

What's the relevance of Physics Education Research to the Advanced Lab?

Transforming the Advanced Lab: Part 1 – Learning goals

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Project Goals

- (1) Create a really spiffy lab.
- (2) Study how students learn in lab courses.
- (3) Provide resources for faculty to develop their own transformed labs.
- (4) Increase student learning.

Existing Advanced Optics and Modern Physics Lab

- 15 students per instructor.
- Mostly seniors.
- Broad content:
 - Nuclear physics (gamma ray spectroscopy)
 - Particle physics (cosmic ray muon lifetime)
 - Condensed matter physics (scanning tunneling microscope, NMR)
 - AMO physics (saturated absorption spectroscopy, magneto-optical trapping)
 - Physical optics (diffraction, interferometry, polarization).
- 4-6 labs in a semester.
- Not linked with any lecture course.
- Associated lecture period not coordinated with lab.
- "Cookbook" lab guides.
- Minimal emphasis on applications of physics.
- 5 week long final project allows for creativity and independence.
- The formal assessments are written lab reports and oral presentations.

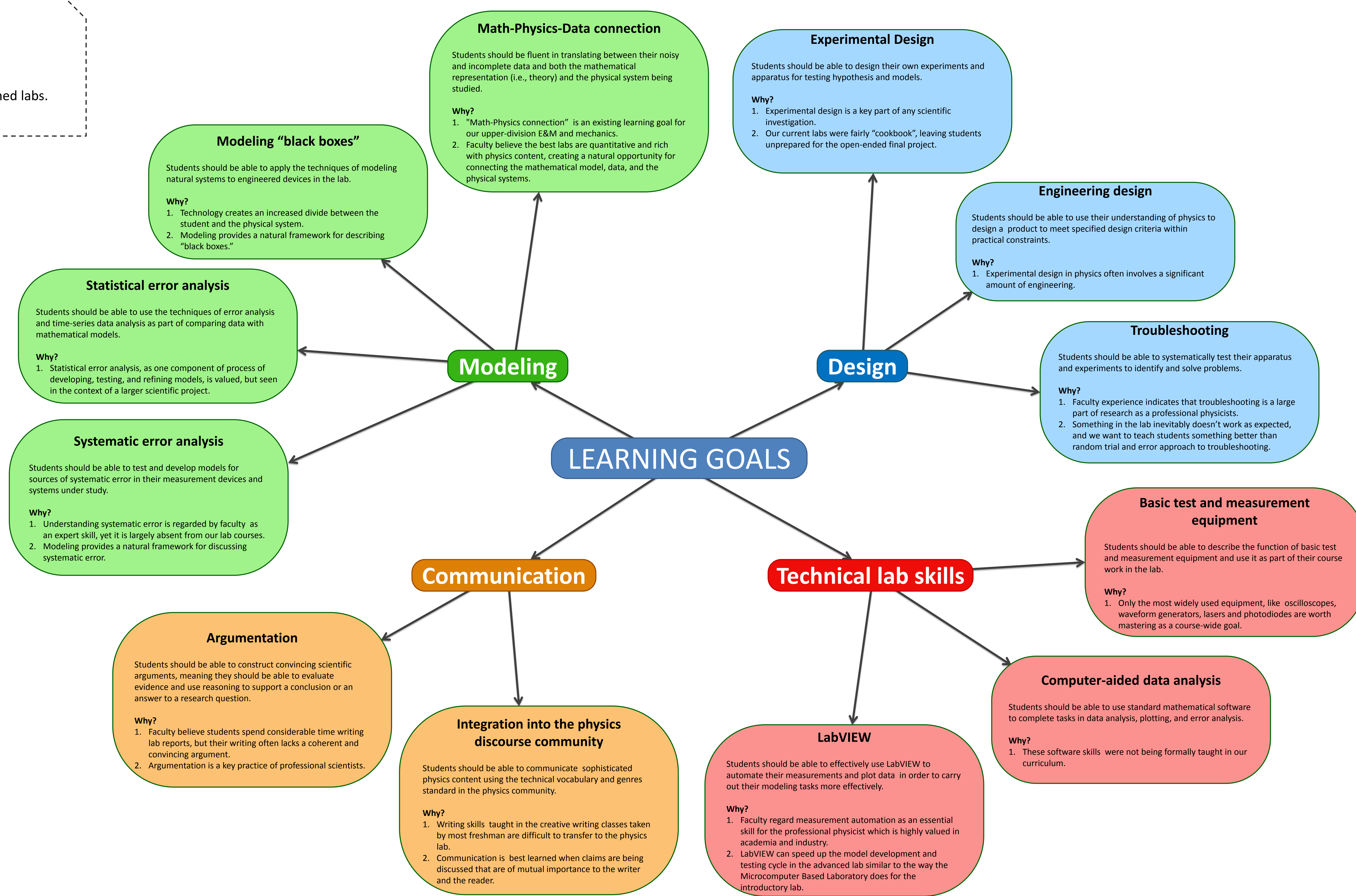
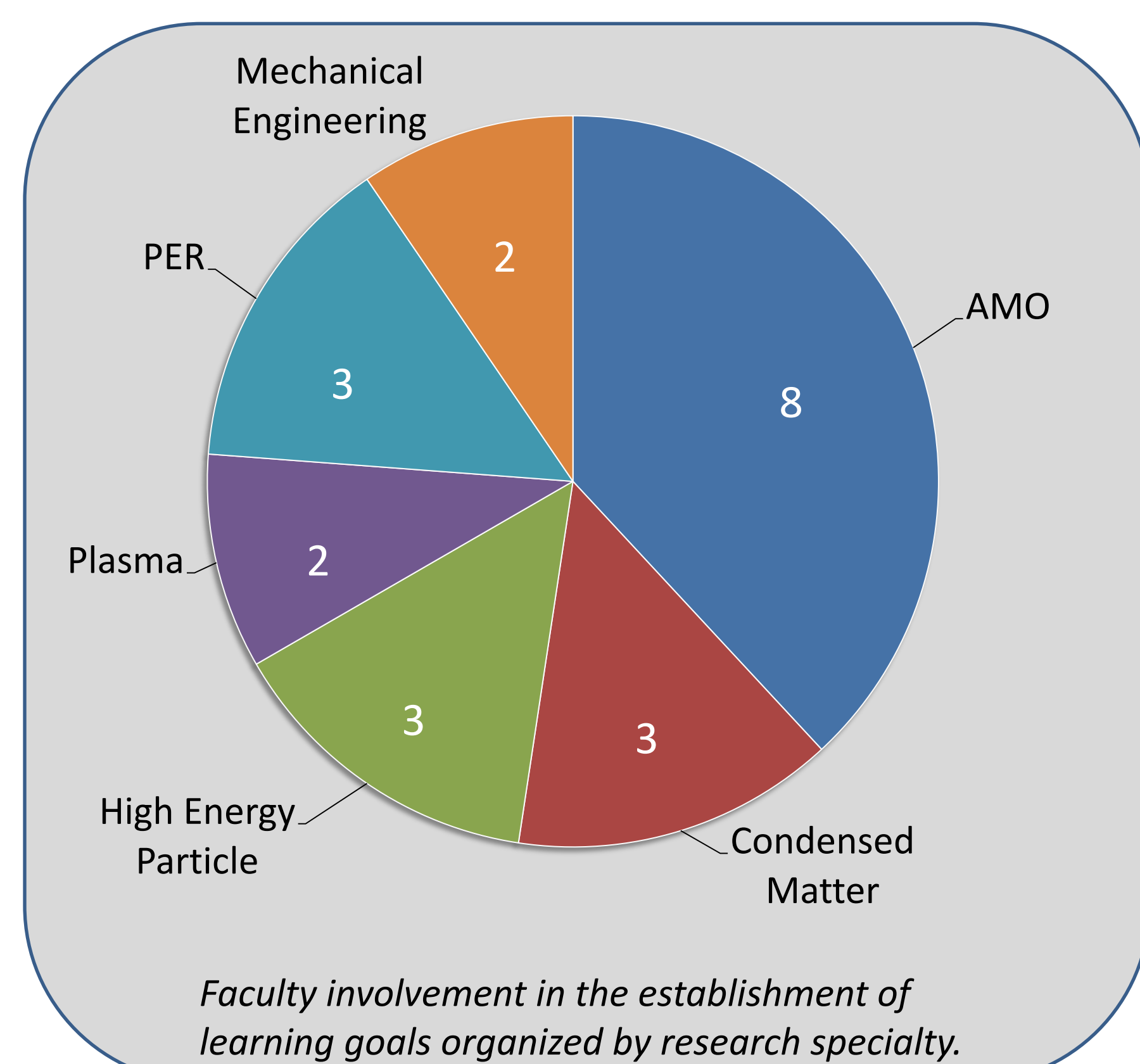
Methodology

Input from CU Faculty

- 15 faculty interviews (example questions)
- "What is the purpose of a good lab course?"
 - "What is the goal of communication in the lab?"
 - "What abilities do you look for when hiring a new student in your lab?"

A draft set of learning goals was produced

Two working group meetings to develop consensus.



Input from previous goal statements

- AAPT Goals for the introductory physics laboratory.
- Goal statements from the advanced lab community.

Input from STEM education

- Modeling (Modeling instruction)
- Design (Engineering education)
- Argumentation
- Writing instruction

Ongoing work: Revision of existing labs

- Incorporating learning goals into labs, while keeping most of the equipment unchanged.
- Converting lecture periods into hands-on tutorials for LabVIEW and computer-aided data analysis.
- Reorganize and restructure the lab course.

Ongoing work: Resources for instructors

- Guidelines for instructors
- Online tutorials for LabVIEW and Mathematica.
- Rubrics for evaluating assessments.
- Tools for developing new labs.

Ongoing work: Assessments

- Embedding formative assessments into the labs.
- Rubrics for evaluating the assessments.
- Pre-post tests to measure learning gains.