Should we change how we teach?
A trial of an active learning strategy
in a large first year chemistry class.

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Outline

1. How do we teach?
2. Why change?
3. How could we change?
5. Where to next?
6. How this might be useful for you.
   Acknowledgements
1. How do we teach?

A different answer for all of us!

• Many topic and curriculum structures ascribe certain time usage – “tutorial”, “lecture” and “practical” classes.

• Some movement from the traditional –
  • *First year biology* hold “lectorials”, “pre-lectures” and PASS tutorials
  • *First year chemistry and physics topics* hold “drop-in” tutorials and key competency tests

• “Lectures” often account for a significant part of the theory instruction time (50 - 75% is typical).

Tensions ...

• Teaching is telling  
• Knowledge is facts  
• Learning is recall  
• Teaching is enabling.  
• Knowledge is understanding.  
• Learning is active construction of conclusions.

What do we want?

• Factual knowledge  
• Ability to synthesise ideas and apply them in new situations  
• Ability to generate new knowledge

2. Why change?

An opportunity to:
• Address first year experience difficulties
• Embed graduate qualities within a large first year ‘lecture’ scenario.
• Encourage higher order thinking (leading to deeper understanding)
• Enable students to improve communication skills, gain confidence in their ability to master content and apply their knowledge
• Foster interactions with peers and staff.
• Improve students confidence in themselves, the material and the teaching staff.

3. How could we change?

Active Learning Strategies can be used either within a traditional setting or in place of it.
• Focuses the learning on the learners.
• Requires learners to be cognitively active during learning activities

Examples of Active Learning Strategies include:
• Peer led team learning
• Guided inquiry learning
• Team based learning
What has been done?

• ALTC funded Active Learning in University Science (ALIUS) project has identified an example of best practise: Process Orientated Guided Inquiry Learning (POGIL)

• In POGIL classes students:
  • grapple with new concepts
  • develop their own conceptual understanding
  • assess their own learning
  • communicate with their peers (teach/discuss/learn)

Rick Moog & John Farrell
Franklin & Marshall College, PA, USA
http://www.pogil.org/

POGIL

• Orientation is on the Process
• Teacher becomes the facilitator and Guides the Inquiry of the student.
• “Lectures/tutorials” become “interactive workshops”
  • students work in groups, each student is assigned a role
  • together they discover relationships between facts which leads to concept discovery
• Students must engage with the material and think on a deep level to discover the key concepts.
• In general, knowledge is retained well and students have increased confidence in themselves, the lecturing staff and the material.
Weeks 8 – 11, Semester 2, 2010 (257 students).

• 11 “lectures” were transformed into 7 “interactive workshops” interspersed with 4 summary lectures
• Students work in groups of three
  • together they work through problems on a worksheet
  • reach group decisions and conclusions
  • report back via multiple choice questions (flash cards), roving microphone, answers on board etc
• Opportunity for feedback given in each class
  • “clearest point/point you would like explained further”
• Next class started with response to feedback

Early Student Feedback Samples

• Understood well
  • “the whole lecture was awesome. Really easy to understand and keeps me interested.”
  • “I liked. I understood the concepts presented.”

• Like to revise
  • “equilibrium constant” (x5)
  • “nil..maybe more on hydrocarbons”
  • “go over oxidation numbers this way before the exam”
  • “none, understood content well”
Students and feedback

Feedback given during interactive workshop sessions

- 32 – 42 groups in each session
- 9 – 23 feedback sheets filled in each session (25-50% of groups)
- The immediate feedback was valuable both for students and teaching staff.

Factors effecting success

Preliminary data and comments from a student survey (n=150) conducted on completion of the trial.

- Attendance was recorded at all interactive lectures.
- Lecture attendance varied between 85 and 140 students.
- Only 66% felt they attended the lecture/workshops often.
How did the students respond?

Some students changed attendance in response to the interactive workshops.

Least helpful aspects of topic:
“not going to every lecture”
“new interactive lectures because I stopped attending them”

Students were positive

Overall workshops were seen to be both of benefit to learning (57% broad agreement) and enjoyable (49% agreement).

Students who achieved high academic standards with traditional teaching methods often preferred lectures to interactive workshops.
Student thoughts on tutorials

There was 82% broad agreement that the tutorials contributed to learning.

Only 26% broad agreement that the tutorials would be better in the interactive workshop style.

Challenges from staff view

- Class size
- Student attendance at lectures
- Staffing of classes
  (works best with more than one facilitator)
- Coverage of material (pace and extent)
- Time in preparation/adaption of materials and resources
- Anticipating the timing for worksheets can be difficult
- Presenting is surprisingly hard work but also very rewarding
Best Aspects (from students)

• “the interactive sessions helped lots in understanding equilibrium reactions”
• “easy to understand workshops, help was usually available”
• “working in groups – hearing other people put it differently”
• “definitely the activities”
• “interactive workshops & being able to approach ‘roaming’ lecturers was invaluable”
• “teamwork”
• “Very, very happy with interactive style. Extremely helpful.....thinking outside the square very much appreciated”

Improvement suggestions (from students)

• “slowing down a little”
• “a faster pace”

• “Having some teaching then some time to work on problems”
• “perhaps start the week with a lecture on that week’s content”

• “Having some extra take home examples for practise which will be reviewed at the start of the following lecture”

• “No interactive. Lectures much more effective and enjoyable”
• “making more group oriented lectures they seemed to help more”
• “group lectures were great as some key concepts were discussed and explained. If anything include more group lectures.”
5. Where to next?

This methodology will be used again in this topic in 2011. Improvements informed by current trial will include:

- more thorough induction to methodology to students
- monitoring of length and complexity of activities
- maintaining a presence of extra facilitators in workshops

Further analysis

- More rigorous analysis of the survey data needs to be undertaken
- Assessment data from online quizzes, examinations and key competency tests will be compared to previous years.

This active learning strategy is also being considered for use in other parts of this topic.

6. How this might be useful for you

- POGIL is just one example of an active learning strategy.
- Many well developed strategies exist.

*These can be strategically adopted and adapted on a small or large scale.*

- Search for active learning strategies in your subject area

*The extent of the resources available and the enthusiasm and willingness of others to help may surprise.*
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