FLIPPING THE OPTOMETRIC CLASSROOM WITH ONLINE LEARNING

by

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ABSTRACT

Background: The flipped classroom is a relatively new teaching modality that is being employed by teachers and professors of all levels, from high school to graduate school. By researching flipping the classroom studies at various institutions, this project will report on the positives and negatives of the modality. In addition, this project will attempt to connect the studies, and hopefully open the door, to utilizing this teaching style in optometry schools. *Methods:* This report analyzed research that was conducted at various educational levels including Southern College of Optometry, the University of North Carolina College of Pharmacy, undergraduate universities in the subjects of physics and biology, and high school in the subject of mathematics. Each study, although different, employed similar techniques to study the efficacy of flipping the classroom. *Results:* The studies analyzed in this paper demonstrated successful results for flipped classroom techniques. *Conclusions:* The studies that were researched demonstrated many positives of flipping the classroom. Although these studies all showed short-term effectiveness of flipping the classroom, it is agreed and a well-known fact that more research is needed in this area. In addition to the research, there are recorded videos covering various topics to be used for future first through fourth year optometry students included at the end of this project.

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CHAPTER 1

INTRODUCTION

The flipped classroom is a relatively new educational modality that has been used in teaching institutions across the nation for many years. This modality was first conceived in the early 2000's but did not become a reality until 2007 when two high school teachers in Colorado discovered software that would allow them to record their PowerPoint presentations in real time and post them to the web for student use. The following year the two teachers pre-recorded all lectures for students to use before class time, and thus began the now termed "Flipped Classroom."[1] A flipped classroom is defined as interactive group learning activities inside the classroom and direct computer-based individual instruction outside the classroom.[2] The main ideology of the flipped classroom is that work that is typically done as homework, such as worksheets and essay writing, is better undertaken in class with the guidance of the instructor; whereas, listening to lectures is better accomplished at home.[3] Numerous case studies have been performed to test the flipped classroom technique, all proving its efficacy in the classroom. However, few studies have been done to test this modality in the optometric classroom. The goal of this research project is to report on flipped classroom studies, as well as to create learning modules to be used outside of the classroom in order to foster better understanding of select optometry skills and principles.

CHAPTER 2

METHODS

The Southern College of Optometry studied the effectiveness of traditional teaching methods versus flipped classroom methods in 2012 and 2013. In 2012, the Ocular Pharmacology courses received a traditional lecture modality with the typical reading assignments, handouts, exams, and lectures. Video recordings of the lectures were available for students to access if needed. The course teaching modality was "flipped" in 2013. Pre-recorded lectures were available for students well before class, as well as digital and hardcopy versions of the PowerPoints, outlines, and articles. Students would then use the scheduled lecture hours for small group discussions in order to properly prescribe various ocular pharmaceuticals for different cases. The final exam was used to compare the two teaching modalities.[4]

The University of North Carolina College of Pharmacy professor Russ Mumper flipped his Basic Pharmaceuticals II course. He and his team received a $10,000 grant to demonstrate how students in the flipped classroom achieved better grades, were more engaged in class, and improved their application of course material.[5] The study tracked and compared data from three consecutive courses of the Basic Pharmaceuticals II course given during the first year of the pharmacy program. The first course, given in 2011, was taught via the traditional method, with 75-minute lectures given two days a week. The second two consecutive courses, taught in 2012 and 2013, were given via the flipped

model. The in-class lectures given previously were transitioned to shorter online videos that students could watch and review as needed. Lecture hours were then used for student-centered exercises designed to assess knowledge, promote critical thinking, and stimulate discussion.[6]

Carl Wieman and colleagues also published evidence that proved the success of flipping the classroom. The group studied a large, two section physics class to gather data. During the twelfth week of the semester, after determining that the two sections were equal in teaching methods and learning gains, one section was "flipped." The students in the new flipped classroom section were given reading assignments and quizzes to do at home, and were instructed to use scheduled class time for group discussions and written response quizzes. The control section continued the remainder of the semester using traditional learning techniques through assignments, class lectures, and class exams. In order to determine the effectiveness of flipping the classroom, a multiple choice exam was given to both sections, and student engagement was also measured.[7]

Moravec et al. used similar techniques to flip an introductory biology course. Students were required to watch video recordings of PowerPoint presentations and complete a worksheet prior to lecture. During the scheduled lecture time students participated in ten minute mini-lectures and roughly five minute active learning exercises. The successfulness was determined by analyzing exam questions specifically related to the content taught outside the classroom via videos.[2]

Lastly, two professors in Niagara Falls, NY proved that the flipped classroom modality can be successful even in mathematics courses. Amy Kilmer and Ed Ventry pre-

recorded mathematics lessons, posted them to an on-line platform for students to access at home, and provided guided notes for students to complete while watching each lesson. Students then came to lecture to work in small groups to discuss troubling equations and work on additional assignments.[8]

CHAPTER 3

RESULTS

The teaching modalities at Southern College of Optometry's Ocular Pharmacology course were compared by analysing the results of the 2012 and 2013 final exams. The mean for the 2012 class was 81.56% and the range was 52%-98%. The mean for the 2013 class was 83.62% and the range was 64%-100%. Although the difference is small, this demonstrated that the flipped classroom modality is effective in optometric education.[4]

Following the three year study at the University of North Carolina College of Pharmacy, cumulative final exam performance was assessed. The results showed a 5 point increase from 80% in 2011 to 85.1% in 2013. In addition to student success, student opinions rose after the flipped classroom modality was instituted. Ninety-three percent of students agreed that the flipped classroom improved understanding of key concepts, and 91% agreed that this modality greatly enhanced their learning. Attendance was also shown to be noticeably higher in the flipped classroom courses.[5,6]

Carl Wieman and colleagues found, using four trained observers, that student engagement increased from 45 +/- 5% to 85 +/- 5% in the experimental section but remained unchanged in the control section. To assess the amount learned over the experimental period a multiple choice exam was given to both sections of the physics course. The flipped classroom scored an average of 74 +/- 1% compared to the average

score of 41 +/- 1% for the traditional classroom, thus confirming the effectiveness of this teaching modality. Long term gains were not studied by Wieman and colleagues.[7]

Moravec et al.'s study led to a performance increase of 21% on exam questions related to the topics introduced outside the classroom with videos. One fault with this study, however, is the short length of time that this experiment was run - the flipped classroom modality was only instituted for three lectures. Although the authors did not maintain this modality for a longer period of time, the dramatic increase in student learning still supports the flipped classroom modality.[2]

Kilmer and Ventry's studies resulted in dramatic improvements in test results on the Regents exam, an optional statewide standardized exam testing core high school subjects. Eighty-three percent of students in honors trigonometry passed the Regents exam, compared to 71% the year before; and 35% achieved scholastic mastery, compared to 14% the year before. Fifty-five percent of students in general algebra passed the exam, compared to 35% the year before; and 7% achieved mastery compared to 4% the year before.[8]

CHAPTER 4

DISCUSSION

As seen in the above five studies, there is evidence proving the effectiveness of flipping the classroom in areas such as student performance and engagement. Although there is variation in the methods of these studies, they all had the common theme of online lectures utilized in combination with close-ended homework assignments including problems and quizzes. According to a compilation of studies titled The Flipped Classroom: A Survey of the Research, flipping the classroom is carried out in a way that utilizes "group-based interactive learning activities inside the classroom, citing student-centered learning theories based on the works of Piaget and Vygotsky."[2] Another way of describing this modality comes from Case Studies and the Flipped Classroom where the principle behind flipping the classroom is described as, "work typically done as homework (e.g., problem solving, essay writing) is better undertaken in class with the guidance of the instructor. Listening to lecture or watching videos is better accomplished at home".[3] With a discussion focused on problem solving and guidance on typical homework items, the flipped classroom is more than simply swapping lecture and homework; it is a complete expansion of a curriculum.[2]

There are many benefits and positives for both students and educators that have been discovered while researching the effectiveness of the flipped classroom. Many of the studies are performed in the STEM (science, technology, engineering, and

mathematics) realm, which correlates to the medical model. Teachers and instructors have collaborated and listed many benefits that help to lure both professors and students into this learning modality. With lectures being recorded, students are able to move at their own pace and are able to pause to take notes and replay the material as desired. In addition, professors are able to see what areas of homework are common struggles and can focus attention on difficult areas, which means the curriculum can be changed to better suit the students in real-time.[3] This leads to a more effective use of classroom time. Also, professors have found students enjoy this modality and saw increases in the amount of student achievement and interest as compared to the standard lecture classroom experience. Also, technology is constantly on the rise and students appreciate their education moving towards being more technologically savvy.[3] Not only do students enjoy the use of technology, but instructors can also be more flexible with how material is presented. In addition, since classroom time is not used for lecture, there is more time to spend on research and scientific equipment that is not typically available at home.[3] Another benefit relates to students who are involved with extracurricular teams and events. These students are able to attend their extracurricular events and they do not have to miss out on valuable lecture time when they are unable to attend class. Overall, this method has been found to increase and promote thinking inside and outside the classroom since the classroom time contains valuable problem solving and expansion of understanding of the material presented to the students online. [3]

In addition to the many positives that were observed in the above studies, there were a few negatives that educators in the STEM group pointed out. One main problem is that some students came to class underprepared and did not engage in the problem-

solving and discussion activities because this modality requires at-home involvement for success.[3] In addition, there was some student resistance because of the work required ahead of class time and because the initial time the students are exposed to the material, they are at home rather than at school. Some educators tried to combat this problem by administering a short quiz either online or in class to cover the basic concepts outlined in the online lecture.[3] Another negative that STEM educators reported on was the difficulty of obtaining appropriate lecture materials. Some instructors feel the videos must be custom tailored to students for the best possible outcome. This obviously varies for different subject matter and student age. Many of the instructors reported that they used lectures provided by online learning centers such as the Kahn Academy and BozemanScience.[3] Other instructors are compiling their own lectures, which takes valuable planning skills and time. Instructors who are recording their own lectures have used software programs like Camtasia, PaperShow, Tegrity, or iPad applications like Educreations and Explain Everything. Once the desired lectures are chosen or recorded, they must be posted to either easily accessible sites like YouTube or iTunes or to course management sites like Blackboard or Moodle.[3]

With its reported success and large list of positives, many medical schools are implementing this type of teaching modality and some schools of optometry are incorporating the flipped the classroom into their curriculums. Michigan College of Optometry at Ferris State University has two pioneering professors experimenting with this teaching style. Drs. Randy Vance and James Miller have both utilized flipping the classroom in their courses. Dr. Vance has used it in his procedures course to successfully teach first-year students the basic principles of an optometric exam. Dr. Miller has

flipped his ethics classroom for first-year students to leave more class time available for valuable discussions on controversial topics. Other schools of optometry are also incorporating this style into their curriculums. Southern College of Optometry has led the way in research in incorporating technology into all four years of their program. Table 1 below is a model for each of the four years of optometry school and their proposal for expanding their program to include more technology.[9]

Professional Year	Course Title	Relevant Content	Educational Modality
PY1	*Optometric Theory & Methods I & II*	Application of optometric informatics in clinical setting - skills and techniques for direct patient care	Traditional lecture, e-capture, e-management & practical laboratory
	Practice of Optometry I	Introduction to optometric informatics in clinical setting - access, quality of care, cost of care	Blended learning, e-capture, e-management
PY1	*Optometric Theory & Methods III , IV & V*	Application of optometric informatics in clinical setting - skills and techniques for direct patient care	Traditional lecture, e-capture, e-management & practical laboratory
	Practice of Optometry II	Legal & ethical issues related to informatics, assessing community health needs, HIPAA, DICOM	Blended Learning, e-capture, e-management
	Clinical Communication & Patient Care	Application of optometric informatics in clinical setting - skills and techniques for direct patient care	Blended learning, e-management & practical laboratory
PY3	*Clinical Internship I, II & III*	Application of technology in patient care, general office operation and patient satisfaction	Active participation, online resources
	Practice Management	Design & assessment of optometric informatics for patient flow, patient contact, office efficiencies, patient experience	Blended learning, e-capture, e-management
PY4	*Clinical Internship IV*	Application of technology in patient care, general office operation and patient satisfaction	Active participation, online resources
	Clinical Externship I	Observation, assessment and critical analysis of optometric informatics in various practice modalities	Active participation, online educational modules
	Clinical Externship II	Observation, assessment and critical analysis of optometric informatics in various practice modalities	Active participation, online educational modules
*Curriculum based, in part, on that in place at SCO for Academic Year 2012-2013. This model does not include the various basic science and optometric curricular components without a direct tie to the informatics content. e-Capture with Tegrity Campus® e-Management with Moodle® Online Educational Modules with Camtasia Studio® by Tech Smith® & Moodle®			

Table 1: Proposed model by Southern College of Optometry for incorporating technology into a four-year optometric curriculum[9]

Overall, most STEM instructors agree that the benefits far outweigh the negatives on the current literature studies on flipping the classroom, but researchers also agree that more research is needed in this area. According to The Flipped Classroom: A Survey of the Research, it is important to gather more data utilizing "controlled studies that objectively examine student performance throughout a semester, with both traditional and

concept-inventory style problems."[2] It is also important to take what has been learned from this point and use this research and framework to design effective studies. In other words, it will be important to define the various activities performed both outside and inside the classroom. As stated above, many of the current studies employed different methods and utilized different in-class activities for learning. In order for these results to be compared, there must be uniformity among the studies.[2]

The flipped classroom is a relatively new teaching modality that is being used by many educators and is working its way into the curriculums of many professional programs. Current studies show promising results for the future, but more controlled studies are needed to evaluate the long-term success of this teaching style. By researching this modality and formulating videos that will teach students various optometric topics and procedures, the goal of this project is to enhance the learning of the students and further broaden the modalities of teaching available to professors, thus creating better clinicians in the future.

CHAPTER 5

VIDEOS

In order to assist in the research process of flipping the classroom in optometry, we have recorded various procedures and topics relevant to all four years of the optometric curriculum. The following have been recorded and are included in our research project:

- Scleral depression
- 3- and 4-Mirror Gonioscopy
- Intravenous and Intramuscular Injections
- Anterior Segment Evaluation
- Posterior Segment Evaluation
- Soft and Gas Permeable Contact Lenses: Insertion, Evaluation, and Removal
- Intraocular Pressure: Goldmann, iCare, and Tonopen
- Fundus Drawings
- Cranial Nerve Assessment
- AC/A Determination: Calculated and Gradient

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