

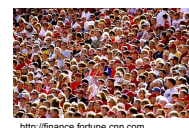
Teaching Strategies (Monday, June 11, 2012)

→ Engaging students in large classes with Andrew Goodliffe and Robert Rhew



Engaging students in large classes (outline)

- I. Setting the stage
 - A. *you, your students, your team*
 - B. *promoting thinking and learning*
- II. The Interactive Lecture
 - A. *delivering the lecture*
 - B. *engagement triggers*
 - C. *engaging non-majors*
- III. Classroom management
 - A. *Handling e-mail/office hour overload*
 - B. *Using Blackboard/course website*
 - C. *Dealing with academic dishonesty*
 - D. *Dealing with legitimate excuses*
 - E. *Classroom technology*



<http://serc.carleton.edu/NAGTWorkshops/earlycareer/teaching/LargeClasses.html>

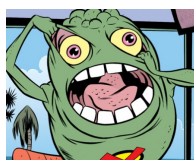
I. Setting the stage

A. *you, your students, your team*

How do you prepare for big lectures?

Suggestions:

1. *Figure out your main points*
For lecture and for each slide
2. *Prepare your visuals (draft)*
3. *Practice your unfinished talk ALOUD*
4. *Write out sentences that need to be precise*
5. *Focus on your slide transitions*
Better than "And this slide shows..."
6. *Revise your slides*
7. *Print out your notes*
8. *Keep track of time*
9. *Calm your nerves beforehand*
10. *Don't install new software right beforehand*
11. **PRACTICE**



How do you prepare the students?

Spend the time to put together a good syllabus

- *Clearly express **policies and procedures** for grading, attendance, late homework, missed tests, etc. Making up the rules as you go along is never a good idea, but it can be disastrous in a large class.
- *Announce **office hours** and hold to them, making it clear that you are not available as a round-the-clock consultant to help with homework problems (as opposed to real emergencies).
- *Publish **test dates** at beginning of the semester. Have a clear plan for students who miss exams (for valid and invalid reasons). Will you do a make-up or make the final count for more?

Send a welcome e-mail to the class before it starts.
Put appropriate reading on reserve in the library.
Describe your e-mail policy in advance.
Make clear what it takes to do well in the class

* from <http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Papers/Largeclasses.htm>

How do you prepare the teaching team?

Detail your expectations from the teaching assistants, in writing

explain duties: lecture attendance, office hours, proctoring exams, maintain grades, setting up projectors, running review sections, potential guest lectures, punctuality.

Team work: make clear division of labor, set up regular meetings, plan as much as possible at the beginning

Records: Teaching assistants must keep records of all communications and assignments, but not keep personal student data on their computers (security).

If co-teaching a class: make sure each professor has clear responsibilities, especially regarding student issues.

B. Thinking and learning – well established findings

“Trying to teach anything to someone whose attention is divided will impair learning.

Unnecessary cognitive overload (jargon, complex figures) impedes the learning process.

Covering a topic, testing, then considering the job done may not result in retention of what was learned.

Telling something to listeners who don't process the information in some way will not create long-lasting knowledge.”

Nobel Laureate Carl Wieman, describing research results about thinking and learning that are well established, *Harvard Magazine*, May-June 2012, pg 48-49.
<http://harvardmagazine.com/2012/02/learning-to-the-hilt>

Thinking and learning – what you can do

trying to teach anything to someone whose attention is divided will impair learning

solution: No computers/smart-phones allowed except for note-taking. No web browsing, texting, face-book checking, etc. during class. Even if you think you are multi-tasking, you are actually wasting time.

unnecessary cognitive overload (jargon, complex figures) impedes the learning process

solution: Prof - make a point to define every new term on the slides. Student - make a point to ask for definitions if a new term is introduced.

covering a topic, testing, then considering the job done may not result in retention of what was learned

solution: frequent assessments to practice retrieval. "You learn a lot more from exams than from reading material." (Roddy Roediger, WUSTL)

telling something to listeners who don't process the information in some way will not create long-lasting knowledge.

solution: do interactive lectures/ in-class assignments, revisit topics in labs, and repeat major concepts.

II. The interactive lecture

- A. Delivering the lecture
- B. Engagement triggers
- C. Engaging non-majors



A. Delivering the lecture

EXPRESSIVENESS is the most basic and most direct way to keep students' interest

Vocal variation, facial expression, movement, gesture

Is more interesting and easier to understand

Yields contagious enthusiasm

Improves retention of material, higher ratings

Is more about communication than about entertainment (is compatible with content coverage and high academic standards)

<http://cgi.stanford.edu/~dept-ctl/cgi-bin/tomprof/posting.php?ID=790>

B. Engagement triggers

"Interactive lectures: classes in which the instructor breaks the lecture at least once per class to have students participate in an activity that lets them work directly with the material"

1. Engagement triggers:

1. Interpreting graphs
2. Making Calculations
3. Demonstration/ making predictions
4. Brainstorming
5. Reading to solve a problem
6. Physical prop
7. Evocative visual/ picture
8. Cartoons
9. News clips
10. Clips from movies or tv shows

2. Incorporate into an activity

1. Think-Pair-Share
2. Small group discussion
3. iClicker
4. Audience participation

<http://serc.carleton.edu/NAGTWorkshops/earlycareer/teaching/LargeClasses.html>

Example 1: demonstration + audience participation + iclicker use

How does deep water get formed? Phase 1

Experimental conditions

1. high salinity water, room temperature (blue)

Make your predictions using your iclicker

The layer of room temp salty water will...

- A. Float on or near top layer
- B. Sink to intermediate depth
- C. Sink to bottom of tank

Room temp freshwater

Example 1 (continued)

Phase 2: Layer of warm freshwater

Make your predictions with iclicker

Experimental conditions

2. Freshwater, warm temperature (green)

The layer of warm freshwater will...

- A. Float on or near top layer
- B. Sink to intermediate depth
- C. Sink to bottom of tank

Room temp freshwater

+ layer of room temp salty water

Example 1 (continued)

Phase 3: layer of cold saltwater

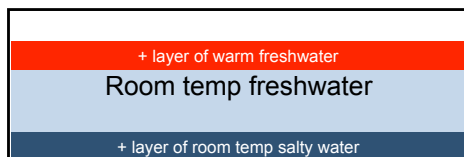
Experimental conditions

3. Ocean salinity water, cold temperature (red)

added 17.5 grams to 500 mls warm water to get ~35 ‰

The layer of cold saltwater will...

- Float on or near top layer
- Sink to intermediate depth (below orange, above blue)
- Sink to bottom of tank (below blue)



Example 2: think-pair-share + pop culture + iclicker use

What have you heard about the Coriolis force (CF)?

some starter fill in the blanks:

1. Occurs because Earth is _____ and _____
Northern Hemisphere, deflects winds to the _____
Southern Hemisphere, deflects winds to the _____

2. CF **counteracts** the _____ force.

3. CF is **greatest** at the _____, **zero** at the _____

4. What type of motions/ spatial scales is the Coriolis force relevant to?

5. What types of motions/ spatial scales is the Coriolis force irrelevant to?

Educational video from *The Simpsons*
Season 6: "Bart vs Australia"...

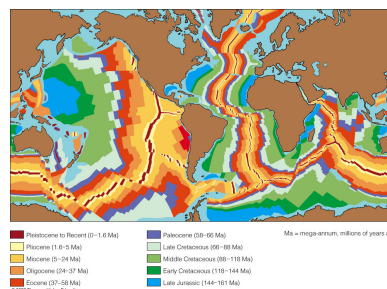
Lisa Simpson says the water drains *counterclockwise* in the *Northern Hemisphere*, and *clockwise* in the *Southern Hemisphere*.



- Lisa is half right. They both drain counterclockwise
- Lisa is half right. They both drain clockwise
- Lisa has it backwards. It should drain clockwise in Northern Hemisphere, counterclockwise in Southern Hemisphere
- Bart is right. The Coriolis effect is negligible on the scale of toilets and sinks.
- Lisa is right (as usual).



Putting things together: Sea floor spreading, magnetic stripes, convergent plate boundaries



All in the magma chamber
2 million years per magma-person upwelled
Forward for normal polarity
Backward for reverse polarity
Who is the oldest? Youngest?

Come up with your own list of engagement triggers

Think-Pair-Share

- Interpreting graphs
- Making Calculations
- Demonstration/ making predictions
- Brainstorming
- Reading to solve a problem
- Physical prop
- Evocative visual/ picture
- Cartoons
- News clips
- Clips from movies of tv shows

C. Engaging non-majors

Many large lecture classes serve as a breadth requirement and have many non-majors who are not necessarily engaged with the topic. This is your chance to get them excited about geoscience!

- Make it relevant for their lives
- Make pop culture work for you
- Recognize different learning styles
- Bring in your own personal experiences

Make it relevant for their lives

What different minerals do for you
How geology made your drive to school possible
How jet stream affect flight times
How oceanography affected D-Day
Rare earth metals in your cell phone
Rice makers and phase changes
...

Pop culture. Have lecture soundtracks (using music to start your lecture)

Ring of Fire, Johnny Cash
Four seasons, Vivaldi
Yellow Submarine, Beatles
Octopus' s Garden, Beatles
Message in a Bottle, Police
The Tide is High, Blondie
Toxic, Britney Spears
Under the Sea, (Little Mermaid)
Blowin in the Wind, Bob Dylan
Dust in the Wind, Kansas
Walking on Sunshine, Katrina
and the Waves
Ocean waves (sound)
Polynesian sounds

Pop culture: Clips from movies and shows

(be aware of copyright rules)

Simpsons: metric system, angular momentum, 2nd law of thermodynamics, Coriolis Force, evolution, Newton' s laws

Doldrums: in "Master and Commander", (also: Rime of the Ancient Mariner, by Samuel Taylor Coleridge)

Earth' s magnetic field, core/mantle/crust in "The Core"

Positive feedbacks: Deep thoughts, by Jack Handy

Shutdown of thermohaline circulation/ abrupt climate change "The Day After Tomorrow"

Mid-Holocene Climate Anomaly and the Green Sahara, Cave of Swimmers "The English Patient"

El Niño: Chris Farley "Weather Channel" skit

How to use clips, see <http://serc.carleton.edu/sp/library/media/how.html>



III. Classroom management

Teaching a class with over 100 students is a management challenge. You will have students who have conflicting school activities, personal crises, learning disabilities, health issues, and academic integrity issues.

- Handling e-mail/office hour overload (underload?)
 - clearly delineate
- Using Blackboard/course website/Facebook
 - make TA in charge?
- Dealing with academic dishonesty
 - use plagiarism software
 - have students do academic honesty assignment
- Dealing with legitimate excuses
 - expect them and have a plan
- Classroom technology

E. Classroom technology

Benefits and drawbacks of iclicker and other classroom technology



<http://www.startrek.com/article/trek-class-blog-the-case-for-assimilation>



Final word: Keep testing techniques

Things that don' t go well are good learning experiences.



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