Adventures in Problem-Based Learning

(CPSC 221: Data Structures & Algorithms)

Dr. Kimberly Voll,
Dept. of Computer Science

Motivation

The Opportunity: Two sections of the same computer-science course, CPSC 221: Data Structures & Algorithms, were offered in Winter Term II... *taught by the same instructor*.

The Idea: Run one section as an **experiment** in workshop-based learning, and the other as a **control**.

The Question: Can we improve the quality of learning through workshop-based classrooms?

The Theory: Well designed exercises will help guide the students to their learning destination.

Hypothesis

Workshop-based learning improves student understanding and long-term retention, and increases overall enjoyment.

What is workshop-based learning?

Guided learning— student understanding of the material *evolves* through in-class activities, clicker questions, and micro lectures.

Why workshop-based learning?

...students are not passive recipients, but engage the material

...aims to give students a sense of *ownership* over their learning, which in turn leads to greater *retention*.

The Experiment

Two Sections of CPSC 221:

201: MWF 10am - 11am (64 students) *CONTROL*

Traditional lecture: Powerpoint slides w/ learning goals delivered by instructor, mild classroom interaction via questions, clicker questions, short discussions.

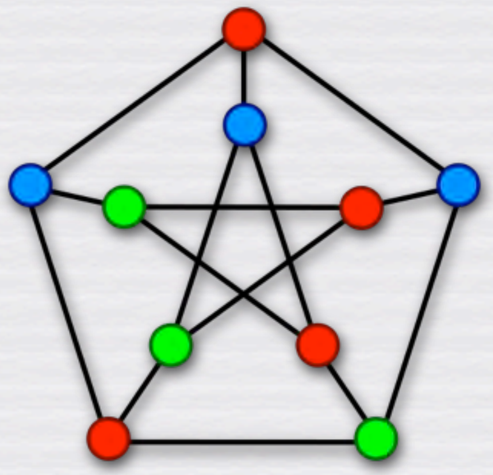
202: TTh 3:30pm - 5pm (47 students) *EXPERIMENTAL*

Lecture: Brief introduction delivered by instructor, remainder of lecture delivered as workshop (instructor as facilitator only)

Assessment

Experimental results were generated between the two sections on the basis of midterm and final exam marks:

All questions were prepared on the basis of provided learning goals (standard practice).



Exam Control Questions:

Two units were offered to establish a baseline for comparison on the exam.

Graph theory taught as a workshop-based class; complexity theory taught traditionally.

Results

Final Grades:

Control (Sec 201): 74%

Experimental (Sec 202): 70%

CPSC 221 historical 5-year average:

Section 201: 71.58% (STDEV 2.9)

Section 202: 70.7% (STDEV 2.5)

Baseline Comparison:

The control section did better on both control questions, suggesting perhaps a stronger section overall.

In general the control performed better on programming assignments and programming questions.

In all other areas the two groups performed equally...

What I Learned...

Student enjoyment seemed higher in experimental group:

Evidenced by extremely high attendance and mid-term anonymous reviews.

Workshop delivery needs to be refined with clearer introductory lecture component and wrap up:

Performance on questions in later units improved and surpassed that of the control group.

This method of teaching is effective:

Even as an inaugural, experimental offering, student performance was on par with standard 221 offerings and close to the control.

Confounding Factors

My experience level with the traditional lecture, versus my inexperience with workshop-based delivery.

This may show improvements in later offerings of workshop-based CPSC 221.

Variations between student body in each section may be impacting overall section averages

Further experimental iterations will help to eliminate this effect.

Follow-up and Conclusion

Retention?

Student anecdotal evidence suggests workshops increase retention for exams, reduce study time...

In September, will run survey testing longer-term retention.

Conclusion:

Increased enjoyment and on par performance motivate serious consideration of this approach as means to increase student learning, retention, and overall enjoyment. *Further study is required.*

Next steps...

Techniques from experimental section will be refined and applied to summer term of CPSC 221 as further data point.