DO GROUP CREATED LAB DESIGNS HELP AID STUDENTS IN UNDERSTANDING OF CONTENT AND SCIENCE PRACTICES?

I created this action research project to enhance the learning environment of my community college engineering and biological science (pre-med) students in their first semester physics. I noticed that students focus on developing the mathematical problem solving abilities, but do not gain a strong understanding of the concepts, science practices, and overall confidence in the material. This leads to low retention of the knowledge (an equation has no meaning if you do not remember the concept it is connected to) and so high drop and low exam rates in future engineering and physics courses. It is my belief that the lab is the perfect place to address issues of concepts, science practices, and confidence in physics material.

Background

Focus Question: What is the effect of using student group designed experiments in a problem based laboratory environment on student physics conceptual understanding?

Sub-questions

Sub-question 1: What is the effect of a problem based lab environment on student understanding of physics concepts?

Data Source

Pre-Test | Force Concept Inventory | Post-Test & Exam 1

Sub-question 2: Does designing and implementing an experiment give students more confidence with physics content?

Data Source

Pre-Survey | Student Interviews | Post-Survey

Sub-question 3: What is the effect of a problem based lab environment on student understanding of scientific processes and data analysis?

Data Source

Pre-Test | Group Lab Analysis | Post-Test

Sub-question 4: Does designing and implementing an experiment give students more confidence and understanding of scientific processes?

Data Source

Pre-Survey | Student Interviews | Post-Survey

Results

• A noticeable increase in student conceptual understanding was found. This was evident by increased scores on the lab pre/post quizzes, as well as normalized gain of 0.34±0.08 on the FCI.
• A noticeable increase in student confidence with physics content, data analysis, and general science processes. This was evident in pre/post survey data, as well as came out in student interviews. I personally saw students grow in their ability to openly discuss science concepts and data interpretation during group presentations.
• Data analysis is where I feel the intervention had the greatest impact. As was evident when comparing pre/post data analysis test scores, it was observed that students became more comfortable with regression modeling, error analysis, standard deviation, etc.

Value

The intervention was valuable to my students learning, but also to myself by making me step out of my comfort zone and try something new. I am now more actively involved in using physics education research to continue evolving how I run my classroom, and work to get students more engaged.

Future

I feel as if the intervention had many good outcomes, but was also frustrating to students. I plan to continue with student designed labs, but with more guidance then was given. I will also be adding more group experiences into the lecture portion of my class as well.