

The logo for Plymouth State University, featuring a dark green wave-like graphic above the text "Plymouth State" in a serif font.

Plymouth State

Spring Pedagogy Institute 2024

Re-engaging Students in Intro STEM Classes

Brad Moser

Physics and Astronomy

Assistant Professor of Practice

CoLab STEM Pedagogy Affiliate

Physics 1

Fall 2022

- ▶ What I thought would work:
 - ▶ Modeling Instruction framework
 - ▶ Constructivist labs
 - ▶ Lots of whiteboarding
 - ▶ Group problem solving
 - ▶ Very little lecture
 - ▶ Intro Physics for the Life Sciences curriculum
 - ▶ Restructured topics
 - ▶ Focus on life science applications



What Happened?

University Physics 1

- ▶ Modeling Instruction worked great!
- ▶ Lots of active engagement from students in the class
- ▶ These were meteorology and chemistry majors

Physics 1

- ▶ Crash and Burn
- ▶ Lab structure (Modeling) didn't work well
- ▶ Very little student engagement in whiteboarding and group problem solving
- ▶ Students didn't do well on assessments



Now What?

- ▶ I felt confused.
 - ▶ This framework and approach usually worked well.
- ▶ I felt disheartened.
- ▶ I knew COVID played a role in this.
- ▶ I knew I had to do something.

What about those clusters?



The Integrated Cluster Model is about redesigning the university so that it works better for learners.

What is Cluster Learning?

The Integrated Cluster Model is about redesigning the university so that it works better for learners. This model encourages students to work on real-world issues, ideas, and challenges and strives to make our community's knowledge and expertise accessible to anyone who needs it. **Cluster Learning** is the teaching and learning approach that powers this unique academic environment. It centers on three practices:

- **interdisciplinary** inquiry and research
- **open** educational practices that remove barriers and empower students to contribute to the knowledge commons
- **project-based** learning that extends past the walls of the classroom

Cluster Learning is how PSU students practice the four Habits of Mind that are the cornerstone of our HoME (Habits of Mind Experience) general education program. The Habits of Mind are: purposeful communication; problem solving; integrated perspective; and self-regulated learning. Cluster Learning is designed to give students regular, engaging opportunities to develop these key habits!

▶ I was on the Gen Ed committee (now HoME).

▶ I had submitted a new INCAP proposal.

▶ I was excited about a big project-based experience.

OPEN
CoLab

PLYMOUTH STATE UNIVERSITY



Who ya gonna call?

Physics 2

Spring 2023

- ▶ "Dipped my toes" with a ½-semester project
 - ▶ First half - physics as usual
 - ▶ Second half - the project
- ▶ Physics 2 specs
 - ▶ 8 students enrolled
 - ▶ All were pre-PT (physical therapy)
- ▶ First half
 - ▶ Same lack of engagement as Physics 1
 - ▶ Even worse, because 8 students meant VERY quiet



Did it work??



**YES!
YES!
YES!**

The Students...

- ▶ Came to life!
- ▶ Were curious.
- ▶ Worked hard.
- ▶ Worked well together.
- ▶ Were open to feedback.
- ▶ Were engaged in the process of co-creation.
- ▶ Were grateful.

Rave Reviews

What else would you like your instructor to know about your learning experience?

Student Responses

I loved this professor, I think he is by far one of the best professors I have had at plymouth state. He is very personable, he comes up with ways to get students attention from the minute you walk into class until the clock ticks and class time is over. He does a very good job of relating the concepts we are learning to each and every students major/future career so that all students understand in a better way. He is not one to just lecture, he is always engaging students and making sure we understand concepts before he moves to the next one. He comes up with questions that pertain to anatomy/exercise science and the physics behind them which I really enjoyed because all of us students are pre PT students so it is easier for us to understand concepts when questions are related to our field of study.

I liked how the course was laid out with the project at the end of the semester, i thought it was a good way to engage everyone. I do wish we did more hands on labs.

I enjoyed the half and half semesters. It kept me engaged in this class.

I found the class to be enjoyable even though Physics isn't what I would typically think of as enjoyable. I took a lot from this class and I am glad that I was in this time with this professor.

I had a lot of fun in this class. I have never enjoyed a class like chemistry or physics, but I thought it was really cool to do something that we were all are interested in.

I think overall, I really liked the set up of half lecture and half project term because not only does the project focus on the physics principles but really helped us to interpret with meaning in comparison to our own field of study.

We all enjoyed the project!

Week-by-Week Itinerary

The following is a week-by-week summary of how the project proceeded.

- I trusted the “emergent” nature of the project.
- I planned each day only after the previous class had ended.
- I always gathered feedback and input from the students.

The Framework

PROJECT OUTLINE (POSSIBLE)

- *Week 1: Connections:* Working together to identify how physics connects and intersects with your field of study and career intentions. Presenting connections.
- *Week 2: Project Shaping:* Considering various themes and applications, exploring measurement and analysis tools that are used in the field or model physical scenarios, and investigating modes of delivering a public presentation. Presenting measurement techniques or field-based modalities, example data, possible stakeholders, and big picture questions
- *Week 3: Project Proposal:* Form teams, focus on a target theme and audience, determine an experimental approach and mode of presentation. Present project plans, gain feedback, consider next steps.
- *Weeks 4-6: Work on Project, Project Check-Ins* each week
- *Week 7: Project Completion and Reflection*
- *Week 8 (Final Exam): Project Presentation*

But Wait...

- ▶ Doesn't this mean I'll cover less content in my course?
 - ▶ Yes. Probably *a lot* less.

This is a significant departure from business as usual.





Take 2: Physics 2 Spring 2024

- ▶ "Dive in" with a full semester project
 - ▶ More time to explore and discover topics
 - ▶ More time for data collection and analysis
- ▶ Physics 2 specs
 - ▶ 11 students enrolled
 - ▶ All (but one) were pre-PT
- ▶ Same success?
 - ▶ Sort of - it was a learning curve for me
 - ▶ BUT, I'm totally committed!



The New Framework

- *Weeks 1-2: Big Ideas: Working together to understand big ideas in physics and how they connect to physical therapy, medicine, and biology. Short presentations regarding major physics topics and measurement equipment and devices used in professional settings.*
- *Weeks 3-5: Exploring Physics and Measurement: Deepening investigation of a shortlist of project ideas. Investigating relevant physics principles and measurement modalities that may contribute to the project(s). Interfacing with professionals in the field. Possible work includes reading assignments, problem solving, gaining experience with measurement equipment. Deliverables include teaching presentations and demonstrations.*
- *Week 6: Project Proposal: Form teams, focus on a target theme(s), audience, select measurement apparatus, and hone research questions. Project Proposals due next week.*
- *Week 7: Present projects plans, Feedback, Next Steps*

Spring Break

- *Weeks 8-12: Work on Project!, Project Check-Ins with instructor*
- *Week 13: Final analysis, Preparing presentation, Formal project reflection*
- *Week 14: Project Presentation at PSU Showcase*

A photograph of a person sitting on a stone bench in a park. The person is wearing a dark jacket and pants, and is looking down at something in their hands. The park is lush with green trees and bushes. In the background, there is a building and a street lamp. The text "Thoughts? Ideas?" is overlaid in a light blue, sans-serif font on the right side of the image.

Thoughts?
Ideas?