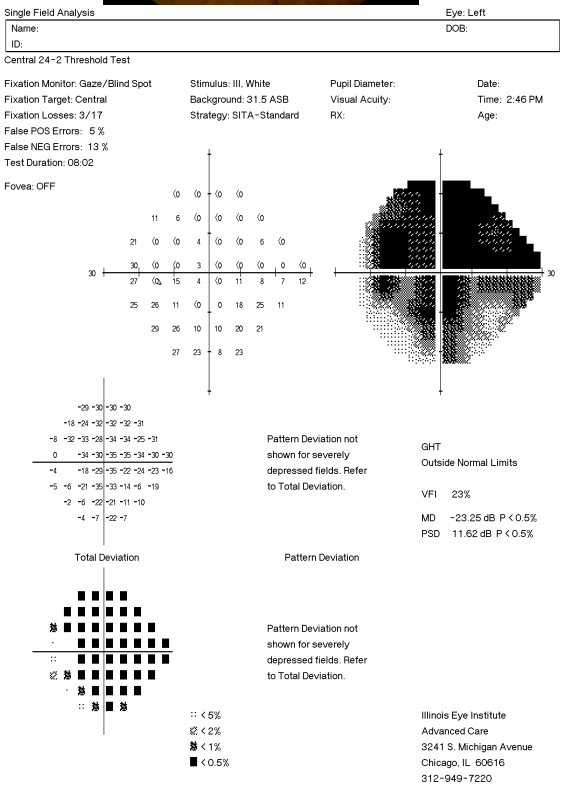


Clinical findings:
VA without correction:

Distance	Near
OD: 20/25	20/40
OS: 20/50 PH 20/40	20/50

Habitual distance Rx: none
Pupils: PERRL, negative APD
EOMs: full, no restrictions OD, OS
Confrontation fields: full to finger counting, OD, mild constriction 360° OS
Cover test: 3XP, 6XP'
Stereo: + forms, 50" of arc
Retinoscopy:
OD: +1.50-0.25 x 180 20/20
OS: +1.50-0.50 x 180 20/40
Subjective refraction:
OD: +1.50-0.25 x 170 20/20
OS: +1.00-0.50 x 180 $20/30^{-1}$
add +1.00 20/20 OD, $20/30^{-1}$ OS
Von Graefe phoria: 10 XP'
Slit lamp:
- **Lids/lashes/adnexa:** mild posterior blepharitis OD, OS
- **Conjunctiva:** mild injection OD, OS
- **Cornea:** clear OD, OS
- **Anterior chamber:** deep and quiet OD, OS
- **Iris:** brown and flat OD, OS
- anterior chamber angle: grade 4 nasal and temporal OD, OS
- **Lens:** clear OD, OS
- **Vitreous:** clear OD, OS

IOPs: 14 mmHg OD, 33 mmHg OS at 1:20 pm with Goldmann applanation tonometry
Blood pressure: 130/80 mmHg right arm sitting at 1:25pm
Fundus OD:
See IMAGE below at left; periphery: unremarkable
Fundus OS:
See IMAGE below at right; periphery: unremarkable
Additional testing:
Humphrey visual field: See OD IMAGE (below at left) and OS IMAGE (below at right)



when notified by the proctors. They are reminded of the amount of time they will be given to complete the case (16 minutes during the first quarter with the time being reduced by 2 minutes each subsequent quarter). An end time is displayed on the classroom screen so that students can self-monitor their pace. The proctors alert students when 7 minutes have passed and again when 1 minute remains. Students are allowed to bring any non-electronic (to ensure no communication between classmates) reference material to class for use during completion of the case. At the end of the allotted time period, the completed Scantron forms are collected, but the students retain the printed case information for reference during the discussion period, which immediately follows.

Case discussion

The case author reviews the case and questions with the remaining class time (approximately 30 minutes). The presenting faculty prepares a PowerPoint presentation that includes statistical data collected from the questions on the LMS so that the students can view the overall class performance. These data help the presenter guide the discussion, placing emphasis on areas of confusion. Similar data for the in-class questions are generated in real-time using an audience response system. The faculty clarifies the difference between each option and explains why each is correct and/or incorrect, placing an emphasis on the options that were popular distractors.

The PCC coordinator remains in the classroom during both the in-class case and subsequent discussion. The coordinator is available to assist with anything the presenter may need, including help with Scantron collection and technical assistance in the Smart Classrooms.

Grading

The scores from the questions presented in class (not the LMS version of the case) comprise 4% of the student's final clinic grade. Because four cases are presented each quarter with 6-7 questions per case, the final score is derived from approximately 24-28 questions. The class mean and standard deviation (SD) are calculated. If the student's final score falls within 1 SD of the mean

Table 1
Case Types Presented During Primary Care Conference

• Refractive Condition	• Anterior Segment	• Glaucoma
• Binocular Vision	• Low Vision	• Pediatrics
• Posterior Segment	• Ophthalmic Optics	• Post-Surgical

Figure 2
Learning Management System (LMS) Questions

The questions that are posted with the case information on the LMS. The questions include commentary to supplement the article text. All multiple response questions are scored as "all or none." No partial credit is given.

Key: 1. C, D, F, I 2. B 3. A 4. A 5. A 6. A, C 7. B

1. Which of the following best describes the optic nerves? (SELECT ALL THAT APPLY)

A. 0.3V/0.3H OD, 0.5V/0.5H OS
B. 0.5V/0.5H OD, 0.7V/0.7H OS
C. 0.65V/0.65H OD, 0.9V/0.9H OS
D. Rim tissue perfused OD, OS
E. Rim tissue non-perfused OD, OS
F. Margins distinct OD, OS
G. Margins distinct OD, indistinct OS
H. PPA OD, OS
I. PPA OS

This question requires interpretation of a visual, which will assist in recognizing the "abnormalities" seen in this patient's optic nerves.

2. Considering the information presented, which of the following is the most likely diagnosis?

A. Pigment dispersion glaucoma
B. Angle recession glaucoma
C. Primary open angle glaucoma
D. Acute angle closure glaucoma

This question requires clinical thinking, putting the case data and image interpretation together to arrive at a diagnosis. This question is PAIRED with In-Class question #1.

3. When selecting a glaucoma medication for this patient, which of the following mechanisms of action would be most appropriate?

A. Decreased aqueous humor production
B. Increased uveoscleral outflow
C. Increased trabecular meshwork outflow
D. Formation of an osmotic blood-vitreous gradient

This question builds on LMS question #2 by placing emphasis on the fact that the etiology of the condition must be considered prior to selecting a treatment. It also underscores the importance of pathophysiology and serves to foreshadow In-Class questions. This question is PAIRED with In-Class question #2.

4. Which of the following fields on the visual field printout confirms that this patient has absolute defects?

A. Raw Data
B. Total Deviation
C. Pattern Deviation
D. Total Deviation Probability Plot
E. Pattern Deviation Probability Plot

This question serves to remind students of content taught in the didactic curriculum. No analysis of data is required to answer this question. This question is PAIRED with In-Class question #3.

5. Assuming the phoropter is set at plano, your working distance is 66 cm, your initial reflex when you begin retinoscopy using the plane mirror position on this patient would have been?

A. With movement
B. Against movement
C. Neutral

This question aids with content review from the didactic curriculum and requires a small amount of data analysis. This question is PAIRED with In-Class question #4.

6. Which of the following tests should be performed prior to prescribing the subjective refraction and add to ensure the patient will not experience diplopia? (SELECT ALL THAT APPLY)

A. NPC
B. Worth 4 dot
C. BO vergence at near
D. BI vergence at near
E. Fused crossed cylinder

This question serves to remind students that patients in clinic often present with multiple problems that involve both knowledge of binocular vision and disease.

7. Which of the following lens changes would be the just noticeable difference (JND) for the patient's left eye?

A. 0.25 DS
B. 0.50 DS
C. 0.75 DS
D. 1.00 DS

This question functions to review when to deviate from our "standard routine." A very small amount of data analysis is required to answer this question. This question is loosely PAIRED with In-Class question #6.

(above or below) the student receives 3%. If the student achieves a final score above 1 SD of the mean, the student receives 4%. If the student's final score is below 1 SD of the mean, the student receives 0%.

Discussion

Primary Care Conference cases have become a core component of the third-year clinical education at ICO. This learner-centered module boasts objectives that extend far beyond simple content mastery. The overarching student objectives to these cases include but are not limited to: lifelong learning, knowledge-base enhancement, clinical thinking refinement (data analysis and interpretation of visuals), understanding treatment/management hierarchy, problem-solving efficiency and preparation for NBEO Part II. From a curricular stand point, the deliberate rotation of case types standardizes clinical exposure during the third year, which provides each student an introduction to fundamental conditions and concepts prior to his/her fourth-year clinical rotations. PCC also ensures that the entire class experiences a given case rather than relying on happenstance to provide each student with an individual clinical patient encounter of each type. In addition to student objectives, these cases provide faculty and administration with opportunities to develop junior faculty, contribute to curriculum vitae building, and reinforce basic health science integration into clinical practice.

Studies have shown that data analysis and interpretation is a challenge for medical students.[1,8] We have found that our optometry students are similarly challenged. Thus, the concept behind the PCC cases is to "break down" the thinking into a stepwise activity and guide the student through the process. Placing the lower-level questions on the LMS offers the student the opportunity to review the case and content in a lower stress environment, which will prepare him/her for the graded in-class case. Since the topics selected for the cases have already been covered in the didactic curriculum, each student will view the case with a different knowledge base, depending on how much he/she recalls from his/her courses. This process aids the student in identifying information that he/she does not know. Therefore, the LMS case serves as a good content review with an opportunity to apply the information to a given patient scenario.

When the student first opens the case on the LMS, he/she has no idea what topic will be presented. This is intentional to mimic a patient walking into the clinic. Students have to read the case and answer the questions in the allotted time, primarily with the knowledge they retained from their didactic courses. They are allowed to use references, but the time limitation often does not allow for much referencing initially. Once they complete the case, they are able to go back to review the case to see how they performed. The review screen displays both the student answers and the correct answers. The students can review the case for as long as they want and as many times as they want until the case closes shortly before the in-class version is presented. The students know that the in-class case will be the same, so it motivates them to review and understand the case to achieve a better grade in class. Furthermore, reviewing the LMS questions independently sets the stage for a

Figure 3
In-Class Questions

The questions that are printed with the case information for the In-Class case. The questions include commentary to supplement the article text. All multiple response questions are scored as "all or none." No partial credit is given.

Key: 1. C 2. E 3. A,D 4. B 5. B 6. B

1. A gonioscopic view of this patient's anterior chamber angle most likely would reveal a:

A. separation of the ciliary body from the scleral spur
B. convex iris with apposition of the peripheral iris against the trabecular meshwork
C. tear between the longitudinal and circular muscles of the ciliary body
D. dense homogenous band of dark brown pigment in the trabecular meshwork

This question is a basic science correlate to learning management system (LMS) question #2. Reviewing the case on the LMS would assist the student in answering this question.

2. Which of the following medications would be the most appropriate initial treatment?

A. Diamox
B. Travatan Z
C. Pilocarpine
D. Cosopt
E. Timoptic XE

This question is the clinical correlate to LMS question #3. This question reviews contraindications and mechanisms of action of various glaucoma medications. This question requires a fair amount of data analysis; however, the LMS questions serve as a stepping stone to reach this level of critical thinking.

3. Which of the following statements best describes this patient's left visual field? (SELECT ALL THAT APPLY)

A. Inferior nasal has 2 absolute defects
B. Inferior nasal has 9 absolute defects
C. Inferior nasal has 14 absolute defects
D. Superior nasal has 13 absolute defects
E. Superior nasal has 14 absolute defects

This question is PAIRED with LMS question #4. It requires application of the content tested in LMS question #4.

4. Assuming the phoropter is set at +1.50, your working distance is 66 cm, your initial reflex when you begin retinoscopy using the concave mirror position on this patient would have been?

A. With movement
B. Against movement
C. Neutral

This question is PAIRED with LMS question #5.

5. Considering the refractive results, which of the following NRA/PRA results are most likely?

A. +0.75/-0.75
B. +1.50/-1.50
C. +2.25/-2.25
D. +3.00/-3.00

As with LMS question #6, this question serves to remind students that patients in clinic often present with multiple problems that involve both knowledge of binocular vision and disease.

6. Which of the following is the most appropriate approach to balance accommodation?

A. 3BU/3BD
B. Red/Green
C. Alternate occlusion
D. Balancing accommodation is irrelevant on this patient

This question is loosely PAIRED with LMS question #5. This question also demonstrates that questions can be PAIRED to different degrees.

deeper more meaningful discussion in the classroom. The review process fosters lifelong learning. The open-book nature of the case interaction encourages the student to independently retrieve evidenced-based information to solve problems. Additionally, this gives the student an opportunity to evaluate which references are most appropriate under different conditions. Reference familiarity results in efficient information retrieval, which is an important lifelong learning skill.

The design of the questions is very purposeful. There are 2-3 questions aimed at content review with minimal interpretation needed to arrive at the correct answer. This is a good opportunity to include interpretation of visuals (ocular images, visual field printouts, optical coherence tomography printouts, etc.). In our example, LMS question 1 involves visual interpretation, and LMS questions 4 and 7 involve simple content review with little to no data analysis required to answer the questions. The remainder of the questions are aimed at improving clinical and critical thinking. These questions often require a 2- or 3-step process to arrive at the correct answer. Some of the questions are designed to set the stage for the subsequent question, reducing the number of steps required to arrive at the answer. For example, LMS question 2 assists the student with arriving at the diagnosis. The answer to question 2 serves as a stepping stone to answer question 3, which asks underlying pathophysiology. One could simply ask question 3 without question 2; however, this would raise the level of difficulty of question 3. In this instance, question 3 requires data analysis, diagnosis and then an application of basic science concepts. This stepwise process is all too familiar to experienced clinicians and becomes second nature; however, to novice clinicians and students, this process is foreign and must be learned. We often split the multistepped process between questions on the LMS and in-class questions. For example, LMS question 2 facilitates the analysis required to answer in-class question 1. Another example of interconnected questions is LMS question 3 and in-class question 2. Having to independently tackle clinical problems, develop an answer rationale, and participate in a class discussion of the item distractors led by an experienced clinician helps the student enhance his/her ability to think through a case in a logical stepwise manner. Additionally, because PCC is moderated by many faculty members throughout the academic year, the student gains some appreciation that there is often more than one way to manage a clinical problem. This variety in clinical approaches allows the student to further understand treatment/management hierarchy, why certain treatments are good, why others are better and which is best given the situation.

In addition to enhancing the student's content knowledge base, the cases give students a preview of common clinical mistakes. Because faculty choose real case scenarios with which they frequently witness students struggling in clinic, the student in PCC gains exposure to these frequent mistakes. Calling attention to such errors helps the student avoid making the same mistake when encountering a similar case in clinic. Furthermore, the cases reinforce basic health science integration into clinical practice. Students and optometrists often fail to recognize the relevance of their basic health science coursework. Primary Care Conference directly connects relevant basic health science concepts to the clinical cases at hand. Finally, because the students review the content of the case using references, their knowledge base is strengthened through application rather than simple memorization. This is accomplished by both the independent study and in-class discussion.

The lively discussions that often ensue during PCC encourage students to professionally communicate in a group setting. Being able to respectfully disagree in a collegial environment is a helpful skill for future optometric practice. Because the discussion immediately follows the in-class case, it is important that the questions are error-free.

Lastly, the cases prepare the students for the NBEO Part II: Patient Assessment and Management Examination. The patient information is presented in the same format that is used for this portion of the board examination. The format and timing allow students to gain familiarity with the examination structure. The board examination requires students to complete 30 cases in 3.5 hours (210 minutes), thus they must pace themselves at an average of 7 minutes per case. For this reason, we give the students a 7-minute warning during the in-class cases to increase their awareness of time passed and efficiency.

As mentioned earlier, we have found that there are a number of advantages to these cases from a faculty and administration viewpoint. The participating faculty experiences more mentoring and educational interactions. Primary Care Conference provides an opportunity for him/her to discuss clinical cases with other faculty members in a deliberate way. This allows the faculty member to have increased exposure to his/her mentors or mentees.

For newer faculty members, PCC provides lecture experience in a supportive team environment. It may be difficult to gain lecture experience prior to becoming responsible for a significant portion of a course. Even then, faculty members are often left to themselves to develop course materials and a lecture style. Primary Care Conference provides a venue for a faculty member to gain experience in organizing classroom materials, developing PowerPoint presentations, writing quality exam items, reviewing question statistics and lecturing, all with the direct assistance and feedback from skilled faculty members. PCC presenters are not formally evaluated by students because many faculty present in a single academic quarter. However, the presenting faculty and PCC coordinator meet informally to discuss how the cases can be improved for subsequent years.

Having to develop cases, write exam items, and articulate treatment/management rationales encourages the faculty member to delve into the evidenced-based literature to justify the various item answers and distractors. Reviewing this knowledge helps the faculty member to become a more effective teacher, clinician and clinical preceptor.

Particularly in a departmentalized academic setting, most faculty gain experience with only a subset of clinical cases. For example, the faculty member work-

ing only in the Binocular Vision Service will seldom manage adult ocular disease. Primary Care Conference gives an opportunity for the faculty member to interact with new and different cases presented by other faculty members, increasing his/her exposure to a diversity of cases. This provides a good review and even expands his/her clinical repertoire.

Just as with the students, the cases reinforce basic health science integration into clinical practice. Having to develop basic health science case questions allows the faculty member to engage with clinically relevant basic science content. Reviewing basic health science concepts helps the faculty member to be a better clinical preceptor. Most basic science lecturers are effective at making basic health science course work clinically relevant, but it is important to encourage clinical preceptors to reinforce basic health science importance as well.

Participation in PCC provides evidence of teaching and contributes to curriculum vitae building, which allows the faculty member to be more successful in the merit and promotion process.

Outcomes

Measuring a change in critical thinking and data processing aptitude is difficult. However, despite the fact that PCC is not formally evaluated by students, we have received a number of direct comments from fourth-year students. They believe that the cases assist with clinical thinking development by giving them additional opportunities to analyze a large volume of patient data and realize the correlation between the information. They went as far as to suggest that the number and frequency of these cases should increase in the curriculum. The suggestion was to begin the cases in the first year and have them continue throughout the third year. This would allow for earlier development of the data analysis skill. Additionally, based on feedback from curriculum focus groups, the students feel these cases play a role in their success on standardized examinations.

We have found the discussion portion of PCC to be extremely important to emphasize the stepwise nature of data assimilation and clinical reasoning. For example, when looking at the total percent correct on LMS question 2 (diagnosis question), which is designed to be a stepping stone for a multi-stepped question, one can compare the performance of two multi-stepped questions, one with and one without the benefit of discussion. There was a 28% increase in a multi-step question relating to LMS question 2 when asked during the discussion. Alternatively, there was a decrease in 29% percent in total percent correct on a multi-step question relating to LMS question 2 when the students were left to answer the question independently. This difference in percent correct may suggest that the discussion is aiding with critical analysis and understanding the process necessary to make clinical decisions.

Statistical analysis of the case questions also plays a key role in the development/improvement of the cases over time. It is important to consider the question statistics to ensure the goal is being achieved. Key statistics to consider are the total percent correct, the percent correct for the upper 27% of students, the percent correct for the lower 27% of students and ultimately the discrimination index (DI, which is the difference between the upper 27% and lower 27% of the class). When looking at the statistics, one must keep in mind that case topics may be selected with the intent of targeting common clinical pitfalls, which may negatively impact total percent correct. Therefore, considering only total percent correct may not fully represent the question reliability. The authors recommend looking at the question DI in conjunction with the total percent correct.[9] It has been found that our case questions rarely have DI values lower than 0.35 on any given case. This most likely is the result of the content application nature of the case questions. For example, the average DI on the sample LMS case questions was 0.51. Because overall percent correct may be lower than desired, we only grade the in-class cases and base the grades on the mean and standard deviation. This grading method allows us to truly capture the outliers in the class. If these students are deficient in both conference and clinic, then they are remediated individually through our Primary Care Clinical Support Program. The program provides support through additional case reviews with a faculty mentor, supervised technical skills practice and critical written reviews by an attending faculty member who is assigned to individually observe the student's clinical patient encounters. As the academic year progresses, the time allocated to complete the PCC cases decreases and the level of case complexity increases. Despite these time and content changes, the mean percent correct on the cases remains similar thus suggesting an improvement in clinical thinking.

Conclusions

Primary Care Conference provides the tools and experiences necessary to improve students' ability to think clinically and apply didactic knowledge to clinical patient care through hybrid project-based learning. The wide variety of cases aids students in identifying areas of weakness in their current knowledge base, while the open book nature of PCC allows students to become more familiar with quality reference material and how to access information effectively, which is a critical skill for lifelong learning. The format of the clinical cases familiarizes students with the NBEO Part II exam structure.

PCC also provides many benefits to the faculty members involved. It aids in the development of junior faculty, increases their exposure to students, expands clinical knowledge, reinforces importance of basic science, and aids in curriculum vitae building.

Despite the lack of true outcome measures of a change in student clinical thinking aptitude, ICO has adopted this approach based on feedback and general impressions. Problem-based learning has been well studied and has a strong history of positively impacting students,[6,7,10] thus we are pleased that we have discovered a novel format that allows us to provide our students with the benefits of problem-based learning but in a large class setting.

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Optometric Education in Trinidad and Tobago: Developing a New Program in the West Indies

Sandra Wang-Harris, OD, MPH, FAAO

Abstract

Trinidad and Tobago (TT) is a twin island nation in the Southern Caribbean, just northeast of Venezuela. TT had recently signed the World Health Organization's Vision 2020: Right to Sight declaration and was working closely with the Pan American Health Organization's Strategic Framework for Vision 2020-Caribbean Region, when the University of the West Indies St. Augustine Campus opened its doors in 2009 to the first BSc degree program in optometry in the English-speaking Caribbean. Since then, the university has forged a foundation seeking to produce world-class optometrists recognizable by international standards. This paper summarizes the history of this degree program, the current situation and the multitude of factors shaping the future TT graduates in optometry. .

Key Words: *international optometry, Trinidad and Tobago optometry, WHO Vision 2020, optometric education*

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Economy and Background

The two islands comprising Trinidad and Tobago (TT) are small in land size at 5,000 sq. km., slightly smaller than the U.S. state of Delaware, but TT is the economic, industrialized powerhouse of the English-speaking Caribbean, West Indies. Due to its large oil and natural gas reserves, its energy sector accounts for more than 40% of the Gross Domestic Product. 90% of TT's export commodity and 50% of the government's revenues are derived from oil and natural gas.[1-3] TT's growth rate and per capita income are among the highest in Latin America and the Caribbean, and the island nation is poised to continue to grow as the current government looks to diversify the economy amid current inflation surges during the worldwide recession.[1]

The 2011 Human Development Index, published by the United Nations Development Program, ranked TT 62nd out of 197 countries, which positions it in the category of "high human development."[3] With almost 1.3 million inhabitants, the country has an average life expectancy of 71 years and boasts one of the highest literacy rates in the world at 98.6%.[2] Primary and secondary education through 12 years is compulsory and free for all TT children. The government places education high in its priorities, providing 100% government tuition funding for TT citizens who matriculate and pursue a tertiary level qualification at a local or regional university.[4] This environment of strong educational support has fueled the birth of optometry as a tertiary professional degree.

History of Trinidad and Tobago Optometry

The profession of optometry has a long history in the republic of Trinidad and Tobago that is directly linked to the country having been part of the commonwealth of the United Kingdom (UK). Under British rule, ophthalmic opticians set up practice and dispensed ophthalmic prescriptions at the turn of the 20th century. Prior to 1960, TT optometrists followed the British National Health Service Regulations. Ironically, optometrists were freely al-

lowed to use diagnostic drugs such as mydriatics and cycloplegics at that time. In 1960 the Trinidad and Tobago Opticians Registration Council (TTORC) was created to act as a regulatory board. Afterwards, the Opticians Act of 1960 barred optometrists from practicing with mydriatics, cycloplegics or other pharmaceuticals. The title or degree of "Doctor" was also barred from use by optometrists or practitioners registered under the Act of 1960.[7] This offense is still on the books as punishable by a $1,500 fine and 6 months imprisonment.[7] More recently, the Amendment of 1987 allows registered optometrists only limited use of diagnostic anesthetics and diagnostic staining drugs.[8] However, the original Opticians Act of 1960, drafted more than a half century ago, still stands as the law of TT in today's practice of optometry. Currently, a revised draft policy proposal is under review by the TT Ministry of Health to change the structure of the TTORC and increase the scope of practice available to qualified and licensed optometrists.[6] As in other developed countries, any legislative proposals to widen optometry's scope of practice have been met with severe criticism by political and economic interests as well as organized ophthalmology.[10]

There are 114 optometrists registered with the TTORC under the Ministry of Health.[5] Of this total, the majority of licensed optometrists received their training and licensure from the UK (approximately 60%). The next largest group of optometrists were trained and qualified in Nigeria (approximately 25%). At 13% and increasing yearly, optometrists trained and qualified in South Africa comprise the third group of optometrists. The remainder of registered optometrists are North American-trained and licensed (2%).[6] As occurs in Jamaica, the British-trained optometrists receive bachelor's degrees in optometry, qualify and register under the General Optical Council in the UK and, with further training and licensure, can qualify to prescribe therapeutic pharmaceutical agents (TPA). Yet, under current TT law, these optometrists, regardless of qualification, are still restricted in TT from use of diagnostic and therapeutic pharmaceutical agents.[9,11] The TT law today makes it illegal for any optometrist to dilate pupils in order to perform a thorough fundus examination, regardless of the country in which he or she was qualified and licensed. Failure to diagnose a blinding condition due to incomplete examination not only endangers the patient, but also diminishes public confidence in the provider and the eyecare profession overall.

Establishment of the Optometry Degree Program at the University of the West Indies

Rationale and history

The decision to begin any academic training program, particularly a professional program, must be carefully weighed by all stakeholders, including the government's Ministry of Health, Ministry of Tertiary Education, the public health sector, the private health sector and the training institution that would undertake the program. In the original syllabus of the BSc optometry degree, the rationale for starting the program states:

"This proposal for the introduction of a Bachelor of Optometry programme at the undergraduate level at the St. Augustine Campus of the University of the West Indies arose out of the need to increase the number of trained optometrists to adequately service the region's ever growing demand to deliver effective health care services within the health sectors of the region [. . .]. The University of the West Indies has as one of its mandates the provision of appropriate human resources both in terms of numbers and appropriate skills and competences necessary to fulfill the developmental needs and in the process positively transform the Caribbean Region. It is in this context that the FSA [Faculty of Science and Agriculture] is pleased to propose this programme and now sets the way ahead to address this human resource need required by the region as it strives to fulfill the delivery of Vision 2020."[17]

In TT, the cost of health care provided in public hospitals is borne by the government. Salaries of the optometrists in public health service are also paid for by the Ministry of Health and the TT government. Prior to 2000, the TT government sponsored students to study in the UK and return to public health service after receiving their diploma. A generation of optometrists returned to their native country to practice optometry and after finishing their public health service contractual period in the government clinics, began their private practices. Slowly, as optometrists retired and left the public sector, government clinics and hospitals closed the primary care optometry and optical eye services for lack of adequate staffing or resources. Ophthalmology services, however, always provided for the public in the government-sponsored hospitals and clinics throughout this time until the present. In 2006, TT signed onto the World Health Organization's (WHO)'s Vision 2020: The Right to Sight initiative, and TT's public stakeholders realized that optometry ought to play some role in the provision of primary health care in the public sector.[14-16] In 2008, a UK-trained optometrist joined staff at one of the pilot eye departments at Sangre Grande Hospital and is currently the only optometrist employed by the TT's Ministry of Health.[12] Now realizing the importance of optometry in eyecare services for the public, it is the present goal of the Ministry of Health to open optometry eye clinics and staff them with locally trained optometrists at the country's major hospitals by late 2013.[19]

At the same time TT's public health services sought to improve its provision of eyecare services, the private sector also became an integral stakeholder in the optometry degree program. Over the course of the past two decades, along with the upsurge of TT's economic growth, demand for optometric and sight testing services increased. Private sector independent and corporate optical companies could not meet the consumer demand for optical goods and services. In response to this enlarged economic demand, the private sector began looking into ways to increase optometric manpower. One of the ways to do this was to augment the number of sponsored Trinidadian students on scholarship to the UK. After qualifying in the UK, these TT citizens were expected to return and work for the sponsoring company. More recently, private companies using recruitment services

have been able to staff optical offices with optometrists from other foreign countries such as South Africa. Seeking still other sources of optometric manpower, many private companies supported the idea of a local training center, which would produce optometric manpower that would be economically feasible and self-sustainable for TT.

A working and planning committee consisting of private, public and educational stakeholders began working on the feasibility, funding and impact of starting the first BSc degree program in optometry in the English-speaking Caribbean.[13] The University of the West Indies (UWI) was the prime location to launch this endeavor as UWI is the premier institution in the region with campuses in 15 countries. UWI is known internationally for academic and research excellence, boasting eight prime ministers, two Nobel laureates and many dignitaries as alumni. With the full support and commitment of Professor Clement Sankat, Pro Vice Chancellor and Principal of UWI's St. Augustine Campus, and Professor Dyer Narinesingh, Dean of the former Faculty of Science and Agriculture, the UWI BSc optometry program commenced with its first class of 16 students in September 2009. Faculties from both the former Science and Agriculture as well as the Faculty of Medical Sciences taught students. Now, starting its fifth year, the program has shifted to the Faculty of Medical Sciences under the Office of the Dean, Professor Samuel Ramsewak. There are currently four full-time optometry faculty members and one part-time distance-based faculty member (the author). The faculty members must have graduate degrees in optometry, vision science or the equivalent in experience. Today, there are approximately a total of 90 students in all four years of the BSc program, including students from other Caribbean countries.

Objectives of the optometry program in Trinidad and Tobago

For any type of optometric training program, the mission is to produce graduates who can provide quality eyecare services to the public. From the beginning of the establishment of the planning committee for the optometry program, there was much discussion

Figure 1

Jehan Ali, a student in the BSc degree program in optometry at the University of the West Indies St. Augustine Campus in Trinidad and Tobago, works with a patient. The program is the first BSc degree program in optometry in the English-speaking Caribbean. (photo by Annelise Randall)

Figure 2

Camelia Powdhar is a student in the BSc degree program in optometry at the University of the West Indies St. Augustine Campus in Trinidad and Tobago. In the past two decades, demand for optometric services in the twin island nation has increased along with an upsurge in its economic growth. (photo by Annelise Randall)

on how comprehensive the training should and could be in order to receive the UWI BSc in optometry. In other words, at what competency level would UWI optometry graduates qualify after receiving the BSc degree? In the BSc in optometry syllabus, the curriculum states the following objectives:

- To provide a sound scientific and professional base for the production of optometrists capable of working anywhere in the Caribbean and elsewhere in the world where the qualification, skills and competence of the BSc optometry (UWI) are acceptable.
- To produce optometrists who would satisfy internationally recognizable standards and who could undertake further training towards specialization.
- To produce optometrists with sufficient management ability to play a leadership role in healthcare delivery.
- To provide such training as would equip the optometrists to render and/or participate with other health practitioners in providing health care.[17]

In the points above, UWI actively seeks students from other Caribbean nations in order to meet the human resource needs for the region. Also, UWI clearly states that it aspires to train graduates in optometry to international standards. Due to the rapid globalization of most health professions and the wide differences in educational standards from country to country, the World Council of Optometry (WCO) has developed a Global Competency-Based Model of Scope of Practice in Optometry. The four categories of services represent cumulative skills in this order:

1. **Optical Technology Services**

   Management and dispensing of ophthalmic lenses, ophthalmic frames and other ophthalmic devices that correct defects of the visual system

2. **Visual Function Services**

   Optical Technology Services, plus

   Investigation, examination, measurement, diagnosis and correction/management of defects of the visual system

3. **Ocular Diagnostic Services**

   Optical Technology Services, plus

   Visual Function Services, plus

   Investigation, examination and evaluation of the eye and adnexa, and associated systemic factors, to detect, diagnose and manage disease

4. **Ocular Therapeutic Services**

   Optical Technology Services, plus

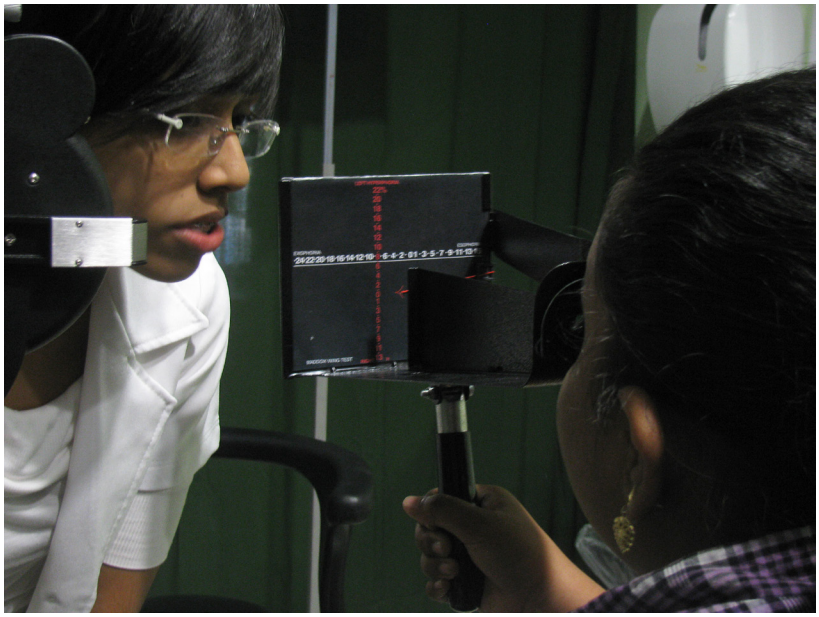
   Visual Function Services, plus

   Ocular Diagnostic Services, plus

   Use of pharmaceutical agents and other procedures to manage ocular conditions/disease[18]

Figure 3

Among the students in the BSc degree program in optometry at the University of the West Indies is Farielle Khan. Built on a strong foundation in curriculum, clinic, teaching and support from the Trinidad and Tobago government and the university administrators, the program graduated its inaugural class this year. At the same time, it is being met with controversy by some in the community regarding the scope of practice and licensure of graduates. (photo by Annelise Randall)



In order to progress from category to category, there are stringent indicators to measure each level of criteria. Optometrists must show competency based on performance in order to achieve the next standard. The WCO writes that in order to be an optometrist, an individual must "provide comprehensive eye and vision care, which includes (1) refraction and dispensing, (2) detection/diagnosis and management of disease in the eye, and (3) the rehabilitation of conditions of the visual system.[18] The document entitled "World Optometry: Enhancing Vision, Protecting Health: A Case Statement" is highly recommended reading for those who would like a detailed description of the global competency-based model for optometry.[18]

The current syllabus of the UWI BSc in optometry written in collaboration with stakeholders on the planning committee accounts for the WCO definition and offers UWI graduates a robust and comprehensive optometric education worthy of a UWI diploma recognizable by international regulatory bodies.

Qualifications for admission into the BSc in optometry program

The requirement for admission to UWI's BSc in optometry is quite rigorous and competitive. Since the program's inception in September 2009, this popular program has had large

numbers of applicants. The large pool of qualified applicants is partially due to TT's Government Assistance for Tuition Expenses (GATE) funding scheme allowing TT citizens to obtain a tuition-paid tertiary education. However, only candidates with strong academic backgrounds are accepted into the BSc program.[4] There are more than 100 applicants every year for entrance into the program, while only 24 are accepted based on competitive standardized tests and qualifications.

The Caribbean Advanced Proficiency Examination or CAPE, as it is commonly called, is used to assess students finishing secondary schools. The Caribbean Secondary Education Certificate (CSEC) is given by the Caribbean Examinations Council (CXC) using a six-point grading scheme. Grade I is the highest grade for the CSEC; whereas, Grade VI is the lowest grade possible. The General Certificate of Education qualification (GCE) is also known as "A" level or Advanced level. To the North American reader, this is loosely equivalent to a beginning freshman course in an undergraduate degree program. Entry into the UWI optometry program requires the candidate to meet the following minimum qualifications:[17]

- The university requirements for UWI matriculation and have passed English, Mathematics, Biology and Physics at CSEC General Proficiency level at Grades I, II or since 1998, Grade III or equivalent qualifications.
- Obtained passes in three two-unit subjects at CAPE, both units at Grade II or better, or GCE A Level Equivalent. This must include Physics and Chemistry, or
- Have an appropriate Associate Degree or equivalent certification with a minimum GPA of 3.0 (or equivalent) from a recognized Tertiary Level Institution, or
- Have any other appropriate qualification and experience acceptable to the Faculty of Medical Sciences.[16]

Despite stringent admission requirements and a large pool of applicants, there is still some attrition (less than 3% of total optometry students) and repetition of courses with students failing to comprehend the degree of intensity mandated both in time and depth of academic study to complete the optometry program as a bachelor's level professional degree.

Program curriculum development[17]

The UWI optometry program is a meticulous, strenuous course of study with clinical practice. The university calendar is based on two semesters of 10 weeks each. The first year of the optometry course consists mainly of theoretical and basic science courses with a strong emphasis on physics, biochemistry, anatomy and physiology **(Appendix A)**.[17] The courses are taught by both lecturers in the Faculty of Medical Sciences and the newly formed Faculty of Science and Technology. The optometry faculty members concentrate on the vision science courses, including perception and visual optics. The second year of the optometry course continues with a strong foundation of theoretical vision sciences with the addition of clinically related courses including general clinical procedures, binocular vision, contact lenses and low vision in the latter part of the year. The third year is strongly clinically based with particular emphasis on ocular and visually related systemic disease and manifestations. To further prepare students for professional practice, students also complete a course on visual ergonomics and another in law and optometric management. A third-year capstone experience is a yearlong assignment on a relevant thesis, including literature review, seminal research with clinical element and a summary poster presentation. This research project is to give students an opportunity to conduct a small-scale study on a topic of interest to both the local and worldwide optometric community. It is hoped this experience will give some students a chance to consider optometric research or optometric education as a career possibility.

The UWI's first low vision clinic began seeing patients in May 2011 and works cooperatively with the Trinidad and Tobago Blind Welfare Association with low vision patient recruitment and dispensing of low vision aids to the clients. To date, it has performed well over 100 low vision evaluations and has dispensed as many low vision aids. Working with a pediatric behavioral specialist from the public health hospital system, the pediatric and binocular vision clinic began seeing patients in November 2011. UWI's specialty clinic currently provides comprehensive pediatric examinations, binocular vision training, perceptual vision testing and training. There is no lack of patients, as referrals from patients, community optometrists and staff keep the waiting lists full for these types of services, which are not readily available anywhere else in the country.

Before students are allowed to continue to the fourth year, their internship year or pre-registration year, all students must successfully pass a competency examination in the final weeks of the third year. This exam on basic clinical skills, including refraction, binocular vision assessment, lensometry, tonometry and fundus examination, is evaluated by all optometry faculty as well as external examiners. Students evolve rapidly into independent clinicians during the fourth year. This is when they attain proficiency in the professional and ethical aspects of the optometry profession. The fourth-year clinical experience includes eye clinics in the public hospitals, an outpatient clinic of the optometry department at UWI, as well as private eye clinics or practices that can ensure adequate supervision by an assessor or preceptor.[19] After the fourth-year internship is successfully completed, students graduate with a BSc in optometry from UWI and are eligible to become candidates for registration with the TTORC.

Credentialing and licensure of graduates from UWI

At the time of this writing, procedural policy has not yet been enacted on an external assessment of UWI graduates in order to demonstrate their competency level. The TTORC, which is the regulatory body for opticians and optometrists, needs a mechanism in order to license the new graduates. Licensure solely by virtue of graduation is not sufficient in other developed countries, and therefore should not be in TT either. There are many people who rightly have the responsibility of safeguarding the public's vision and thus the responsibility to ensure the quality and competency level of optometry graduates from UWI and TT. To this

end, the UWI optometry faculty realizes that this program must be accredited by a recognized international accreditation body in order for the program to be viewed as a proficient and superior educational institution for optometry. Successful registration for UWI optometry graduates to practice in TT or other countries is one of the top priorities for the faculty at UWI in this academic year. Overall, the program is a very vigorous three-year course with a solid clinical practice internship in the fourth year.

Strengths and Weaknesses of Optometric Human Resource Development in TT

From the UWI optometry program's inception until present, key persons have wholeheartedly supported the idea of optometric education in TT. These include the visionary leadership of the Deans of the respective Faculties of Science and Technology and Medical Sciences, as well as the strong support of the Pro Vice Chancellor and Campus Principal of the UWI, St. Augustine Campus, Trinidad. Professional educational programs require great investments of time, money, resources, political persuasion and personal emotional energy.

Another crucial element in the successful building of this educational venture is the support of the government of TT, especially the Ministry of Health and the Ministry of Tertiary Education and Skills Training. Also, the faculty members, lecturers and staff increased their already full-time workload during these first years of the birth of this program. It is clear that this program could not have started and continue to thrive if devoted individuals did not continuously fan back into a flame the goal of producing state-of-the-art optometrists in the region. The commitment of these individuals and institutions is a strength that cannot be lightly stated in the long-term outcome.

With any new academic program, there any many limitations to what can be done in a short period of time. One of these is faculty recruitment and development. Although more than 100 practicing optometrists are registered on the island, virtually none have graduate degrees at the doctoral, professional or post-doctoral level. Per university regulations, lecturers must possess a degree at the graduate level. Managing 90 full-time optometry students in all four years of study, the four full-time optometric faculty members are teaching multiple courses while simultaneously providing clinical instruction and administrative supervision — a feat unheard of by counterparts in other developed countries. Although specialty clinics are being managed by the current faculty, lecturers and instructors with specialized training, such as in low vision and pediatrics, are difficult to recruit for full-time faculty positions. Both specializations — childhood blindness and low vision — target underserved areas and are WHO goals in Vision 2020: The Right to Sight.[20] UWI is managing only due to strengths from committed individuals. Some of the brightest and most aspiring students are already stating ambitions to continue optometry studies abroad, complete graduate degrees, and return to TT to join the faculty at UWI.

TT might be resource-rich in natural gas and oil; however, the public healthcare system suffers from system-wide lack of supplies and equipment. Nevertheless, the optometry program at UWI is able to find other ways of providing for the immediate need for specialized ophthalmic equipment for teaching, training and patient examination. Perhaps one of the most generous contributors from whom UWI optometry has benefitted in these first years is the partnership with Volunteer Optometric Services to Humanity (VOSH). The mission of VOSH is "to facilitate the provision and the sustainability of vision care worldwide for people who can neither afford nor obtain such care."[21] By supporting optometry schools and clinics, VOSH is fulfilling its mission statement through sustainable human resource development. VOSH, along with other international eyecare service organizations such as the Lions Club, has given invaluable service and support to the students at UWI. Working to combat blindness in developing countries, both organizations are stakeholders for the development of optometry in the region of Latin America and the Caribbean. Realizing that the long-term solution to avoidable blindness is patient/public education as well as provider training, VOSH has sent thousands of U.S. dollars' worth of equipment, spectacles and optical goods to TT for use in student education and patient service.

Discussion

TT has been fortunate to have large increases in its socioeconomic development in recent years. Though eyecare services have been more privatized over the past decade, there is still a great need for public and hospital-based optometry to help the majority of the population without the means or resources for private care. More importantly, with the increase in socioeconomic development, treatment of communicable eye disease is no longer the first priority in reduction of blindness in TT. Rather, eyecare practitioners in TT are called upon to treat chronic eye diseases and provide long-term care and rehabilitation.[15] Around the world in developed countries, populations will continue to age, and the risk of visual impairment from glaucoma, diabetic retinopathy, and age-related macular degeneration is a top priority for Vision 2020 implementation.[15]

Conclusion

As populations begin to age and life spans increase, ministries of health are well aware of the chronic morbidities such as blindness that can exact an economic cost as well as a cost of adherence and patient compliance.[15] Optometrists play an important role in managing these populations, usually being the first point of contact for patients seeking eyecare services in TT.

Now in its fourth year **(see Addendum)**, the BSc in optometry program at the University of the West Indies, St. Augustine, is running with a strong foundation in curriculum, clinic, teaching and support from the TT government entities and the UWI university administrators. However, it is being met with controversy by some in the community regarding the scope of practice and licensure of graduates. If all of those who have doubts on the competency level of UWI's optometry graduates would consider the competent level of education given to the students by UWI's Faculty of Medical Sciences, and prioritize the needs of the country and the population, particular-

ly the public with limited access to care, it will be evident that optometry plays a pivotal role in the long-term eye care of the patient — not just short-term provision of optical goods. Perhaps the controversies regarding the role of TT's future optometrists revolve around the educational level and competencies because improved educational development usually works simultaneously with the legislative process?[11] It is clear that UWI's optometry students are being trained to WCO's highest level of education for an optometrist. Thus, ensuring a legislative future based on reason and focused on patient needs will reflect the true abilities of UWI's future optometry graduates. Such legislative change will, until proven over time, make some uncomfortable.

Regardless of the discussion or arguments, policy-makers must always remember that the good of the patient is paramount. Patient needs should always be considered first and foremost. Optometry and UWI's BSc program currently stand at a crossroads to improve the accessibility of quality eye care for the people throughout the entire Caribbean region. A high-level training program will attract the best students and faculty from other countries, while impacting the provision of optometric services for the future and fulfilling UWI's mandate in "the provision of appropriate human resources both in terms of numbers and appropriate skills and competencies necessary to fulfill the developmental needs and in the process positively transform the Caribbean Region."[17] The reality is today's UWI optometry graduates are well-positioned to deliver the needed services and health care to protect and preserve citizens' eye health and functional vision. The UWI optometry program is soundly poised to become the primary optometry training facility for not only Trinidad and Tobago, but the entire English-speaking Caribbean

Addendum

As noted in the manuscript, the University of the West Indies, St. Augustine Campus, established the first BSc degree program in optometry in the English-speaking Caribbean in 2009. In September 2013, the program graduated its inaugural class.

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APPENDIX A

UWI BSc in Optometry Program Summary

Every credit hour is equivalent to 1 hour of lecture per week and 1 hour of laboratory biweekly

Year 1

OPTM 1011 (4 credits) Human Anatomy and Physiology
OPTM 1012 (4 credits) General Pathology and Microbiology
OPTM 1062 (3 credits) Introductory Biochemistry
OPTM 1021 (6 credits) Anatomy and Physiology of the Eye
OPTM 1022 (3 credits) Anatomy and Physiology and Physiology of Related Structures
OPTM 1031 (2 credits) Introduction to the Optometry Profession
OPTM 1032 (2 credits) Introduction to the Clinical Optometry
OPTM 1041 (3 credits) Pure Optics
OPTM 1042 (3 credits) Visual Optics
OPTM 1051 (3 credits) Vision 1
OPTM 1052 (3 credits) Perception 1
OPTM 1061 (3 credits) Learning and Key Skills Development.

Year 2

OPTM 2021 (3 credits) General Pharmacology
OPTM 2022 (3 credits) Ocular Pharmacology
OPTM 2042 (3 credits) Ocular Pathology and Immunology
OPTM 2072 (3 credits) Ophthalmic Lenses and Dispensing
OPTM 2031 (3 credits) Visual and Ocular Assessment and Techniques
OPTM 2061 (3 credits) Assessment of Binocular Vision
OPTM 2051 (3 credits) Physiology of Vision and Perception II
OPTM 2082 (3 credits) Contact Lens Practice
OPTM 2011 (6 credits, yearlong) Clinical Optometry and Communication Skills
OPTM 2092 (3 credits) Clinical Methodology and Statistics
OPTM 2102 (3 credits) Low Vision and Ageing

Year 3

OPTM 3011 (3 credits) Ocular and Systemic Diseases I
OPTM 3012 (3 credits) Ocular and Systemic Diseases II
OPTM 3021 (6 credits, yearlong) General Clinical Practice
OPTM 3031 (6 credits, yearlong) Advanced Clinical Practice
OPTM 3041 (3 credits) Visual Ergonomics
OPTM 3051 (3 credits) Binocular Vision and Orthoptics
OPTM 3061 (3 credits) Contact Lens Practice II
OPTM 3072 (3 credits) Law and Optometric Management
OPTM 3082 (6 credits) Research Project

Year 4

OPTM 4021 (8 credits) Primary Eye Care Clinical Externship (summer, semester 1 and 2)
OPTM 4022 (6 credits) Paediatric and Binocular Vision Externship (summer, semester 1 and 2)
OPTM 4022 (6 credits) Paediatric and Binocular Vision externship (summer, semester 1 and 2)
OPTM 4023 (6 credits) Cornea and Contact Lens Externship (summer, semester 1 and 2)
OPTM 4024 (4 credits) Low Vision Externship (semester 1 and 2)
OPTM 4031 (8 credits) Medical/Surgical Clinical Externship (summer, semester 1 and2)
OPTM 4041 (4 credits) Current Topics in Practice Management, Law and Ethics and Occupational Health (semester 1 and 2)

Traditional vs. Blended Learning of Pharmacology

Len V Hua, OD, PhD, FAAO
Denise Goodwin, OD, FAAO
Alfred Weiss

Abstract

Blended learning integrates online learning modules with traditional in-classroom lectures. Little is known about the effectiveness of blended learning in optometric education. The goal of the study is to compare traditional vs. blended learning by optometry freshmen, focusing on the essentials of medical pharmacology. The results suggest a positive trend in understanding pharmacology with blended learning and warrant further implementation. Even with advanced technology, instructors still must know why, what and how educational technology can enhance learning. Further, instructors should start slow and be flexible to change.

Key Words: *optometry, pharmacology, online learning, blended learning, Moodle*

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Background

Over the past few decades, computing technologies have advanced exponentially and drastically changed the way things get done in almost all aspects of life. Although the 21st century comes with the availability of very powerful computers and fast information networks, many classrooms in education, even in higher education, are still conducted via a format that was established in the 19th century. In an attempt to advance education from the 19th to the 21st century, education researchers, trainers and teachers have designed and implemented a variety of teaching methods that use online technology to improve traditional face-to-face teaching. One particularly successful strategy is blended learning, in which students learn via online activities at their convenience in addition to traditional face-to-face sessions.[1] Blended learning is not new and has been widely applied in the training industry for more than a decade.[2] Blended learning has gained more popularity and applications over the years and is believed by many education researchers to be the predominant model for future education, surpassing either fully online or face-to-face instruction.[3] In 2010, a report by the International Association for K-12 Online Learning indicated that 75% of school districts nationwide had one or more students taking an online or blended learning course, and that the revenue for the online learning market was about half a billion dollars, with 30% annual growth.[4] In 2011, Horn and Staker of the Innosight Institute reported that the number of K-12 students taking online courses has increased rapidly from 45,000 in 2000 to more than 3 million today, and that by 2019 the majority of high school courses will be available online.[5] For higher education, the number of online courses available is expected to be even higher because higher education institutions have been earlier adopters of educational technology than K-12 institutions in teaching and training students. A recent analysis of high impact scholarship and publication trends in blended learning found that the vast majority (66.1%) of the analyzed publications focused solely on

the higher education setting.[6] Clearly, online learning modules or activities have been increasingly integrated in education over the past few decades.

Blended learning has become the method of choice for many students in education and training for a number of reasons. The systematic integration of an online component to traditional teaching introduces new opportunities for students and teachers to interact meaningfully with technology.[7] Blended learning provides greater flexibility and responsiveness in the teaching and learning process.[8] Online instruction can overcome the limitations of time and space via instant access anywhere, anytime. Further, online learning modules support novel ways to learn beyond what textbooks can offer to students.[9] For example, a video clip on a subject matter can be linked and played directly online to enhance learning. Overall, applications of online technology in education can facilitate a community of inquiry and learning, which can take place asynchronously on an as-needed basis. [10]

Computer-assisted instruction also has been an important component of medical education in numerous medical institutions for more than two decades[11,12] because of its flexibility and ubiquitous accessibility. Early online learning modules were developed and used to enhance clinical experiences and to comply with medical education standards.[13,14] Recently, Rowe et al. did a literature review to determine the impact of blended learning in dental, medical and pharmacy schools. The authors found only a few studies that evaluated the role of blended learning in clinical education, but these studies suggested that blended learning has the potential to improve clinical competencies among healthcare students.[15] Additionally, blended learning has been implemented in didactic teaching as well, as in microbiology with satisfactory and valued student experience[16] and in biochemistry with a majority of students finding it intellectually stimulating.[17]

Although blended learning has been applied and studied in other health-related fields, few, if any, reports have been published for optometric education. The only report about online learning activity in optometric education was a survey given to a group of second- and third-year students from the School of Optometry and Vision Science at the University of New South Wales to assess the usefulness and the frequency of use of a learning management system (WebCT).[18] The authors concluded that Web-based learning tools can serve as a platform to facilitate independent learning and foster learning communities among optometry students.

With respect to pharmacology, Rosenbaum et al. recently designed and delivered a five-week course in clinical pharmacology via blended learning for six postgraduate dental students and concluded that a blended learning format can be successfully integrated into postgraduate dental education. The use of a blended model provided these students with enhanced flexibility, location convenience and time efficiency.[19] In an attempt to add new knowledge on the potential effectiveness of blended learning in optometric education, we designed an initial study to compare traditional vs. blended learning in a pharmacology course for first-year optometry students. This report highlights some lessons we learned and shares what we plan to do differently for a better experience and improved learning in the future.

Methods

At Pacific University College of Optometry (PUCO), Essentials of Medical Pharmacology is composed of three one-credit courses, two of which are conducted in the fall and spring of freshmen year and the third of which is given in fall of sophomore year. This study was done for the first course, which was taken by 90 optometric students in the first semester of their first year. The class started with a traditional method of a one-hour lecture on Wednesdays followed by biweekly quizzes and a midterm exam. This is the way most of the first-year courses are conducted at PUCO. Once half of the pharmacology course was completed, the class shifted to a blended learning format. During week eight, online learning activities were added to the face-to-face discussion for the remaining half of the course. In this portion of the course, online learning activities were posted onto the Moodle Learning Management System on Sundays prior to the in-class lecture on Wednesdays. (**Table 1**) The students got an e-mail update whenever a new learning item was posted onto Moodle. Additionally,

Table 1
Representative Contents on Moodle

Traditional Contents on Moodle	Blended Contents on Moodle
3 September - 9 September oQ1 dQ1 Assessment reflection 1_2-Intro PD PPT as part of session 1 10 September - 16 Septembe dQ Question dQ2 PD Chat Prefixes-Suffixes 3_4-PK Question on oQ availability	5 November - 11 November Anesthetics oQ4 Weekly Forum Post your question or comment here! Anesthetics Summary Systemic and local anesthetics 1 Anesthetics LP1 in class Anesthetic LP2 after class Anesthetic-PostQ 12 November - 18 November Respiratory Drugs Respiratory Drugs-Summary dQ5 Respiratory-PostQ

students were reminded to complete the weekly online learning activities before coming to class. The pre-session online activities included a summary podcast on the topic of the week and an online quiz with five questions. When the blended learning format was first introduced, the in-class sessions began with several questions being presented to the students via Poll Everywhere (www.polleverywhere.com/). (**Figure 1**) The students worked in randomly assigned groups of four or five to complete the questions and submit answers. The responses were immediately viewed as they were submitted with the software, and further explanation and clarification were conducted by the instructor. A post-session quiz with five questions was made available online until Fridays. Weekly podcasts of the relevant topics were recorded in 5- 10-minute segments via Audacity software (http://audacity.sourceforge.net/) or Camtasia software (http://www.techsmith.com/camtasia.html). Assessments including biweekly quizzes and two exams were carried out online via Moodle for the entire course. Pre-tests and post-tests were developed and administered before and after each half of the course. Additionally, a satisfaction survey was administered to the students at the end of the course. T-tests were performed to evaluate the results of tests and exams comparing the data of the two formats.

Results

Sixty-three out of 90 students responded to the end-of-class survey. **Figure 2** shows that about two-thirds of the students found the online activities were helpful in preparing for class discussion or performing on a quiz. Similarly, **Figure 3** shows that about two-thirds of the class found the online activities useful in understanding pharmacology. **Figure 4** confirms that the majority of the class spent more than an hour engaging in course work outside of the class for each hour in-class session, and 21% of students spent more than three hours working outside of class time. **Figure 5** identifies that about half of

Figure 1
An Example of Interactive Discussion via Poll Everywhere

Figure 2
Students Respond to How Well Online Learning Modules Prepared Them for Class or Quiz

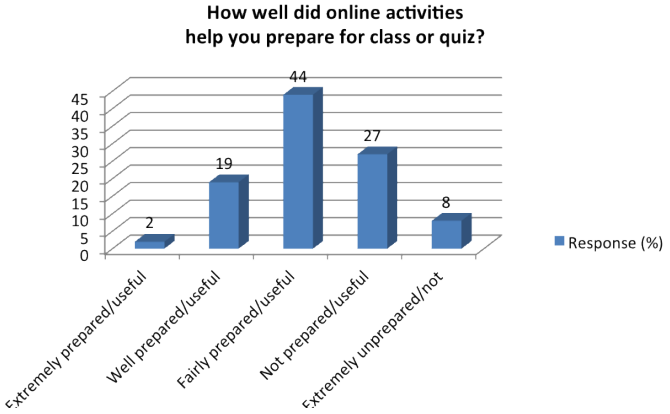


Figure 3
Students Respond to How Well Online Learning Modules Helped Them to Understand the Material (n=63)

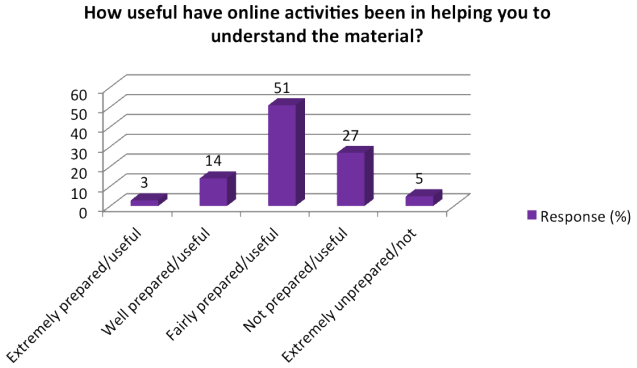


Figure 4
Students Respond to How Much Time They Spent Outside of Class for Each Hour in Class

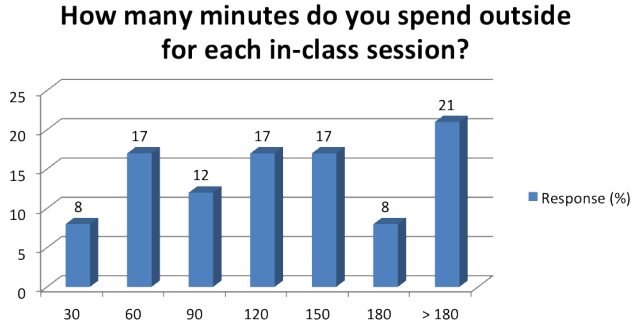


Figure 5
Students Respond to How Much Online Material They Prefer

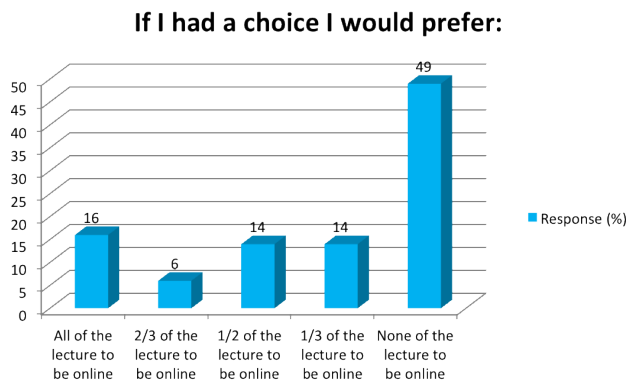


Figure 6
Students Report Which Format They Prefer

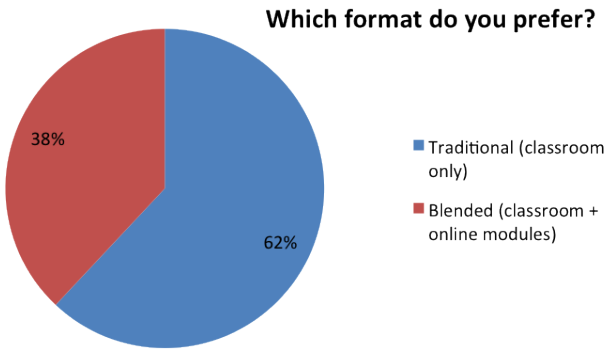


Table 2
T-Test Analyses of Pre-Tests and Post-Tests

	Traditional Learning		Blended Learning	
	Pre-Test	Post-Test	Pre-Test	Post-Test
N	90	86	88	88
Average (x/16)	7.04	12.82	5.81	7.06
STDEV	2.09	2.43	1.87	2.43
Two-Tailed T-Test	$P = 1.05 \times 10^{-37}$		$P = 1.79 \times 10^{-4}$	

Table 3
T-Test Analyses of Exam 1 via Traditional Teaching vs. Exam 2 via Blended Learning

	Exam 1	Exam 2
N	90	90
Average (%)	75.15	77.28
STDEV	8.14	11.52
Two-Tailed T-Test P = 0.155296		

the class preferred to have some online activities in addition to traditional lecture, whereas the other half did not prefer to do online activities. **Figure 6** shows that the majority of students were more comfortable with the traditional format.

Two-tailed t-test analyses were done to compare the effectiveness of traditional vs. blended learning with respect to tests and examinations. **Table 2** shows both methods significantly improved the average post-test scores. **Table 3** shows the class average percentage for exam 1 via traditional learning was not significantly different from the class average percentage for exam 2 via blended learning. Finally, **Table 4** presents some representative likes, dislikes and suggestions for future improvement to the course.

Discussion

To the best of our knowledge, this was the first study comparing traditional learning with blended learning in medical pharmacology by a large class of optometric students. As an initial attempt to introduce blended learning in pharmacology, we wanted to know how students would accept a new educational method, and how effective it

Table 4
Summary of Representative Reflections from Students in the Course with Regard to Blended Learning

Likes	Dislikes	Suggestions
I really like online modules because I'm able to listen to the lecture before AND after class.	It seemed like WAY too much information for a 1-credit course.	Make sure it's known what's expected of us.
It is helpful to have the online modules because then we are able go back and re-listen to them while we study.	They sometimes add more work/demand than should be necessary for a 1-credit class.	I feel that the lecture time in class should be used to teach and go over required material, while questions and modules should be done outside of class.
I enjoyed having two attempts at the online quizzes because I felt less pressured time-wise.	No more online lectures unless it is supplemental to the actual lecture material given in class.	Consistency is the most important so that we know what to expect and how to study.
I really love the post quiz questions because it gives me an idea of where my focus should be.	I didn't like how we have to listen to the recordings prior to lecture.	I think online pharm "assignments" every week is better than quizzes.
I also like the learning points.	Depending on the workload for the week it was sometimes challenging to fit in time to listen to the online modules.	OPT541 should be formatted how we are currently doing it with the traditional lecture in class with activities on Moodle and learning points on the side.
I really liked how on one of the lectures the information was already in the notes.	It is also hard to expect us to have the time to sit down and learn the material before we come to class. This is only a 1-credit class and I feel too much has been expected of us for this type of course.	I would like to have the online quiz questions available after it is taken.
Online modules were helpful in preparing and knowing what we would be discussing in the upcoming class. I believed the blended lectures helped a lot in preparing for the quiz.	It's just kind of inconvenient to remember to do another thing outside of class, and then if you don't remember to listen to the online lecture you're totally lost during lecture.	Maybe you could disperse the quiz questions a little bit throughout the lecture after you cover the concept.
Since so much of the information goes by really quickly, it's nice to be able to go through the Power Point with the audio lecture when studying.	I don't like that we have all of our tests and quizzes on our computers.	I think that whatever is on the online module should also be gone over in class, and then it can be used as supplementary material.

is compared with traditional teaching strategies. A snapshot of the representative contents on Moodle is presented in **Table 1**. The data from the study provided some interesting lessons and recommendations for future improvement and implementation.

After two blended sessions, at week nine and 10, feedback from the students was that many of them were lost during the face-to-face discussion because they did not have time to do the pre-session online activities before class. They were busy with other courses and would like to have the materials presented to them in class as before. For those who did the pre-session online activities, they found that the online learning activities were helpful for them to follow the interactive discussion via Poll Everywhere. They had a better understanding of the course materials and did well on the quizzes (**Figures 1 and 2**), but they also wanted to have some materials presented in class. By just having questions and answers via Poll Everywhere alone, they felt lost the majority of times. The students' immediate reactions to the blended format were understandable because this was their first semester in a professional school with a heavy load of courses. They had just started to get a handle on their courses and were becoming comfortable with the traditional format of learning in this and other classes, and suddenly they had to embrace a blended learning format with new delivery of materials in this course after the midterm. Moreover, pharmacology was only a one-credit course that appeared to require relatively more work outside of class compared with other courses (**Figure 4**).

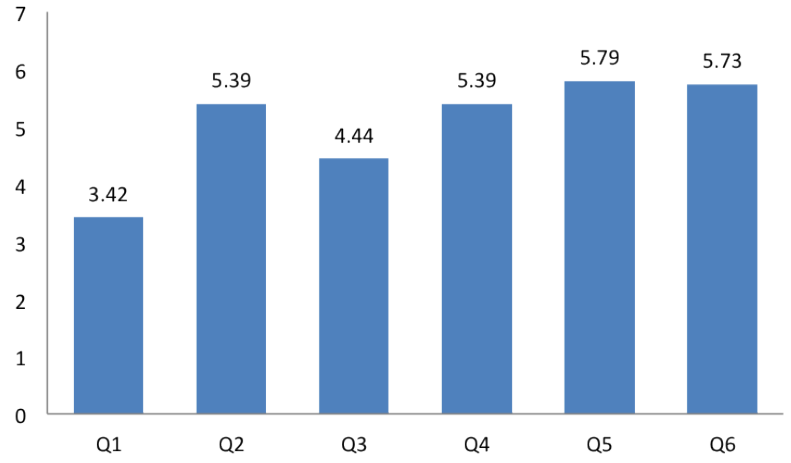
After two initial sessions of the blended format and feedback from the students, a few changes were adopted. The pre-session online summary of the weekly topic continued to be posted prior to the face-to-face session. However, some materials were also presented in class. In addition, Poll Everywhere was still used, but at a later portion of the class to review what was covered. Post-session quizzes were discontinued because many students did not have time to complete the quiz within the short time frame that it was open. Most of the students appreciated the changes and were comfortable with the new blended format for the rest of the course.

In terms of assessment outcomes, some assessment outcomes did not show significant differences after the change to the blended learning format. The post-tests were significantly better than pre-tests with either format, confirming that the students learned new knowledge about pharmacology regardless of teaching format. (**Table 2**) Similarly, there was not a statistically significant difference in the average percentage score between exam 1 via traditional learning and exam 2 via blended learning. (**Table 3**) Moreover, the average of the last three quizzes via blended learning was higher than the first three quizzes via traditional learning. (**Figure 7**) Although blended learning was carried out for only five sessions, the cumulative data suggests a positive trend in understanding pharmacology with blended learning and warrants further implementation.

At the end of the course, a completion survey was administered via Moodle, and students were encouraged to provide reflections on the course. Sixty-three out of 90 students in the class responded with answers and feedback. The majority of respondents found that online activities were helpful or useful in preparing for quizzes and understanding pharmacology. (**Figures 2 and 3**) About half of the respondents preferred to have some online activities as part of the course (**Figure 5**), even though they needed to spend more time outside of class learning via online activities. (**Figure 4**) However, when it came down to which format of learning they would choose, the majority of respondents chose the traditional method. (**Figure 6**) This final answer was surprising initially, given the data that students in the blended learning portion of the course achieved slightly better assessment outcomes. Perusal of the feedback on likes, dislikes and suggestions as summarized in **Table 4** showed that students liked the online activities, which were convenient and accessible anytime. The major dislike was that too much time was required in the blended portion of the class for a one-credit course when compared with other higher-credit courses. Therefore, the main reason why the majority of responders still preferred the traditional format might be that it required less time outside of class for a one-credit course.

After evaluation of students' reflections, a few meaningful reminders need to be made. Students do not like sudden change once they have established their learning habit. Further, they do not want to spend more time outside of class to learn independently online. A few lessons learned from this study include the importance of giving and repeating clear instructions and ex-

Figure 7
Average Quiz Score (x/6)
(The first 3 quizzes were via traditional learning; the later 3 quizzes were via blended learning.)



pectations whenever a new teaching format is used, making sure that additional online activities require a reasonable time commitment, and providing open-access to practice questions. Based on the experience, feedback and suggestions from this study, the next course in the series will be conducted via blended learning with a pre-session online summary, in-class discussions, biweekly quizzes and exams.

Although blended learning incorporates advanced educational technology, educators must first know why they want to use the educational technology, what they want to achieve and how the educational technology can enhance teaching.[20] Further research of blended learning literature revealed that a face-to-face component is critical to the success of blended learning because students like to be in class and work with peers to connect, collaborate and learn from each other. Furthermore, students also appreciate interacting with and learning directly from their professors. This is supported by earlier research, which discovered that when the face-to-face portion was eliminated, the teaching was ineffective.[21]

In a recent article, six blended learning models were proposed.[5] The first is the face-to-face driver model in which the teacher uses online learning to supplement in-class lecture. The second is the rotation model in which students spend a fixed duration of time learning online and the remaining time in class. The third is the flex model in which most of the learning is online and the teacher is available on an as-needed basis. The fourth is the online lab model in which the entire course is delivered online, but within a brick-and-mortar setting, and is supervised by paraprofessionals. The fifth model is the self-blend in which students choose to take one or more courses online to supplement their diploma requirements. The sixth and final is the online driver model in which all the course contents are delivered online with online teachers. For those who plan to implement a blended learning model for the first time, a face-to-face driver model is probably the easiest and best way to begin because it allows for a slow transition or flipping from traditional learning to online learning. In this model, the teacher delivers most of the course content in class and uses online learning modules as supplements.[5]

The strengths of this study were that it was done in a relatively large class and compared blended with traditional learning. The weaknesses of the study were that it was a simple study design and could not convincingly answer the question on effectiveness because there were various uncontrollable variables, such as students' previous knowledge of pharmacology and the time students spent online. However, the study provided valuable experience for better study design for future investigation and for improvement of future implementation in the next series of the pharmacology course.

Conclusion

Blended learning has been implemented and studied in higher education for more than a decade. More recently, K-12 schools also have incorporated blended learning in their curricula. The promises of blended learning are that it has potential to be transformative by offering the "best-of-both-worlds." That is, by incorporating the ubiquity of online learning approaches with the best active learning that traditional face-to-face education affords, students would be more engaged in learning and retaining new knowledge. Although it is exciting to incorporate novel educational technology into teaching, one must know why, what and how online learning activities can enhance learning. Moreover, one must start slowly with clear instructions and expectations, and be adaptable to feedback and changes.

Acknowledgements

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Publication Guidelines for *Optometric Education*

Circulation

Optometric Education, ISSN 1933-8880, a peer reviewed, national and international publication of the Association of Schools and Colleges of Optometry, is published online three times during the academic year. Its circulation includes all of the accredited optometric educational institutions in the United States, as well as students, practitioners, government leaders, and others in the health sciences and education. Its readership also extends to numerous optometry schools outside the United States. Established in 1975, as the Journal of Optometric Education, it is the forum for communication and exchange of information pertinent to optometric education. It is the only publication devoted entirely to optometric education. The goal of the journal is to embrace and support scholarly achievements for the advancement of optometric education and the profession. The journal supports a broad interpretation of scholarship based on the scholarship of discovery, integration, application and teaching. [1]

Examples: [1]

- Discovery: original research
- Integration: novel insights, interpreting themes in discoveries, identifying connections between discoveries. Examples: literature synthesis, conceptual framework
- Application: building bridges between theory and practice. Example: teaching case reports, etc.
- Teaching: communicating one's knowledge, facilitating student's learning, enhancing self directed learning. Examples: comparison of teaching methodologies, development of new pedagogy, etc.

Manuscripts

Manuscripts are considered for publication with the understanding that they are original contributions and have not been submitted for publication or accepted for publication elsewhere. All pages should be numbered consecutively; beginning with the title page. The title page should include the manuscript's title, the author's (authors') name(s) and a brief bio (1-3 sentences) of each author(s). A cover letter should accompany all manuscripts and the letter should identify the corresponding author. The cover letter should also contain a statement that the manuscript has been approved by all of the authors of a multi-authored paper. Copies of letters of permission and other pertinent information should be included.

A blinded copy of the manuscript that omits your name and any reference to your institution must also be submitted with the intact manuscript. Make sure that track changes and all other identifying information are removed from the "blind" version.

Submit the cover letter, intact and blind copies of the manuscripts with original figures electronically at submissions@opted.org.

Conflict of Interest

Authors must disclose (on submission) existence of any financial arrangement with a company whose products figure prominently in the manuscript or with any competitor company. For articles in which frequent references are made to name brand devices, medications, or products – whether any of the authors has such an affiliation or not – a disclaimer should be submitted for clarification (to be published at the end of the article).

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Peer Review Process

All research, teaching case reports and communication manuscripts that are submitted for publication are peer reviewed by two or more members of the journal's editorial review board or in some cases, two or more independent referees who are content experts in the subject area of the manuscript. Reviewers' identities are kept confidential as are author identities. The complete peer review cycle takes approximately two-three months. Every effort is made to publish manuscripts within six-twelve months of final acceptance.

If revisions to the manuscript are needed, authors must submit to the managing editor, difft@opted.org, the revised manuscript including both an intact and "blind" copy, as well as the reviewer's comments and how each of the com-

ments or suggestions was addressed. Do not send track changes.

Contributions that are not peer reviewed include: Editorials, Letters to the Editor, Think Tank, My Best Day in Optometric Education, Educator's Podium and Special Reports.

Editor

One of the roles of the editor is to ensure that the journal publishes high quality educational articles. In addition to the peer review process the editor may review and evaluate articles for publication. All manuscripts must receive an acceptable rating before publication.

Manuscript Submission

All manuscripts should be submitted in the order listed: Title page, Abstract, Manuscript, Acknowledgments, References, Footnotes, Tables and Figures and Appendices.

Title Page

The title page should include the manuscript's title, the author's (authors') name(s) and a brief bio (1-3 sentences) of each author(s). Bios are usually brief, a maximum of two to three sentences long. In a multi-authored manuscript, the person who has made the most significant intellectual contribution to the work should be listed first, regardless of academic rank or professional status. This list should include only those who have made a substantial contribution to the design and execution of the work and the writing of the manuscript. Title page should also list contact information for corresponding author, including phone, fax and email address.

Abstracts

Abstracts should be typed on a separate sheet of paper in one paragraph, and should not exceed 100 words. Abstracts should be as informative as possible and should contain statements regarding background, methods, results, and conclusions. Authors should select about five key words that reflect the primary subject matter of the paper. The purpose of key words is to assist reference librarians and others in retrieval and cross-indexing. The abstract should describe the problem or topic addressed how the study was prepared/conducted, the most important results and what can be concluded from the results.

Acknowledgements

Only those who have made a substantial contribution to the study should be acknowledged. Authors are responsible for obtaining written permission from those acknowledged by name, because readers may infer that acknowledged persons have endorsed the methods and conclusions of the manuscript. Many contributions justify acknowledgement, but not authorship. Such contributions might include acknowledgement of technical help, financial support, sources of materials, and persons who have contributed intellectually to the development of the manuscript.

References

A list of references is placed at the end of a manuscript following the corresponding author's address. References should be listed in sequential order as they are cited in the text by superscript numbers. Accuracy of citations is of major importance because it makes each specific reference retrievable by the reader. Authors should make every attempt to cite references that are relevant, original and current and only references actually consulted. References to personal communication, unpublished information and papers either "in preparation" or "submitted for publication" are discouraged. Manuscripts that have been submitted for consideration for publication, but that have not been accepted, should not be referenced.

Most optometric journals have adopted the style of references used by the U.S. National Library of Medicine.

Basic examples of the correct form of referencing are listed below:

Book citation:

Cervero, RM. Effective continuing education for professionals. San Francisco, CA: Jossey-Bass,

Inc.; 1988.

Journal citation:

Smith RD. The application of information technology in the teaching of veterinary epidemiology and public health. J Vet Med Educ. 2003;30(4):344-50.

Standard citation of an Internet homepage:

Complementary/Integrative Medicine [Internet]. Houston: University of Texas, M. D. Anderson Cancer Center; c2007 [cited 2007 Feb 21]. Available from: http://www.mdanderson.org/departments/CIMER/.

Complete NLM reference guidelines can be found at:

http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=citmed

Footnotes

Footnotes may be used to designate a non-retrievable citation or a personal communication. A footnote can also be used to identify sources of equipment or instruments. Footnotes should be identified with small superscript lower case letters in alphabetical order in the text, and referred to at the end of the text of the manuscript under a listing "Footnotes."

Tables and Figures

The use of too many tables, figures or other illustrations in relation to the length of the text may produce page layout difficulties. In general, Optometric Education publishes one illustration for every 1,000 words of text. Authors should consult the CBE Style Manual for further information on preparation of tables, figures and other illustrative material.[4]

Appendices

Occasionally it is necessary for the author to supply subordinate information that is relevant to the study but that might

distract the reader because of excessive detail, e.g., computer programs, mathematical formulas, address lists, surveys or other data that might be cumbersome to present in the text. Appendices should be labeled Appendix A, Appendix B, Appendix C, etc. Each should have a short, descriptive title.

These instructions are in accordance with the Uniform Requirements for Manuscripts Submitted to Biomedical Journals (Uniform Requirements). [2,3]

Institutional Review Board

When appropriate, the prevailing Institutional Review Board must review all studies/ projects and the outcome of the review process must be stated in the manuscript.

Types of Submissions

1. Research Articles

The goal of scientific writing is effective communication. More specifically, its goal is to communicate abstract propositions, logical arguments, empirical observations, and experimental results, including their interrelationships and interactions. Authors should use the active voice ("this study shows" rather than "it is shown by this study") and the first person ("I did" rather than "the author did"). The past tense is appropriate for describing what was done in an experiment; the present tense is suitable for referring to data in tables and figures. Manuscripts should be organized within the framework of a format outline. The standard outline for reporting of studies, experiments, or other research projects is as follows:

Background

The introduction has several functions. It acquaints the reader with other relevant work performed in the subject area. Only contributions that bear on the interpretation of the results should be referenced. The introduction also presents the general nature of the problem to be addressed, the specific aspect of the problem that was studied, and the hypothesis and the manner in which it was tested.

Methods

The methods should be described in enough detail so that others could replicate them. However, if portions of the methods have been described elsewhere, a summary with appropriate citations is sufficient. It is essential to describe how case and control subjects were selected for study. It is important to describe any commercially available apparatus used in the study by identifying the manufacturer's name and address. Brief descriptions of methods that have been published but may not be universally understood should be presented. In addition, limitations of the methods employed should be presented, and new or modified methods should be described in detail. It is important to identify precisely all contact lenses, chemicals, drugs, or ophthalmic lenses, including generic names, dosages, and administration where appropriate. It is inappropriate to publish names of subjects or patients, their initials or other personal identification. Also, it is inappropriate to use ethnic terms when they serve only to perpetuate unnecessary, unscientific or derogatory connotations.

Results

The results should be presented in a logical order, emphasizing only important findings of the study without elaboration. Limitations of the results and any implications should be stated. The statistical analysis, if any, should be clear and relevant.

Discussion

The discussion should elaborate on the data, noting the interrelationships among the results and relating them to the original question asked in the study. Acceptance or rejection of the hypothesis should be stated. In addition, the discussion should emphasize any unique or new aspects of the study, and discuss the relevancy of the results. It is important to draw those conclusions that can be supported by the results. Implications for basic and applied issues should be stated wherever possible.

Conclusion

Inferences, future research implications and the uses of findings in practical decision making are summarized.

Strengths and weaknesses of the study may be summarized as well as potential impact of the study.

2. Teaching Case Reports

Teaching case reports should be drawn from an actual patient encounter, rather than a composite or fictionalized description. Teaching case reports may be either interventional or observational. Interventional case reports are reports of one (or two) cases in which the outcome of an intervention is described. Observational case reports are reports of one (or two) cases in which the natural history, testing or clinic pathologic correlation is the main theme. Teaching case reports should include: background, educational guidelines, which may include a brief literature review, case description, learning objectives, key concepts, discussion points, discussion/conclusion and references.

Background: Brief introduction to the case, intended audience, relevance of case, and background information on the ocular condition/disease presented in the case.

Case Description: The case description includes the presentation of the case. The author should hold all discussion points until the discussion section. This will allow educators to extrapolate data from the case without having to dissect out discussion comments.

Education Guidelines: The information needed to facilitate a discussion of the case. From the students perspective the knowledge base needed to actively participate and benefit from the case discussion. The educational guidelines may include a brief literature review.

Learning Objectives, Key Concepts, Discussion Points and Discussion: Learning objectives, key concepts, discussion points and the discussion represent the teaching components of the reports. The case discussion section may be used as a vehicle to teach at a more in depth level information contained in the educational guidelines. This section may include teaching methodology, questions to facilitate discussion, critical analysis of information etc.

3. Scholarly Communications

This type of manuscript generally communicates in a scholarly manner an idea, concept or information that is relevant to health professions educators. This type of manuscript supports the scholarship of integration, application and or teaching. Therefore, communication manuscripts must contain scholarly elements, such as novel insights, interpreting themes in discoveries, identifying connections between discoveries, links between theory and practice, comparisons or analysis of teaching methodologies etc. All types of scholarship should contain a clear understanding of the current literature and links to past scholarly work. **Manuscripts which are only descriptive of a course, program, pedagogy, teaching activity, etc. cannot be considered a scholarly communication piece.** Manuscripts on course material, curriculum or programs may be considered communication pieces if the manuscript is written in a scholarly manner.

Communications can also review a body of literature on a specific subject for the purpose of providing health professions educators with guidelines or recommendations regarding the subject matter. Headings for a communications paper do not usually follow the standard format for a research paper, but the author should use headings and subheadings that promote understanding of the topic.

4. Educator's Podium

The Educator's Podium is a forum that provides an opportunity for optometric educators to share, think and question any area related to the educational process or improving patient care. It is an opinion based, non-peer reviewed forum. These submissions should be descriptive or pose a challenging educational dilemma or problem.

Submit all Educator's Podium contributions to Dr. Aurora Denial deniala@neco.edu. The editor will review the submission and determine if it is appropriate for this forum. The submission may be returned for minor revisions or comments. Submissions should be a minimum of 500 words, maximum of 1,500 words. Submissions should include a brief synopsis of the article (maximum of 150 words) for posting on Facebook.

References:

1. Boyer EL. Scholarship Reconsidered: Priorities of the Professoriate.Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.1990.
2. International Committee of Medical Journal Editors. Uniform requirements for manuscripts submitted to biomedical journals. N Engl J Med 1997; 336(4):309-15.
3. Excerpted and modified from Ophthalmology – Instructions for Authors, revised July 2001
4. Style Manual Committee, Council of Biology Editors. Scientific style and format: the CBE manual for authors, editors and publishers, 6th ed., revised and expanded. Prepared by the CBE Style Manual Committee, Bethesda, Maryland: Council of Biology Editors, 1994.

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