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SUPPLEMENTAL PEER INSTRUCTION IN PHYSIOLOGIC CORE CONCEPT
EDUCATION

An Undergraduate Honors Thesis
Submitted in Partial fulfillment of
University Honors Program Requirements
University of Nebraska-Lincoln

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Abstract:

The objective of my thesis project was to create and research the importance of supplemental learning videos within core physiological concepts identified by the Advancement of Physiological Principles for the purpose of assisting Dr. Kim Hansen in better educating students with less extensive foundational knowledge of chemical and biological sciences. Through researching the benefits of peer instruction, identifying core physiological concepts crucial to wholistic physiology education, and describing a student population hypothesized to benefit substantially from the work, I created educational videos to aid Dr. Hansen in her work as an educator and in the educational research she is striving to complete. Video topics included concepts such as cellular cycle, membrane transport, membrane potentials, the endocrine system, and the countercurrent multiplier system.

Key Words: Physiology, Peer Instruction, Education Research

Supplemental Peer Instruction in Physiologic Core Concept Education

Introduction:

The creative project I completed for my honors thesis is based on several principles for a successful physiology classroom. The first comes from research that demonstrates the benefits from peer instruction. The second is rooted in core physiology concepts and research to discover the most beneficial ways to bring them into course instruction. Finally, the third is an ongoing investigation from Dr. Hansen to determine if students with less foundational science course experiences are put at a disadvantage in her physiology courses. All these principles and guiding questions are what led me to create supplemental learning videos for Dr. Hansen's physiology course. Dr. Hansen will utilize these videos as additional resources for her students to access to promote a better understanding of physiology concepts throughout the semester.

Project Research:

Peer teaching has been a popular area of educational research. The question educators want to know is if, and how, students learn from peer instruction and what differences exist between faculty teaching and peer teaching. It is not contested that a "student-teacher" benefits greatly from explaining concepts to their peers. Explaining information to peers allows a student to gain a deeper conceptual understanding of topics and creates the opportunity for the "student-teacher" to integrate new and old knowledge in meaningful ways (4). As a student who has had many opportunities to tutor friends in classes, I can attest to the monumental impact teaching has on my own understanding of course materials. However, the videos I created were not designed to aid my own understanding of physiology, but research shows that there are benefits to providing peer teaching in addition to faculty instruction.

Peer instruction leads to benefits of developing generic academic skills. In an analysis review, Stigmar (4) finds teaching benefits related to “critical thinking, learning autonomy, motivation, and collaborative and communicative skills” and finds that peer teaching programs can reduce dropout rates as well as “create a low-risk environment” for students to ask questions. Bath, Smith, Stein, and Swann (1) found discipline knowledge skills to be developed in addition to students’ ability to gain generic skills as a result of peer teaching. Stigmar (4) does not find peer learning to “result in greater academic achievement gains” over faculty instruction, such as improving course grades. However, when used in conjunction with regular course teaching, peer instruction is a valuable tool for a professor to take advantage of.

To make the best use of peer teaching in Dr. Hansen’s physiology course, we identified specific topics to focus the videos on. Michael and McFarland (3) defined a list of core physiologic principles in 2011. It is an active area of research to determine how implementing these principles into curriculum improves student understanding and what the best method of implementation is. *Advances in Physiology Education* is actively seeking educators to share their methods of integrating core concepts into their courses to determine how it may benefit long-term student understanding of physiology. Dong and Sun Goh identify that creating digital learning resources meets the demand of students today due to the technological orientation of most students (2). They specify that “videos can cater to different levels of student experience in education. In undergraduate medical education, videos can be used to anchor basic science courses” (2).

Dr. Hansen’s hypothesis is that offering peer-made supplemental instruction materials focused on these core concepts will provide improvements to student success. As a student who has previously taken her class, I have the benefit of experiencing topics that were particularly

difficult to understand myself. This provides me the opportunity to specifically highlight those areas in the materials I have created. She has a particular interest in the benefits for students who have taken fewer chemistry and biology courses before enrolling in her course, as many of the core physiology principles rely heavily on a solid understanding of concepts from those introductory courses.

Dr. Hansen has seen a variety of students in her classroom, most of whom are pursuing careers in healthcare. What she has noted in her lectures is that students pursuing careers that have shorter educational requirements will be enrolled in her physiology course with substantially less foundational science coursework. As an example, many students pursuing four-year professional schools will enroll in her course with two full years of chemistry, a full year of biology, a semester of biochemistry, and several other general science courses already completed. Students pursuing shorter educational paths, such as nursing students, often have only one semester of chemistry and one to two semesters of biology before enrolling in her course. Additionally, these students are often enrolled in her course earlier in their education, giving them less experience at the undergraduate level before taking a course that can be challenging.

Dr. Hansen wants to explore whether the students that tend to have a more difficult time succeeding in her course are the students without as much science background. In order to do this effectively, she needs to have materials that explain the basic principles and concepts of biology and chemistry that relate to various physiologic processes created to see if the supplemental information creates a difference in student success. If her hypothesis is correct, students lacking extensive, multidisciplinary science foundations are the students that will benefit the most from additional help.

Work Completed:

My work with Dr. Hansen thus far has been to assist her by creating some of the supplemental resources she will use to determine if providing extra teaching for the core principles identified by Michael and McFarland will provide benefits to the students with fewer foundational science courses. The resources I have created are supplemental instruction videos that cover several core topics. The hope is that by providing student made resources, her physiology students will benefit from peer instruction of the core concepts. My videos are structured to be similar to the teaching done in recitation classrooms.

Chaoyan Dong and Poh Sun Goh developed a list of tips for creating and using educational videos in 2014. Several of the suggestions that they provide for effective videos are exactly what I did when creating my videos. Some tips include “identifying the target students,” “orienting viewers to the video content,” “integrating lecturer images,” “avoiding cognitive overloading,” and “limit video duration” (2). The ideal video as defined by Dong and Sun Goh is a short video covering information concisely and in a familiar way to specific students. These are all factors that I took into consideration when creating my videos and aspects that will make my videos more impactful.

I selected my video topics from the core principles that Dr. Hansen provided me with, and as mentioned before, the topics I chose to cover were the ones that I felt to be confusing when I was enrolled as a student in physiology. Utilizing course materials, online resources, and Dr. Hansen, I evaluated my understanding of the topics I selected to teach in the videos. I utilized screen recording software and my personal laptop to record and followed the outline I created for

each topic. In each video, I created my own drawings to explain the concept. This allows students to be able to draw concepts for themselves, which more sophisticated learning videos containing animations make more difficult. As I discussed my topic outlines and plans for the videos, Dr. Hansen encouraged simplicity. She emphasized that “fancier” resources exist online already, so creating materials that were basic and focused on her course specifically would be the most beneficial to provide for her students.

Upon graduation, I will continue to work with Dr. Hansen to compile student statistics and create additional learning materials as she identifies the best strategies to educate her students. Dr. Hansen has a powerful passion for education and believes that she has the resources and information at her disposal to continue pushing for more effective teaching. Groups such as Advances in Physiology Education are evidence for the importance of continuing to evaluate current methods of teaching physiology. The discipline currently lacks specific guidelines for departments to ensure adequate student learning is accomplished. Through the work of individual professors, such as Dr. Hansen, this will continue to be explored and improved upon.

Conclusion:

The intention of physiology education reaches far beyond simply memorizing information for an exam. Students enrolled in Dr. Hansen’s physiology course are future care givers, biomedical researchers, and pioneers of medicine. Therefore, it is crucial for the education that they receive in her lectures to be achievable and sustainable knowledge for every student that desires to succeed. Dr. Hansen’s responsibility is to provide them with the resources to attain this knowledge in a way that will last the entirety of their educational advancement and professional career. It is my hope that the research and effort invested into creating my videos will result in successful tools for her to accomplish this task.

Links to Supplemental Learning Videos:

Cell Cycle: <https://use.vg/eqwBbp>

Countercurrent Exchange: <https://use.vg/2RM2wV>

Membrane Potential: <https://use.vg/JAXGrs>

Endocrine System: <https://use.vg/Q2mlru>

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