Evaluating the effectiveness of innovative pedagogies – a personal reflection

Simon Lancaster
The plural of anecdote is not data.

A. The plural of anecdote is not data.

B. The plural of anecdote is data.
Professor Mymates module evaluation data

Mymate module evaluation

NSS Median Mean
Contemporary versus traditional?
What proportion of the time are our students actively thinking during (lecture theatre) teaching?

A. <10%
B. 10–30%
C. 30–50%
D. 50–70%
E. 70–90%
F. >90%

16 May 2017
Our model of lecture flipping
The importance of the question

- Remember
- Understand
- Apply
- Evaluate
- Analyze
- Create
What is your objective for a question posed *during* teaching?

<table>
<thead>
<tr>
<th>Rank</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
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<tr>
<td>4</td>
<td></td>
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<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
What is your objective for a question posed during teaching?
The Goldilocks Zone
Opposites attract, like repels like
Which is favourable?

A. Li $\rightarrow$ Li$^+$ + e$^-$
B. Li$^+$ + e$^-$ $\rightarrow$ Li
C. Li$^+$ $\rightarrow$ Li$^{2+}$ + e$^-$
D. Li$^-$ + e$^-$ $\rightarrow$ Li$^{2-}$
How do you feel about your answer?

A. Very confident
B. Confident
C. Not confident
D. Not at all confident

Which is favourable?
A. \( \text{Li} \rightarrow \text{Li}^+ + e^- \)
B. \( \text{Li}^+ + e^- \rightarrow \text{Li} \)
C. \( \text{Li}^+ \rightarrow \text{Li}^{2+} + e^- \)
D. \( \text{Li}^- + e^- \rightarrow \text{Li}^{2-} \)

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C. \( \text{Li}^+ \rightarrow \text{Li}^{2+} + e^- \)
D. \( \text{Li}^- + e^- \rightarrow \text{Li}^{2-} \)
Evidence

Student activity

- Thinking: 54
- PI: 9
- Interactions: 12
- Lecturing: 25
Lancaster’s module evaluation data

Lancaster module evaluation

NSS
Median
Mean
What is learning gain?

A. The learning achieved by a student between two points in time.

B. The improvement in knowledge, skills, work-readiness and personal development made by students during their time spent in higher education.

C. The value added by an institution in terms of the increased likelihood of gaining a good honours degree given a certain range of entry qualifications.
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The UEA project

At UEA, we are examining 3 ways of measuring Learning Gain:

- Student marks/grades/GPA
- Self-efficacy
- Concept inventories
Concept inventories

Conceptual

Validated

Reliable
Collaborative concept inventory use
Normalised gain

\[ g = \frac{\text{post} - \text{pre}}{100\% - \text{pre}} \]

\[ g = \frac{75 - 66}{100 - 66} = 0.26 \]
Mean normalised gain for the bonding concepts inventory

0.19
1. Determine an average mark for the quiz.
2. Assign student to above or below average group. 0,1
3. Calculate student average confidence.
4. Assign student to above or below average confidence group.

<table>
<thead>
<tr>
<th>High attainment</th>
<th>Low attainment</th>
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<tbody>
<tr>
<td>High confidence</td>
<td>X</td>
</tr>
<tr>
<td>Low confidence</td>
<td></td>
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</table>
# Self-efficacy over the course of the module

<table>
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<tr>
<th>SESSION</th>
<th>SIZE</th>
<th>P-value</th>
<th>Association</th>
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<tbody>
<tr>
<td>WK2</td>
<td>89</td>
<td>0.058</td>
<td>BORDER</td>
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<tr>
<td>WK4</td>
<td>86</td>
<td>0.015</td>
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</tr>
<tr>
<td>WK6</td>
<td>83</td>
<td>0.001</td>
<td>YES</td>
</tr>
<tr>
<td>WK8</td>
<td>83</td>
<td>0.126</td>
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</tbody>
</table>

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Dr Fabio Arico       Dr Ross Galloway
Prof Neil Ward       Dr Anna Wood
Helena Gillespie     Dr Anne Nortcliffe
Dr Annamari Ylonen   HEFCE
Dr Adam Longcroft    Turning Technologies
4* evidence

Active learning increases student performance in science, engineering, and mathematics

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Significance

The President’s Council of Advisors on Science and Technology has called for a 33% increase in the number of science, technology, engineering, and mathematics (STEM) bachelor’s degrees completed per year and recommended adoption of empirically validated teaching practices as critical to achieving that goal. The studies analyzed here document that active learning leads to increases in examination performance that would raise average grades by a half a letter, and that failure rates under traditional lecturing increase by 55% over the rates observed under active learning. The analysis supports theory claiming that calls to increase the number of students receiving STEM degrees could be answered, at least in part, by abandoning traditional lecturing in favor of active learning.