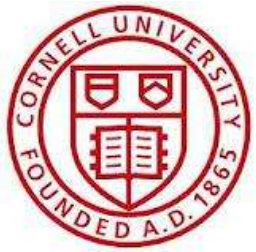


Engaging Approaches to Quantitative Courses

Marisa Hughes, Anoop Grewal

Graduate TA Excellence Series

Certificate topic: Creating an engaging classroom

http://cte.cornell.edu/tap/gradseries.html

28 September 2011

Introductions

Please share with us your…

- Name
- Major
- BRIEF description of your expectations/ what you would like to gain from this workshop

Memories:
A Time YOU were Engaged (think, pair, share)

Following things were shared by the participants:

- Enthusiastic teacher
- Stories
- Videos
- Pictures
- Physical demonstrations
- Time to solve problems
- Real-life applications/ giving context
- Doing physical activity e.g. labs, moving around
- Getting into groups to move around

Ideas for Engaging Your Students

Following things were shared by the participants:

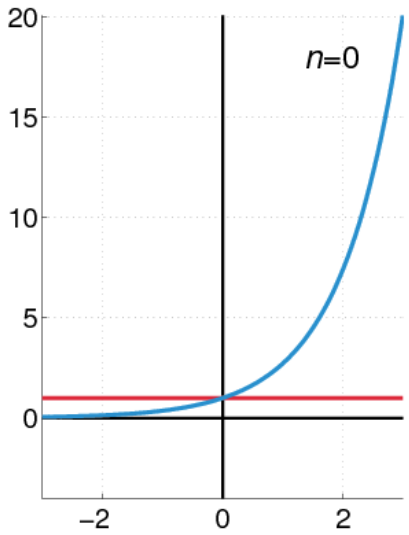
- Class Debates
- Pictionary; games (for CANDY!!!)
- Simulating activity; gathering data
- Hands-on activities
- Make *students* teach (peer-to-peer learning)
- Present problems on the board
- Get students opinions/ ideas
- Personal stories/ humor (in your examples)
- Worksheets (in group)
- multimedia (Youtube videos)

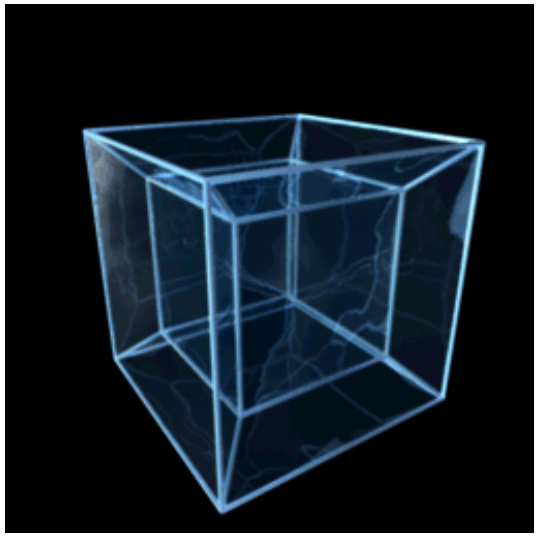
More Concrete Examples:

Animations/ Colorful representations.

Source: Wikimedia Commons, which has a lot of images and gifs in the public domain.

Below: Polynomial approximations of e^x, a 3-D shadow of a hypercube, a morphism from the surface of a coffee cup to a torus





The i-clicker System

- Let you know immediately which questions merit further discussion.
- Give students feedback about their understanding of the material relative to their peers.
- Plus, they're fun!
- Use for polls, decision making, student opinions on logistics etc.

Suppose f is a differentiable function. Then

$$\int_0^x f'(t)\,dt = f(x)$$

1. Always
2. Sometimes
3. Never

Worksheets

Tips:

- Assign work groups at first
- Always start out with some easy questions
- Divide questions up into parts
- End with some challenging problems for advanced students
- If you intend to discuss the solutions, have answer keys ready to distribute in case you run out of time

Worksheets

Ideas for Worksheets:

- Sample problems on the topic from old prelims
- Application questions of general interest
- Fill-in-the-blank notes, diagrams, charts, or **concept maps**
- Find the errors in a collection of worked out problems
- Different problems for different groups to present (or relays)

Making a Lab Engaging

Inquiry based teaching:
emulating the behavior of real world scientists and their methods in your lab, instead of cook-book recipes.

- **Change the purpose of lab to a question**.
  - open ended if possible

- **Make question relevant to students:**
  - real life context e.g. day to day life, relevant to community,
  - student come up with their own questions to explore

- **Let students come with variables, procedures and data analysis techniques.**
  - teacher's regular guidance needed!

Making a Lab Engaging (cont.)

- **Move teacher's explanation / text reading to <u>after the lab</u>**
  - *main point: let them come up with their own explanations, hypotheses based on evidence.*

- **Presentation of findings to other classmates:**
  - *lab-groups present their data and explanations.*
  - *The class share ideas and evaluate logic.*

- **End with teacher's explanations/ expert in the field.**

Too bad, as a grad student we probably wont have much say in the labs. Refer to [3], [5], [6], [7].

Advantages of Active Learning

- Greater engagement
- Higher level of critical thinking
- Improve communication skills
- Peer-based learning
- Students take more responsibility for their own learning
- Wakes students up!
- Applies to a wider range of learners

Limitations/Cons of Discussion

- Cannot cover material as quickly
- Discussion straying
- Students Reluctant to participate
- Students socializing rather than working
- Students who prefer being led along
- Extra planning work for you

How do we address these limitations?

A lesson plan

- Divide into groups

- Select a common topic of interest and design a lesson plan to teach it.

- Include various engaging activities, appealing to a variety of learners.

- Present your outline to everyone.

Group1: Plant Growth

- Lab: factors influencing plant growth
- First discuss the scientific method and experimental process.
- Have groups *design their own* experiment for the Week, thinking of various parameter that may affect growth and then checking their effect.
- Have students present their data later: was their hypothesis supported?

Group 2: Integrals!

- Introduce the concept of an integral with a problem: give each group the same funny shaped curve on graph paper. Have groups estimate the area under the curve, then compare their estimations and discuss their methods.
- Proceed to approach the integral as rectangles; give the equation of the curve and integrate it

Group 3: Cells

•iclicker review going over material that some students may already know, along with some fun facts about cells in the human body to keep it interesting.
• Real cell on video to point out organelles
• Analogies such as a factory for cell parts
• Give students a disassembled cell model, and have them put it together

Conclusions

Please share:

- any new thing you learnt today.
- What you may apply in your teaching

Please fill the feedback forms.

Supplemental Reading and References

[1] W. E. Cashin, Effective Classroom Discussions, idea paper 49.
[2] W. E. Cashin, Effective Lecturing, idea paper 46.

[3] M. Volkman and S. Abell, Rethinking laboratories: tools for converting cookbook labs into inquiry, The Science teacher.
[4] C. Kern, K. Crippen, Mapping for conceptual change, The Science Teacher.

[5] C. Chin, L. Chia, ProblemBased Learning: Using students' questions to drive knowledge construction, 2003, Wiley Interscience
[6] B. Crawford, Embracing the essence of inquiry: new roles for science teachers, 2000, J.ournal of Research in Scince teaching (37, 9, 2000)
[7] B. Crawford, The poisons project: Motivate your students with an inquiry-based unit, Science Scope, 1998, 21, 5

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