- Time: Class time is less than experiment needs. Compensate time.
- Bad attitudes, conflicting personalities. Team building (laser tag).
- Ethical conflicts. Full disclosure & task flexibility.
- Accessibility issues. Task flexibility.
Problem

Sampling

Bio safety

IRB

lack of collaboration

erosion in methodology

- dubious data

limited resources

Solution

apply for waiver

instructor collects samples

use non-hazardous

- C-14 for students with > 60 audits

apply for IRB

- DOE in advance

provide guide for reflection

Assy Model for Assigned Responsibilities

Intro workshop on good laboratory practices

- record keeping
- data collection
- RCA training

Research conduct

collaboration

between us

- CURBS, CURE, CURY, GRANTS
- don't want to gather more data
  - multiple course sections replicating data

- students gather negative data
  - include positive controls
  - replicate experiments yourself
  - modify experimental protocols
  - compare to other replicates

- insufficient class time to complete research goals
  - open lab hours
  - build an experience for next iteration

- very high error among replicates
  - analyze data as it is produced so protocols can be adapted
    (formative)

- team conflict
  - assigned team roles
  - rotating roles
  - (captain, statistician/technician, reporter/recorder, reflector)
1. Some students could not design a good project.

2. If it is a team project, some students rely on one or two students to lead the project, make no intellectual contribution.

3. How to give students a fair score for their project? Authorship or Co-Authorship decision?

4

Solutions

1a - Suggest some projects

2a - Peer grading / use peer assistants

3a - Rubrics
Instances when Student/Research goals might conflict

Student Quality & Research output might not match philosophy
  - practice protocol
  - "foolproof" instructions (videos, step-by-step)

Motivational mis-match
  - Stress the "belonging to scientific community"

Assignments are interdependent & missing assignments are problematic
  - Group check-ins to enforce accountability

[ might not need this step (assuming)
  - Multivariable study to choose own angle for final
    - Choose own angle for final paper/presentation
    - Well-researched and well-placed aspect

Outside classroom
  - Time outside class paper/presentation
    - Well-researched and well-placed aspect
How is this applicable to "real life"?
- put them on a real operation.
  - replicate, compare, troubleshoot

- Safety - tick borne illness
  have students research protocols

What is the hook for students

Willingness to do the work

> A glass of water!

Maintain biodiversity, maintain ecosystem

What does biodiversity do for them?
unsuccessful phage hunt

NO bloom $\rightarrow$ other locations

$\rightarrow$ Culture

$\rightarrow$ compare bloom/non-bloom

NO $\rightarrow$ giants

$\rightarrow$ partners

Bio Safety $\rightarrow$ Scare tactics

$\rightarrow$ hoods

$\rightarrow$ gloves

$\rightarrow$ PPG