Update from the Carl Wieman Science Education Initiative

An approach to improving university education

What should students learn?

What are students learning?

Which instructional approaches improve student learning?
The LS-CWSEI team

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The roles of an STLF

1. Help identify and implement best practices for teaching in Biology courses at UBC
2. Perform pedagogical research to obtain data to support evidence-based teaching practices
Implementing best practices

BIOL 230
Dr. Malin Hansen

BIOL 234
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BIOL 260, 361
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BIOL 336
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BIOL 204, 209
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BIOL 112, 200, 201
Dr. Megan Barker

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Implementing best practices

1. Learning objectives
2. Pre-reading assignments
3. Clicker questions
4. Worksheets
5. Tutorial activities
UBC Biology curriculum

1st year

First year Biology courses

2nd year

Cell biology  Physiology  Ecology
Genetics

3rd year

Biology Electives  Evolution  Statistics
2 organismal diversity courses with lab

4th year

Biology Electives
2 Biology lab courses (any topic)
Fostering active learning in lecture

- Clicker questions
- Pre-readings
- Group exams
- Staged worksheets and in-class problems
- Invention activities

The roles of an STLF

1. Help identify and implement best practices for teaching in Biology courses at UBC
2. Perform pedagogical research to obtain data to support evidence-based teaching practices
Malin Hansen

1. Concept inventory for population dynamics
2. How to use analogies for effective learning
3. Changes in student attitudes to biology across the program

Student attitudes survey

- Survey administered to Biology students in 1st and 4th year
- Do students respond as would an “expert” biologist?

Sample Survey Questions:
- Knowledge in biology consists of many disconnected topics
- Reasoning skills used to understand biology can be helpful to my everyday life.
- To learn biology, I only need to memorize facts and definitions
- Mathematical skills are important for understanding biology
Student attitudes survey

Bridgette Clarkston

- Identifying common misconceptions in genetics (comparison of UBC students vs. students in a MOOC)
- Confronting teleological thinking in evolutionary biology
- Utility of group exams
2-stage (group) exams

- Students complete an exam individually and hand in
- Get together in groups of four and work on the same exam
- Hand in
- Mark is a combination of individual score (75%) and group score (25%)

“The group exams give you a chance to go over your answers to the exam while you still care about the questions.”

Result: Greater learning gains when students tested in groups

![Graph showing normalized change (C_y, y) from individual test to learning test across Midterm 1 and Midterm 2. The graph compares Group and Individual conditions.](image)
Lisa McDonnell

- Misconceptions in genetics (and comparison of UBC students vs. students in a MOOC)
- Retention of conceptual knowledge vs. procedural skills in genetics
- Characteristics of expert vs. novice problem solving behavior in genetics

Laura Weir

- Characterizing student challenges with constructing logical arguments in Biology
- Efficacy of interventions targeting study skills
- Integrating treatment of phylogenetics concepts across courses
Mandy Banet

- Utility of targeted pre-reading assignments
- Characterizing student challenges with constructing logical arguments in Biology

Pre-reading

- Most students do not prepare by reading the textbook before coming to class
- Active learning strategies work best when students are prepared and already familiar with the basics of the material
- How can we get students to read before coming to class?

- Use a targeted approach
Student survey data: pre-readings

When you did the pre-reading assignments, what MOTIVATED you to do so?

“I learn better in class if I have previous knowledge of the topic. I find that I pay more attention and my brain can make more connections and build on previous knowledge.”

“It's for marks and ... it helps me to distinguish what I know and what I have troubles with so I can be all ears in the parts where I am struggling with in class.”

“...so if I have any questions, they would be knowledgeable and well-founded questions.”
Megan Barker

- Effectiveness of “flipped classroom” and “blended learning” strategies

Group project – curriculum mapping

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