

Problem-Solving Labs

Concept developed by the
University of Minnesota
Physics Education Research Group

Different Lab Types

- “Cookbook” Labs
 - Verificational
 - Theory base provided
 - Plenty of direction provided
- Problem-Solving Labs
 - Cycle of prediction-experimentation-verification-explanation
 - Fewer directions provided

What goals are addressed in these labs?

- Confront preconceptions.
- Practice problem-solving skills.
- Learn how to use equipment.
- Observe an event that does not have an easy explanation to realize new knowledge is needed.
- Gain an appreciation for the difficulty and joy of performing an experiment.
- Experience what real scientists do.
- Learn physics by doing something other than reading, sitting and listening.

Why this style of lab?

- “Cookbook” labs have little value in helping students attain the goals.
- Hands-on instruction is a powerful means of

overcoming preconceptions.

- Allows teacher opportunity to determine student difficulties.

How can I make students like and value labs?

- If instructors see labs as “busy work,” so will students.
- Problem-solving labs remove the busy work component.
- This style of lab removes the “take the data and run” approach.
- Create and use labs with real-world applications.

Why have students work in groups?

- Group problem solving is effective.
- Groups rarely get “stuck” due to lack of resources.
- Students learn from mistakes.
- Students get practice explaining.
- Students bring up their preconceptions.
- Labs make instruction more manageable from the perspective of the instructor.

Why are there so many problems in each lab?

- The focus of the lab is not to get the problem “done.”
- Additional problems add flexibility.
- Some groups may need to be challenged.

- Variety helps avoid boredom.

Why don't the lab instructions give the necessary theory?

- Labs are an integral part of an entire course.
- Theory is available in a textbook.
- Labs without theory promote student reading and understanding of the textbook.
- Doing the theory behind the lab problem helps students to understand the lab project.

What is the reason for giving minimal lab instructions?

- The primary reason is to help students learn physics better.
- Good problem solving requires informed decision making.
- Students gain experience in analytical practice.
- Students are allowed to learn from mistakes.

Why should students write up lab problems?

- Some students will leave labs with same preconceptions they entered with, or will generate new preconceptions.
- Reading lab reports gives instructor valuable information about students.
- This in turn helps to redirect teaching.
- Students need experience with technical writing and other forms of communication.

Grading Lab Reports

- Not every student has to have every part of the lab report complete.
- Up to six points are awarded for lab report.
- Bonus points are awarded if the group as a whole does well.