

Randall Harper Research Award Application

During the spring of 2021, I was a freshman learning how to code for the first time in University Physics I lecture and lab. Coding did not initially “click” for me, as my lab partner and I would often spend at least an hour after lab finishing our VPython code. This struggle is a common experience amongst many students who are learning to code, and the goal of my research has been to aid both current and future students as they learn physics through coding.

After I was awarded a FUSE grant in the summer of 2022 to tackle this issue (with guidance from my mentor Dr. Bonham), I created prelab questions that specifically addressed common coding mistakes and lab manual guides to help students translate physics principles into functioning code. In the fall 2022 semester, these interventions were implemented into three experimental sections of PHYS 256. While the data I collected, coded, and analyzed indicated that the interventions were useful, the results were overwhelmed with a more prominent division in students. Regardless of whether students were in the experimental section, the biggest indicator of success was prior coding experience. It was clear that a larger intervention would be necessary to address this gap between students with and without prior coding experience. This led me to expand my project by creating, implementing, and, later, revising in-class coding activities for Dr. Terzic’s section of PHYS 255.

From our analysis of student work in Dr. Terzic’s class, both on paper and using data I collected using an observation protocol, we believe that understanding how students frame (or mentally categorize) VPython activities, whether through a ‘coding frame,’ a ‘physics frame,’ or both, can better explain student difficulties. This specific finding piqued the interest of other physics educators in the PICUP (Partnership for Integration of Computation into Undergraduate Physics) community. In fact, I hosted an interactive webinar (as part of PICUP’s Fall 2023 Webinar Series) over the topic after receiving an invitation from one of the attendees of my talk at the American Association of Physics Teachers summer meeting.

One unique aspect of my project is that I have had the opportunity to present my research from two different angles: (1) as a guide for use by teachers in the field and (2) as findings for the greater body of research. While I may no longer be working with the WKU physics curriculum after graduation, I plan to use my work as a basis for implementing computation into my own future high school physics classroom—a continuation of the ultimate goal of this research project.