

Final NEXUS Learning Grant Report 2015-16.

Title: Human Case Studies and Demonstrations for Active Learning and Application of Critical Thinking for Improved Mastery of Anatomy and Physiology from the Freshman to the Sophomore Foundational Courses

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Project Abstract

The purpose of this project was to support improved student mastery of fundamental anatomy and physiology knowledge and critical thinking skills for health professionals through a longitudinal collaboration across courses in the freshman and sophomore year using innovative NEXUS pedagogies. Currently 35% of students do not meet progression requirements for health majors on campus in Anatomy and Physiology. Multiple pedagogical studies have shown significant success in reversing this trend so that a greater proportion of students master the complex organ system functions essential to their health careers. We collaborated across the freshman and sophomore level to redesign three modules using active learning methods and then tracked both immediate student learning gains using pre and post- tests in both control and active learning classrooms. We also measured learning gains from key Biology 103 concepts and skills that are needed for success in Anatomy & Physiology as well as student study strategies. Research results were disseminated in Spring 2016 with a preliminary presentation at the College of Science & Health Research Symposium on April 13 at Philadelphia University and as the Sigma Chi Undergraduate Research Symposium on April 15th by the faculty and a team of five honors student freshman and one upper-level peer mentor who completed Anatomy & Physiology. A manuscript for submission to *Advances in Physiology Education* is being prepared in Summer 2016 and a poster is also being created for submission to the Temple University Teaching Conference in January 2017.

Project Overview: What We Did

Students learning of key concepts and skills associated with the three specific complex human anatomy and physiology systems: endocrine, nervous, and excretory (osmoregulation) were compared using pre and post-tests in active learning to control classrooms for BIOL 104 Biology II and BIOL 202 Anatomy & Physiology II. The active learning classroom included on-line animations and interactive games in MASTERY and other health websites, quizlets, matching cards, anatomical model labelling, peer analysis of human case studies and hands-on laboratory problem solving testing key physiological principles such as test strips of levels of glucose in urine for diabetes compared to normal function. We did not develop a fourth model on the musculoskeletal system because its coverage in BIOL 104 is limited and the upper level content is taught in BIOL 201 Anatomy & Physiology I.

Project Assessment: What We Learned

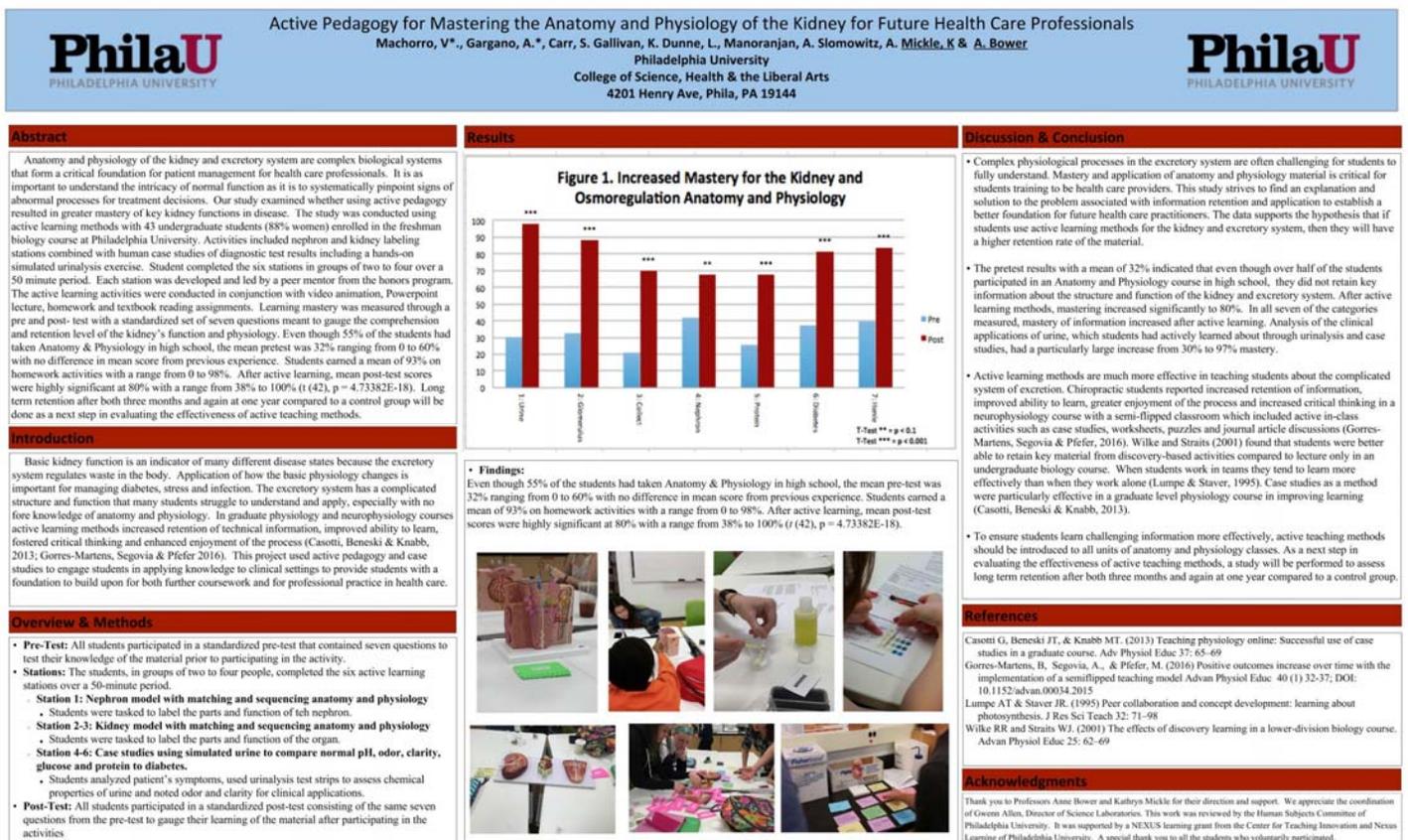
The unit on the excretory and osmoregulation is used to highlight key active learning strategies used and what we learned. The abstract (Figure 1) and poster (Figure 2) below clarify the role of the honors student peer mentors in developing and implementing the active learning teaching materials and the preliminary data results of student learning completed by the upper level student in conjunction with Dr. Bower and Mickle. The results analyzed are from two sections of BIOL 104 taught by Anne Bower.

Figure 1: Abstract from Research Presentation

Machorro, V*., Gargano, A., Carr, S. Gallivan, K. Dunne, L., Manoranjan, A. Slomowitz, A. Mickle, K & A. Bower (2016) Active Pedagogy for Mastering the Anatomy and Physiology of the Kidney for Future Health

Anatomy and physiology of the kidney and excretory system are complex biological systems that form a critical foundation for patient management for health care professionals. It is as important to understand the intricacy of normal function as it is to systematically pinpoint signs of abnormal processes for treatment decisions. Our study examined whether using active pedagogy resulted in greater mastery of key kidney functions in disease. The study was conducted using active learning methods with 43 undergraduate students (88% women) enrolled in the freshman biology course at Philadelphia University. Activities included nephron and kidney labeling stations combined with human case studies of diagnostic test results including a hands-on simulated urinalysis exercise. Student completed the six stations in groups of two to four over a 50 minute period. Each station was developed and led by a peer mentor from the honors program. The active learning activities were conducted in conjunction with video animation, Powerpoint lecture, homework and textbook reading assignments. Learning mastery was measured through a pre and post- test with a standardized set of seven questions meant to gauge the comprehension and retention level of the kidney's function and physiology. Even though 55% of the students had taken Anatomy & Physiology in high school, the mean pretest was 32% ranging from 0 to 60% with no difference in mean score from previous experience. Students earned a mean of 93% on homework activities with a range from 0 to 98%. After active learning, mean post-test scores were highly significant at 80% with a range from 38% to 100% ($t(42), p = 4.73382E-18$). Long term retention after both three months and again at one year compared to a control group will be done as a next step in evaluating the effectiveness of active teaching methods

Figure 2: Poster Presentation of Preliminary Results of Active Learning on the Osmoregulatory System



Deliverables and Dissemination: Getting the Word Out

Research results were disseminated in Spring 2016 with a preliminary presentation at the College of Science & Health Research Symposium on April 13 at Philadelphia University (Figure 3) and as well as at the Sigma Xi Undergraduate Research Symposium on April 15th by the faculty and a team of five honors student freshman and one upper-level peer mentor who completed Anatomy & Physiology. A manuscript for submission to *Advances in Physiology Education* is being prepared in Summer 2016 and a poster is also being created for submission to the Temple University Teaching Conference in January 2017.

Figure 3. Honors Students Presenting Research Poster at Philadelphia University. From left to right Valerie Machorro, Sarah Carr and Ashok Manoranjan

