Concept first, jargon second: An assessment of the influence of technical vocabulary on conceptual learning

Megan Barker, Lisa McDonnell, & Carl Wieman
Rationale/background

• Learning discipline-specific concepts and the technical jargon that represents them is required to achieve fluency in a scientific discipline.

• Traditionally, concepts and jargon are taught in aggregate. This may increase student cognitive load, impacting learning of the concepts (Brown and Ryoo, 2008).
Research Question:
How will student learning be affected if we teach the concepts in plain language first, before teaching jargon?

Aggregate (Traditional):
**Control**
- Concept #1 introduced
- Concept labelled with Jargon #1
- Jargon used to introduce Concept #2
- Concept #2 labelled with Jargon #2
- Jargon used to introduce Concept #3

Concepts-first:
**Treatment**
- Concept #1 introduced
- Concept #2 introduced
- Concept #3 introduced
- Jargon #1, 2, 3 introduced
Study Design

Control (Aggregate)  
n=229

- Jargon included
- Content-related material

Treatment (Concept-first)  
n=231

- Jargon-free
- Introduced to jargon

Pre-class: Reading & quiz  
(~1 hour)

In-class:  
3 minutes

Worksheet, mini-lecture, clicker Qs, worksheet  
~35 minutes

In-class post-test  
10 minutes

Data Analysis: all post-test data of students who did the pre-reading  
(n=42 control, n=42 treatment; populations equivalent based on prior midterm.)
Analysis: Questions & Measurements

1. Can students better **recognize** correct concepts and jargon?  
   Multiple-choice Qs, with and without jargon

2. Can students provide better **explanation** of concepts, and **use** of jargon?  
   Short-response Qs – no jargon in stem.

3. Do students **prefer** the concepts-first or the aggregate approach?  
   Student survey
Analysis: Questions & Measurements

1. Can students better recognize correct concepts and jargon?
   Multiple-choice Qs, with and without jargon

2. Can students provide better explanation of concepts, and use of jargon?
   Short-response Qs – no jargon in stem.

3. Do students prefer the concepts-first or the aggregate approach?
   Student survey
### Topic: Genomes & DNA structure

**Why chosen?**
- Area of student struggle
- New unit in the course
- New jargon to students

<table>
<thead>
<tr>
<th>Topic</th>
<th>Jargon assessed in this topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explain why the structure of DNA is less stable when there is a mutation.</td>
<td>Purine, Pyrimidine, Stacking interaction</td>
</tr>
<tr>
<td>Identify and explain what a genome is.</td>
<td>Genome</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Jargon</th>
<th>Substitute term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purine</td>
<td>Large base</td>
</tr>
<tr>
<td>Pyrimidine</td>
<td>Small base</td>
</tr>
<tr>
<td>Stacking interaction</td>
<td>Hydrophobic interaction</td>
</tr>
<tr>
<td>Genome</td>
<td>Total hereditary genetic material</td>
</tr>
</tbody>
</table>
Results:
1. Multiple choice - No difference
2. Open-Response Question Analysis

With rubric, blind-reviewed subset of responses to determine what jargon and explanations they used

Identified alternate common correct explanations, and expanded rubric accordingly. Re-reviewed responses.

Scored correct use of jargon and a variety of correct explanations
>95% IRR, all differences resolved
2. Open-Response Questions

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td>**</td>
<td>**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**p < 0.05   **p = 0.05

Expl = explanation

DNA Structure

Genome

Percentage of student answers

Control (aggregate)  Treatment (concept-first)
2. Treatment group provided more explanations overall on open-response questions

* p < 0.005
Conclusions and Possible Implications

1. No difference in ability to recognize correct jargon/concepts.
   
   Assumption that students understand concept if selecting correct answer, but was not the case in SA responses.

2a. Variation in correct use of jargon (only one out of 3 terms showed difference between treatment/control).
   
   Differences could relate specifically to topic – accessibility of jargon, prior exposure...?

2b. Increased correct explanations of concepts overall.
   
   More comfortable with descriptive language? Less cognitive load without jargon use.

3. 60% of surveyed students found it preferable to learn new material in a concepts-first manner.
   
   Could investigate interactions between concepts-first approach and ESL?
Future Directions

• Consult students to re-consider identification of jargon and topic prior to study
• Increase sample size
• Implement key component of intervention in face-to-face time, rather than before class
• Broader assessment to investigate differences between different jargon/topics
• Longer experiment
Many thanks for...

Support from course instructors:
Sunita Chowrira, Carl Douglas, Marcia Graves, Ehleen Hinze, Karen Smith

Discussions on study design & analysis:
Laura Weir, Martha Mullally, Trish Schulte

Further questions/ideas – please contact us:
Megan: barker@zoology.ubc.ca
Lisa: lmcdonne@zoology.ubc.ca
Analysis

Cohort: Students who completed the pre-reading prior to quiz (self-reported)

A – I read all of the pre-reading before today’s pre-quiz
B – I read some/most of the pre-reading before today’s pre-quiz
C – I skimmed the pre-reading before today’s pre-quiz
D – I first opened the pre-reading while I was doing the pre-quiz
E – I didn’t read the pre-reading for today

Resulting cohorts:
Aggregate (Control): n=42
Concepts-first (Treatment): n=42