The Flexible Learning Initiative in First-Year Biology: Assessment of the Pilot Phase

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Flexible Learning in First-Year Biology

- Short, targeted reading
- Pre-quizzes
- Online content (videos, animations, pen casts)

In-Class

- Students predict and apply concepts
- Share predictions with peers
- Receive feedback from expert

- Post-quizzes
- Weekly homework
- Learning Centre

Solidify your Learning

Prepare for Class

Figure 1. The “learning path” visual used to provide a visual for biology’s approach to the FLI. The learning path was also used to present weekly course content to students on Connect.
Evaluation plan

Two Classes:

**Biology 112: Biology of the Cell** – 4 sections, 1200 students

**Biology 121: Ecology, Evolution, Genetics** – 3 sections, 700 students

Measures:

1. **Student Learning**
   - Diagnostic Questions
   - Pre & post-tests

2. **Student Perspectives**
   - Student Survey
   - End of term

3. **Use of TAs in FL Classroom**
   - Self-reported Time Use
   - Characterize TA tasks & Time Used
Figure 2. A. Matched mean correct responses (%) for Bio121 students on the pre-test CI in three sections of the course (Lecture-based, Active 1 and Active 2). B. Mean normalized change (%) for students on the post-test. Error bars represent 95% CIs. N = 136 (Lecture), N = 164 (Active 1), N = 148 (Active 2)

Figure 3. A. Matched mean normalized change (%) for students on the CI by question. Error bars represent 95% CIs. N = 136 (Lecture), N = 164 (Active 1), N = 148 (Active 2)
1 Student Learning
Biology 112: Diagnostic development

- Compiled from several validated concept inventories, and/or developed in-house. Three pre-tests deployed during term at beginning of major course units (23 questions total); subset of these questions as post-test (16 questions).
- Continued development ongoing; finalized for Fall 2014.

**Figure 4:** Biology 112 scores over sixteen questions deployed across four sections. Error bars are standard error between section averages. Due to time constraints in the course, no pre-data for some questions.
Student Perspectives
Student perspectives are positive overall

Student Comments:
I think the clicker questions are extremely useful and get us thinking rather than just sitting and listening to someone lecture.

The pre-reading with the quizzes really helped me learn the material before the lectures so I could apply that knowledge.

At first I thought the whole idea of doing homework in class was nonsense, but further on in the course I found it very unique and helpful.

Figure 5. Data from student survey. All data from 6 ‘flexible-active’ sections in Biol 112 & 121; N = 521 students. Scores between 112/121 were consistent, with S.E.s between classes < 10% for each question.
From the data, areas to consider:

Some students don’t see as much value in the active-learning methods. Ideas to address this:

- Tighten alignment between tests and activities inside and outside class
- Improve timing & choreography of in-class activities
- Explicitly reinforce the value of active-learning practices

Student Comments:

The time for in-class activities is sometimes too much and sometimes not enough.

If a person did not do the readings before class, they would be totally lost in lecture.

I like the engaging atmosphere, but at this point in time, still undecided whether that is better for me than a regular class lecture.

**Figure 6.** Data from student survey.
3 TA Roles & Time Usage
Students value TAs, but they are under-used

A.

I often contact my teaching team (instructors, TAs, Peer Tutors) outside of class in this course.

Student comments:
The professors and TAs are extremely nice and helpful. I would love to continue biology in the future.

There is ... a lot of professor and TA involvement to aid the students' learning.

Having multiple TAs in the classroom was also a great advantage.

I wish that there were more lectures available (maybe put on by the TAs?).

Figure 7. A. Survey data from Bio121 and 112 students about contacting the teaching team. B. Self-reported TA data, N = 8 TAs, from both courses. Standard error, comparing between Biol 112 and 121 total workloads = 1.9 hours
Ideas for effective use of TA time & increased student-TA contact:

**Develop learning centre-specific materials - integrated into course structure**
Biol 112 - Small pilot ongoing, larger plan for Fall 2014

**Use TAs across courses to support and invigilate 2-stage testing**
Will help increase instructor/admin buy-in for large 2-stage tests

**Develop other course materials:**
Evaluate, modify class materials (e.g. online quizzes, worksheets).
Have variety of TA roles in team

**Develop course extras:**
Develop & run tutorial series, skills workshops for returning students
Piloted Biol 112, 121 this term; larger plan for Fall 2014
Conclusions

- Student learning (% normalized change in CI score) is higher in the active learning classrooms than in the lecture-based classrooms.

- Students value many of the instructional approaches known to support learning (peer-instruction, practice exams, clickers). There are some approaches (e.g. pre-readings) they don’t perceive as contributing to their learning as much.

- TAs are an under-used resource in first year biology; there may be many more ways they could be used to support student learning.
Future Directions

- Currently collecting instructor data/perspectives

- Evaluating data from Winter 2014
  - Reproducibility
  - Correlating with COPUS observations
  - Improved student survey

- Continued implementation for “final” transformation, Fall 2014
  - Data-informed course decisions
Questions for you...

- Different ideas for analysis?
- Other types of data that we could collect?
- Something we haven’t considered yet?
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