Warm-ups and cold calls: getting students to engage with lecture material

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- Introduction
- Course at WPI (BB1035)
- Educational Goals
- “Warm-ups” & “Cold-calls”
- Classroom Experience
- Student Feedback
- Implementation at UMass Boston

WPI's BB 1035

- "Introduction to Biotechnology"
- 75 students
- > 50% non-majors
- Each week:
  - 3 x 50-minute lecture
  - 1 x 50-minute conference

Goals

- DNA -> RNA -> protein -> function
  - interventions, applications, & modifications
- Application > Memorization
  - *A Problems Approach to Introductory Biology*
  - Conference sections
  - Genetic disease project
- Need to know “where they’ re at”

Warm-ups

- Before material is covered in lecture
- *Cognition and Instruction* **16**(4) 475 (1998)
- Try out application of material
- Provide common experience
- Generate questions
- Assess student's strengths & weaknesses

Sample Warm-up #1

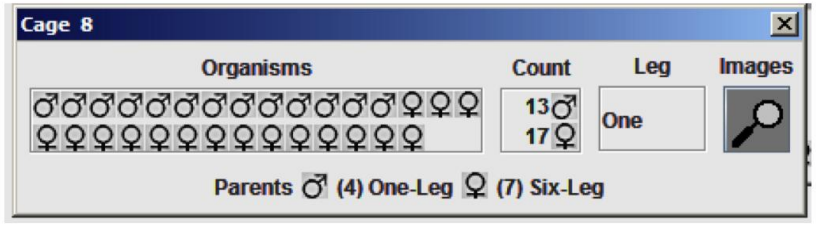
- Virtual Genetics Lab (http:/intro.bio.umb.edu/vgl/)
- *Context*: before start of genetics section
- *Assignment*: do some crosses; do both traits behave the same?

Sample Warm-up #1

- Virtual Genetics Lab
- *Common experience*: traits acting differently
- *Generate questions*: why the difference?
- *Assess*: ability to notice “conspicuous crosses”

Classroom Experience

- Use their work as an example



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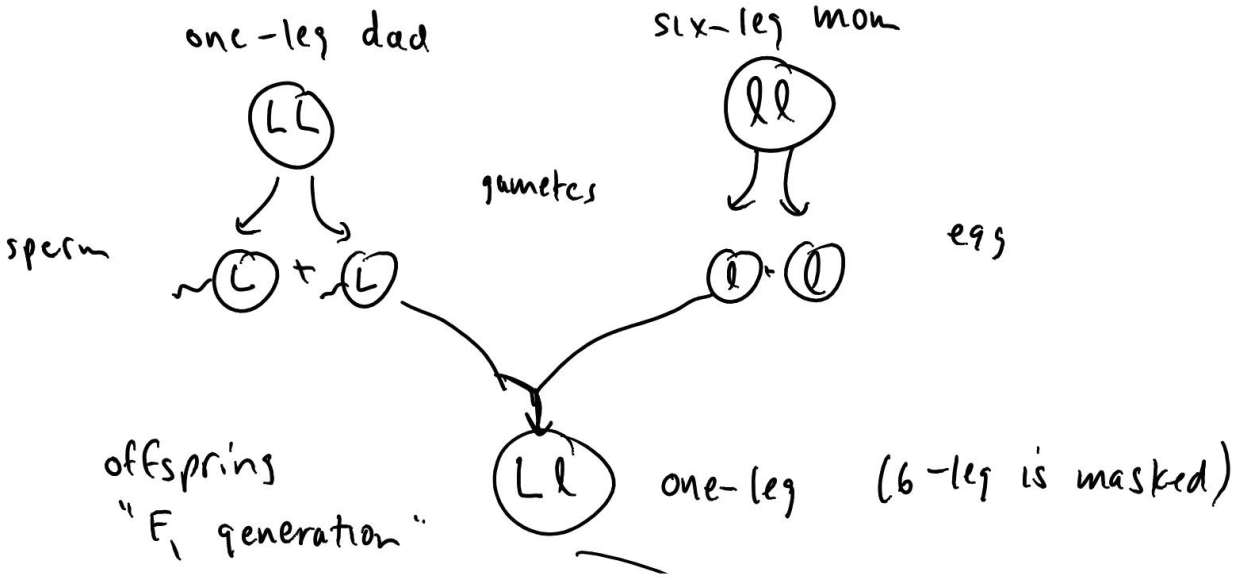


Examples from their work

- Best if can use it specifically
- Can raise common issues
- But they don’t have it with them…
- And may not remember important details

Sample Warm-up #2

- “Build a Protein” (http://intro.bio.umb.edu/pi/)
- *Context*: had introduced
  - non covalent interactions
  - Amino acid properties
  - Protein folding
- *Assignment*: build two proteins:
  - “blob”
  - “stick”

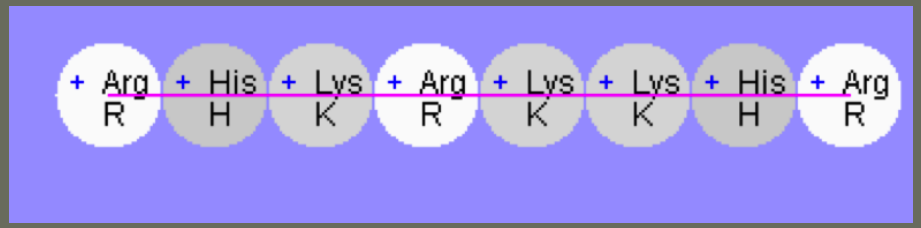
Sample Warm-up #2

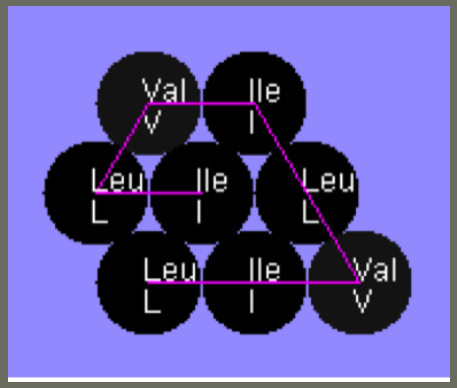
- “Build a Protein”
- *Common experience*: self-assembly via amino acid properties
- *Generate questions*: why did it do that?
- *Assess*: understanding of interactions

Classroom Experience

- Use their work to see where they’re at

The protein that did not "blob" together consisted of hydrophilic amino acids that are all positively charged. Hydrophilic amino acids like water so they will not naturally "blob" together. In addition, all amino acids are the same charge which makes them repel each other causing a straight line. If they were mixed charges, the positives and negatives would attract each other so the proten would bend. The "blob" protein consists of all hydrophobic amino acids. These molecules do not like water so they stick together to avoid contact. Therefore, they create the shape of a circular blob. The hardest part of the assignment was making a straight line. I had to understand that the protein needed to be hydrophilic and have the same charge.

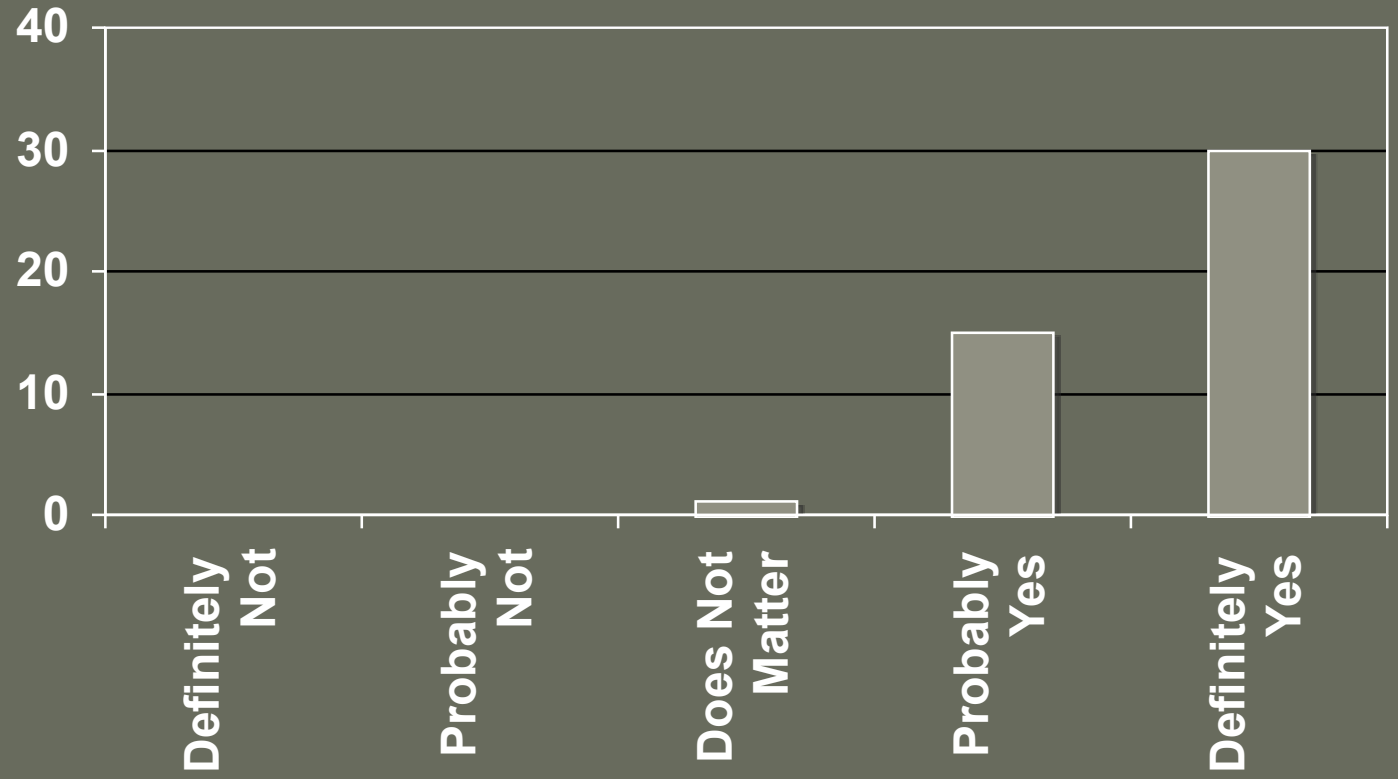




- Other benefits:
  - Students familiar with software & UI
    - Can go further in lecture
    - Can use easily in conferences
  - Better use of everyone's time
  - Best questions:
    - What was most difficult part?
    - What was most surprising?
- Pitfalls & challenges:
  - They don't have their results in front of them
  - They may not remember or notice what you want them to

Warm-ups: student feedback

- Should I use this technique in the future?



Warm-ups: student feedback

- It helped me to visualize the lecture material instead of just reading and memorizing from book. This helped me embed the material in my head.
- The warm up problems allowed me to experience the material on my own before learning about it in more depth in lecture. In addition, they caused me to have questions about the material. In other words, they got me more involved in the material, and I was more likely to really engage in the material during lecture.
- I got a better sense of what to expect in class. But sometimes I have no idea what the problem means and don't understand the stuff before the class, then the practice becomes a pain and not very useful. Maybe we should have it after class.

Cold-calls

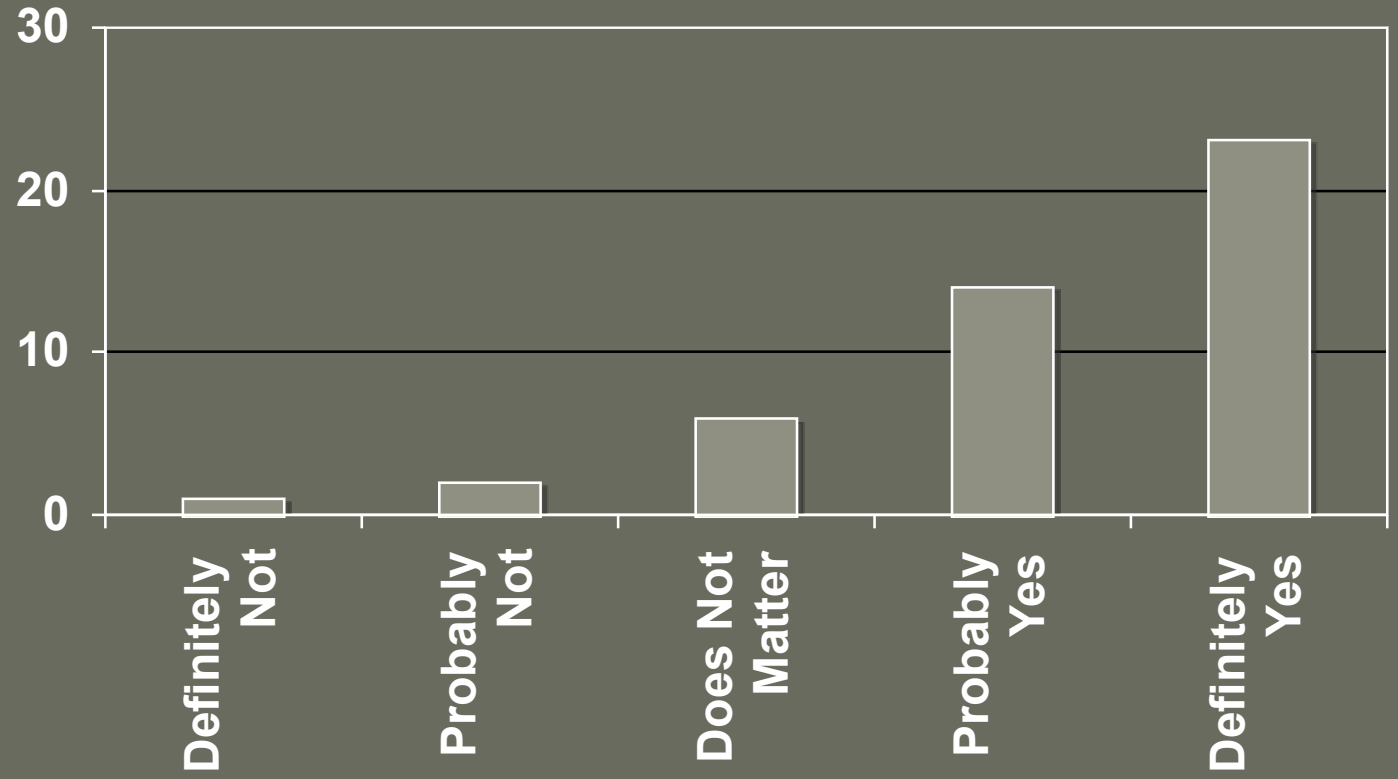
- Call on students randomly; non-voluntary
- Not every question
- After “think, pair, share”
- “Passing” is OK
- Can opt out
- Wrong answers *encouraged*
- “It’s my job to make you look good”
- Get *everyone* thinking about the question
- Get a better sample of student knowledge

Classroom Experience

- Benefits
  - More active classroom
  - Useful wrong answers
  - A sense of where they are
- Pitfalls & Challenges
  - Hands come up spontaneously
  - Hard to choose randomly

Cold-calls: student feedback

- Should I use this technique in the future?



Cold-calls: student feedback

- Not knowing if I would be called on or not meant I had to pay attention and had to formulate my own answers in my head for every question.
- Sometimes I am afraid to admit when I don’t understand something so it was nice to see other students in the same boat as me saying “I don’t know” or answering questions wrong. I learned a lot from others’ mistakes.
- Didn’t enjoy it, but probably for the best.
- While I understand the practical use, it was scary!

Implementation at UMB

- At UMB, Bio 111 has 400+ students
- Warm-ups
  - More technical issues
  - Doing more & Working well
- Cold-calls
  - Made “student picker” application
  - ~ 15 on “do not call”
  - Completely changed the “vibe”
- Graded homework using simulations

Questions?

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