Increased class structure improves short and long term learning (with one caveat)

Pavan Kadandale & Brian Sato

UC STEM LEC Meeting-Part deux
Sept. 2014
Data NOT normalized for GPA/SAT

Don’t *think* it matters (class size, averages, etc.)
Background

“Active learning” - good

High “structure” - good

- Pre-lecture reading
- Online quizzes
- Online homework
- Multiple exams
- In-class activities (not just lecture)

Longitudinal effects?
Biochemistry & Molecular biology at UCI

Traditional lecture course, low “structure”

Large enrollment

Three sections run once a year

Each section taught by 2-3 faculty, little coordination

One mid-term, one final (not cumulative)

Course “works”
The challenge

“Improve” the courses

“Standardize” the courses
“Improve” the course

Increase learning

Increase retention of concepts

Increase engagement

Increase retention of students

Use active learning, and high structure
<table>
<thead>
<tr>
<th>Low structure sections</th>
<th>High structure sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mostly lecture, 2-3 instructors</td>
<td>Class activities, 1 instructor</td>
</tr>
<tr>
<td>No pre-reading</td>
<td>Pre-reading, quizzes</td>
</tr>
<tr>
<td>No homework</td>
<td>Weekly homework</td>
</tr>
<tr>
<td>DS - Worksheets</td>
<td>DS - Problems</td>
</tr>
<tr>
<td>DS – TA lecture</td>
<td>DS – Groupwork</td>
</tr>
<tr>
<td>1 midterm, 1 Final (nc)</td>
<td>3 midterms, 1 Final (c)</td>
</tr>
<tr>
<td>“Knowledge” questions</td>
<td>“Understanding” questions</td>
</tr>
</tbody>
</table>
Winter and Spring 2013 – First implementation

First implementation – few hiccups, some errors

Designed course specific assessment

Multiple choice, Scantron questions

Administered in Discussion section, week 10

No prep, insignificant points for completion
A note about the data

Bio98 = Biochemistry

Bio99 = Molecular biology

Bio98/Biochem in Winter

Bio99/Mol bio in Spring
A note about longitudinal study

Expt Bio98 students in Bio99?

Expt Bio99?
Does it work?
Winter and Spring 2013 – First implementation

Performance on Bio98 assessment (2013)

Overall  Bloom’s 1/2  Bloom’s 3

* indicates significant difference.
Winter and Spring 2013 – First implementation

Performance on Bio99 assessment (2013)

- Expt. Bio98
- Control Bio98

Comparison:
- Overall
- Bloom’s 1/2
- Bloom’s 3
Winter and Spring 2013 – First implementation

Performance on Bio99 assessment (Expt Bio98)

Expt. Bio98
Control Bio98

Overall  Bloom’s 1/2  Bloom’s 3
Lessons learned

If you don’t grade it, they won’t do it

Discussion sections – TA training

More practice at higher order problems (homework)
Didn’t measure performance in Bio98

Other sections implemented *some* aspects

Final assessment in Molecular Biology class

Final assessment = Biochem + Molecular biology

Final assessment Mol bio questions = common
Better structure/design = Better outcomes?
Winter and Spring 2014 – Second implementation

Performance on Bio99 assessment

- Expt. Bio99
- Control Bio99

OVERALL

BL 1/2

BL 3
Winter and Spring 2014 – Second implementation

Performance on Bio99 assessment

- Expt. Bio98
- Control Bio98

Graph showing performance on Bio99 assessment with bars for Overall, Mol bio, and Biochem categories.
Was it just me (not structure)?
Summary

Increased structure -> Increased learning

Increased structure -> Longitudinal gains

Increased structure requires more work!

More work -> Barrier to implementation

Improve course? Increase adoption?