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# ABSTRACT

In response to the national call from the Physics Education Research (PER) community to focus on student engagement within the physics laboratory context, the Michigan State University physics department has recently transformed its algebra-based, introductory physics laboratory curriculum. This newly transformed course, Design, Analysis, Tools, and Apprenticeship (DATA) Lab, emphasizes the development of experimental skills and laboratory practices and provides students with an authentic physics laboratory experience. Students in DATA Lab engage in the exploration of physical systems to increase their understanding of data analysis, model development, measurement uncertainty, and scientific communication.

In this presentation, we will discuss the differences in student outcomes, specifically how students perceive experimental physics, between the context of the traditional laboratory course and the newly developed DATA Lab. In both courses, data (N = 1,901) was collected pre- and post-instruction via the Colorado Learning Attitudes and Science Survey for Experimental Physics (E-CLASS) which is an assessment measuring how much students align with expert-like views of experimental physics.

Results showed a significant difference in post-test scores between the traditional laboratory and the newly transformed DATA Lab with the transformed course demonstrating a higher percentage of expert-like responses [$F(1,1900)=96.3$, $p<0.001$]. In addition, there is a significant difference between male and female students' post-test scores [$F(1,1900)=25.1$, $p<0.001$] with male students having a higher percentage of expert-like responses. The interaction between the transformation and gender is non-significant; the gender gap in expert-like responses is the same in both the traditional course and transformed course.

Although preliminary results demonstrated a significant gender gap in expert-like views toward experimental physics, after controlling for the student's E-CLASS pretest scores, the difference between male and female students' expert-like views is no longer significant. Thus, the transformation of DATA Lab has had a positive impact for all students.

# COMMUNICATION OUTCOMES

As a relatively new field of study, PER has made many strides toward understanding the teaching and learning of physics. Over the course of approximately 40 years, much of the research has been focused on topics such as conceptual understanding, problem solving, curriculum and instruction, and student attitudes and beliefs about learning and teaching. However, with the recent development of the American Associate of Physics Teachers (AAPT) Recommendation for the Undergraduate Physics Laboratory Curriculum, the PER community has turned much of their attention toward the undergraduate laboratory environment.

Throughout my career, most of my opportunities to present my research have been done at the AAPT conference in which the audience is mostly high school physics teachers and physics education researchers. The opportunity to attend the APS April meeting will allow me to present my work to a broader physics audience: department chairs, physicists from other subfields, astronomers, in addition to physics education researchers. As most departments are constantly revisiting how they can better educate their undergraduate students to be ready to enter the workforce, it is extremely important to show the evidence supporting the impact of how course transformation specifically in my case, a laboratory transformation, can leverage the practices and skills that are recommended for jobs outside of academia: scientific and technical skills, communication skills, and professional and workplace skills [1].

With the recent physics laboratory transformation, the Physics Education Research Lab (PERL) at MSU has an opportunity to become a front runner in this research revolving around the national call. Attending the American Physical Society (APS) April meeting will not only allow me to further my achievements in the field of physics education and increase my professional network through the Group on Physics Education Research (GPER) but it will also allow me to represent the cutting-edge research being done here in the MSU physics department..



[1] P. Heron and L. McNeil. Phys21: Preparing Physics Students for 21st Century Careers. Bulletin of the Joint Task Force on Undergraduate Physics Programs. (American Physical Society, College Park, MD, 2016).