COESP Day: Engaging your students

Michelle French
Associate Professor, Teaching Stream
Department of Physiology
University of Toronto
Meta analysis of 225 research studies on active learning in science, technology, engineering and math

“Active learning engages students in the process of learning through activities and/or discussion in class, as opposed to passively listening to an expert. It emphasizes higher-order thinking and often involves group work.”

What do you conclude?

Figure from: Carl E. Wieman PNAS 2014;111:8319-8320
What is the most common top teaching challenge of pre-workshop questionnaire respondents?

A) How to include active learning
B) Student engagement
C) Disconnected students
D) Large classes
E) How to foster higher-order thinking

Others?
Tip: Think about learning outcomes first

Learning outcomes
content & skills

Assessment

Course content and delivery
Tip: Incorporate principles from the science of learning

Learning
builds on prior knowledge
is active
requires sustained motivation
is best when authentic

Barbara Oakley
Engineering, Oakland University
Part 1: How have you fostered student engagement or motivated students to learn?

Part 2: Discuss your responses to part 1 in a group of 4 and write ideas on one sheet
Enthusiasm and variety
Core concepts of biology
300 students
Instructor + 2 helpers (junior faculty and post doc)

- develops a community – bag tags + speaks with students
- index cards for reflection and assignments
- clicker questions
- document camera
- asks for answers from 3 students (names)
- engaging stories
- 30% of mark in class work and homework questions
Second-year genetics
200 students in class

Guided reading and videos for pre-class work
Clicker questions
In-class worksheets
Uses tablet for writing things out

*Change up activities
Uses of clicker questions

Different clicker questions for different roles, at different times:

**BEFORE LEARNING:**
- setting up instruction
- assess prior knowledge
- provoke thinking
- predict
- motivate
- discover
- check knowledge
- real world application

**DURING:**
- developing knowledge
- analysis
- evaluation
- synthesis
- probe misconception
- exercise skill
- demonstrate success
- review / recap
- exit poll

**AFTER:**
- assessing learning

Technology

Clickers

Class response software

- iClicker
- Kahoot!
- socrative
- Mentimeter
- TOP HAT
- Poll Everywhere

- learning|catalytics
Group discussion

1) Which class response technologies have you used?

2) Pros and cons of using these technologies?

3) Pros and cons of clickers vs class response software?
Ask don't tell
Foundations in Physiology (BIO350)

120 students
(3x50min lectures/wk)
Weekly quiz 50 min
Tutorials (30 students)
Weekly assignments

Whiteboard only

What do you know about . . .?

Talk to your neighbour

Random call for answers

https://www.flickr.com/photos/52503205@N07/24507518660/in/photostream/
Foundations in Physiology (BIO350): Tutorials

Groups of 4

Coloured markers

Do not consult notes/phone

Draw . . .

Present

Photo at end

https://www.flickr.com/photos/52503205@N07/24709571191/
Some lectures become workshops

Grant Booker
Associate Professor
School of Biological Sciences
University of Adelaide

650 students, intro chemistry course

Workshops (80 students each):
5 to 8 problems per session
Word cloud, draw graphs, multiple choice etc
Some new material, other parts review
Reduced drop rates
Challenge: “Teaching complex physiological processes”
*COESP Day participant*

**Tip: Physiology – Guided inquiry resource**

Students get real data and then answer guided questions to discover key physiological concepts

Julia Choate
Senior Lecturer
Department of Physiology
Monash University, Melbourne

Anatomy and Physiology: A Guided Inquiry
Patrick J.F. Brown
ISBN: 978-1-119-17525-4
Animations – blood loss, pH, ANS, female reproduction

Joey is a 25-year old healthy male who decided to donate his blood for good cause.

contact michelle.french@utoronto.ca
Large-scale flipping

First-year course: Engineering Modelling and Problem Solving
1200 students in course
- short online videos Khan Academy style
- in-class group work
- 600/class
- tables of 9 working in teams of 3
Attendance now 95% up from 30%
TAs 1:120 students in neon vests
Paper assignments picked up at start of class
Tests incorporate group learning

Brett Gilley
Instructor
Vantage College and Department of Earth, Ocean and Atmospheric Sciences

The Catastrophic Earth: Natural Disasters (2 X 700 students)

Two-stage tests:
30 MCQ individual then in groups 20 min
(5min to get set up)

85% for individual and 15% for group
Collaborative Testing: Evidence of Learning in a Controlled In-Class Study of Undergraduate Students

By Brett Hollis Gilley and Bridgette Clarkston


Take home message: students who engaged in group exam did better in follow-up learning test 3 days later
Why we are teaching science wrong, and how to make it right

Active problem-solving confers a deeper understanding of science than does a standard lecture. But some university lecturers are reluctant to change tack.

M. Mitchell Waldrop

15 July 2015
What are the barriers that would prevent you from using these strategies? Provide possible solutions.
Potential barriers

- Takes up time from class
- Lack of student motivation to participate
- Only a few students answer the questions
- Groups going at different speeds
- Cannot hear students’ responses
- Not sure if doing it right
Tip: Prepare the students before class

- Readings: case studies, textbook, paper, popular press
- Videos (YouTube, textbook, homemade)
- Make it relevant and interesting: tell a story
- Pre-class quiz (or quiz at start of the class)

Remember:

Learning outcomes content & skills
Meta analysis of 225 research studies on active learning in science, technology, engineering and math

“Active learning engages students in the process of learning through activities and/or discussion in class, as opposed to passively listening to an expert. It emphasizes higher-order thinking and often involves group work.”

What do you conclude?

Figure from: Carl E. Wieman PNAS 2014;111:8319-8320
Tip: Explain the strength of weak ties

• In 1973, Mark Granovetter’s article “The Strength of Weak Ties” showed that most people got their current jobs through acquaintances (i.e. “weak ties”) rather than close friends.

• **Weak ties** are our **bridge to the outside world**.
Case study — Tyler Colvin

“In Sunday night's major league game between the Cubs and the Marlins, Chicago outfielder Tyler Colvin was impaled with the shard of broken bat as he headed from third base to home plate.”
Sept 20, 2010, AOL news
http://wapc.mlb.com/play/?content_id=31254741

Questions
1) What are the normal pressures inside and outside the lungs?
2) What keeps the lungs from collapsing?
3) The bat penetrated Tyler’s pleural cavity. What would be his symptoms and how would you treat him?
Tip: Make questions challenging and relevant

e.g. Individual quiz immediately follows peer discussion

Challenge: “online assessments and academic misconduct”

COESP Day participant

(Online vs in-class marks)
Tip: Pay attention to how you deliver the question

“Some of the most important people in this room to you [for you] to be successful in [this course] are sitting around you, okay, they’re not up on the stage.”

Kimberly Tanner
San Francisco State University

Tip: best practices for clicker use

Tip: Use random call

Scott Freeman
Principal Lecturer
Department of Biology
University of Washington

Clickers in classes up to 700

Random call
Students work in a group first
Thank the student for answer
Wrong answer: Say “that this is a common misconception”
Come back to the student later and say "yes you got it right"
Tip: Ambassadors and emissaries

Barbara Oakley
Professor, Engineering
Oakland University
Tip: Catch box
Tip: Seek advice and get feedback

Ask your students – during the term
1) What is helping you learn the most?
2) Suggestions for improvement

Work with faculty or TAs – visit each other’s classes
Team teaching

Carl Wieman Science Education Initiative
at the University of British Columbia

Two professors in the classroom – second one with microphone circulates – talks to students and lecturer

Classroom Observation Protocol for Undergraduate STEM (COPUS)

Teaching practices inventory

Frank Laska
Life Sciences Core - Curriculum & Teaching Initiative
Additional tips

- You have to believe activity is worthwhile
- Play to your strengths
- Start small
- Scientifically assess your intervention
8th Annual oCUBE UnConference

Pursuing Individual Paths to Teaching Excellence

May 23rd – 26th, 2017

Are you a faculty, student, or staff member involved in undergraduate education? You are invited to attend the Ontario Consortium of Biology Educators annual meeting at the beautiful Shamrock Lodge.

This is an excellent opportunity to share and reflect on your teaching experiences, practices, and challenges in order to improve the undergraduate biology education experience for both instructors and students.

Registration open
March 23rd - May 5th, 2017

For information, please visit: www.ocube.ca
To register, please e-mail: ocubeorg@gmail.com

Shamrock Lodge, Port Carling, ONT
www.shamrocklodge.com

ocubeorg@gmail.com
Best wishes for success with your teaching!

michelle.french@utoronto.ca