Three Pillars of Successful Lab Instruction

1. Be **SAFE!!!**
   - GSI Guidebook
     - [http://www.crlt.umich.edu/gsis/p7_7](http://www.crlt.umich.edu/gsis/p7_7)

2. Have **FUN!!!**

3. **Teach, learn, and get things done!!!**
Goals for the Session

You will be able to:

■ Have a better idea of what to expect when leading a lab
■ Identify principles to effectively prepare for lab sessions
■ Apply these principles via interactive discussions and case studies
■ Formulate thought-provoking questioning techniques
■ Identify resources to support lab instructors
Safety First!

Just like you should in your lab, we are going to start with safety.
What’s wrong? Identify 6 different safety concerns shown in the picture below.
Don’t fool around during a lab.

Always point test tubes and other items away from yourself and others when heating.

Keep hair and other flammable objects away from flames.

Don’t eat or drink while in the lab.

Don’t leave a flame unattended.

Always wear safety goggles when doing an experiment.

Image: http://morrisonlabs.com/lab_safety.htm

Created or selected by Chris Heumann

From Sciencespot.net
Fun Safety Videos

- Puppet Safety!
Fun Safety Videos

- Don’t try this at home.
- http://www.youtube.com/watch?v=cr7roogzM8c
What makes teaching a lab unique?

Grading Issues –
Concurrent
Session B

- Presenting Lectures
- Organizing Group Work
- Leading hands-on learning
- Asking meaningful questions
- Evaluate student work

See Resource Packet, Pg. 15-16

Teaching Problem Solving –
Concurrent Session B
What should an ideal lab look like?

- **Think** about the features of an **effective** lab.
  - What does the instructor do?
  - What are the students doing?

- **Pair** with a partner and share your knowledge.

- **Share** your ideas back with the class. Record additional ideas on your handout.
General Principles for Labs

What does the instructor do before the lab?

**Read**
- Become familiar with assigned activities, theories, concepts, and terms

**Know**
- Familiarize yourself with the equipment and/or software and any safety concerns

**Perform**
- Run the experiment yourself, anticipate common concerns, think about timing

Adapted from “Instruction at FSU The Florida State University Academic & Professional Program Services A guide to teaching and learning practices “
General Principles for Labs

What does the instructor do during the lab?

**Introduce**
- Begin on time, provide overview, identify common bottlenecks

**Interact**
- Make yourself available to students, answer and ask questions to direct learning

**Conclude**
- Summarize key findings, outline objectives for students before next lab

Adapted from “Instruction at FSU The Florida State University Academic & Professional Program Services A guide to teaching and learning practices“
Case Study Analysis

Case Study 1: Avery in a computational lab
Case Study 2: Zhang in an experimental lab

- What are the issues in these cases?

- What can the instructor do to improve this situation?
Generate several possible suggestions.

Be prepared to share your responses with the group
Case Study Overview

Case Study 1: Avery in a computational lab
- First-time teacher, researches a similar topic to course material
- First year graduate student

Case Study 2: Zhang in an experimental lab
- First-time teacher in sophomore-level lab
- Fourth year graduate student
Common issues in labs

- **Instructors are often**
  - Not familiar with concepts, lab exercises, and/or techniques
  - Unable to help students understand material
  - Giving answers instead of making students think
  - Unavailable to students outside lab

- **Students are often**
  - Unprepared and spend lab time reading manuals & instructions
  - Lacking conceptual understanding
  - Unable to design experiments to meet objectives
  - Unable to timely analyze data and write reports

Strategies for Ensuring Student Preparation

- Assign advance readings
- Require pre-lab write ups
- Give short quizzes
- Discuss important laboratory procedures
- Create K-W-L checklists
- Pose questions using Bloom’s taxonomy

Adapted from Instruction at FSU The Florida State University Academic & Professional Program Services A guide to teaching and learning practices
K-W-L Checklists

Know it, Want to know it, Learned it

- Great way to find out student needs (see page 12 in Resource Packet)
  - Have students enter class with a list of what they know and want to know for the lab
  - Start class with a survey of what needs to be addressed from the KWL checklist
  - Review the “Learned it” items at the end of class

- How might you use this approach in your lab?
K-W-L Checklists

**Know**
(What you know)

**Want**
(What you want to learn)

**Learn**
(What you learned)

See sample KWL checklists in your packet
What questions can you pose to students? (Bloom’s Taxonomy)
Develop checking questions

- **Think** about a lab assignment for a class you will teach

- Using Bloom’s Taxonomy, **brainstorm** as many checking questions as possible from the ‘Remember’ and the ‘Create’ levels
Successful Problem Solving

- When solving problems
  - Have the problem solving process unfold to reveal solution

- Students need to:

  *Struggle, persist, struggle some more!*
Group Learning

- Group work ...
  - Develops higher-order thinking and analysis skills
  - Develops skills of interaction and cooperation
  - Leads to academic success
  - Works in classes of any size
Successful groups are...

- Heterogeneous in ability and background
- 3-5 members in size
- Held accountable as groups and individuals
Summary

Before the Lab
- Read
- Know
- Perform

Ensure students are prepared
- Pre-labs
- K-W-L checklists
- Ask questions (Bloom’s Taxonomy)

During the lab
- Demonstration
- Description
- Interaction
Resources

■ “Leading a Lab Section” Resource Packet

■ GSI Guidebook (Part Six: Leading Laboratory Sections)
  http://www.crlt.umich.edu/gsis/gsi_guide.php
  ● Laboratory Safety
  ● Strategies for Managing Discussions with Groups in the Laboratory Class
  ● Grading Laboratory Reports (with sample rubrics)

■ Concurrent Session B
  ● Grading: Policies, How-to, and Tips
  ● Teaching Problem Solving Skills
  ● Handling Office Hours

■ Engineering Teaching Consultants
  http://crlte.engin.umich.edu/gsi_serv/etcwebrequest/
Any Questions?

Eric Bumbalough (ebumbalo@umich.edu)
Sara Lu (salu@umich.edu)
Additional Information
General Principles for Labs
What does the instructor do before the lab

- Prepare a short overview of the lab

Outline learning objectives

Plan to check for understanding

Develop the introduction

Plan the main body of the lesson

http://www.crlt.umich.edu/gsis/P2_5.php
Managing Groups

■ Desired students skills:
  ● Leadership.
  ● Time management.
  ● Communication.
  ● Problem solving.

■ Effective skill development of teamwork:
  ● Individual accountability.
  ● Interpersonal skills.
  ● Self-assessment of personal and team functioning.

(Woods, Felder, Rugarcia, Stice, 2000)