Towards conceptual understanding in the teaching of tertiary Science

Pauline M. Ross and Deidre Tronson
University of Western Sydney

Students in any learning situation bring:
- experiences from previous learning
- understanding which is personal, incomplete and sometimes contradictory
- a high resistance to change

Students also bring
Differences in learning styles

Learning styles
- Auditory learn through listening
- Visual learn through seeing
- Kinesthetic learn through moving, doing, touching

If there is variability in the way students learn
What to do?

Option 1 - Lets ignore it
- Students need to learn how to learn
- i.e. Students need to learn my way
- i.e. Students need to learn one way
- Outcome – Negative?
Towards conceptual understanding in the teaching of tertiary Science

**Option 2 - Lets include it**
- Students learn in different ways
- i.e. Students may learn differently from me
- i.e. Students need to be taught differently
- Outcome – Greater understanding for all?

**Traditionally at tertiary**
- Transmissive teacher centric model is common
- Emphasis often auditory, sometimes visual

**Less often multisensory**

**An example of an abstract concept**
Photosynthesis

**Learning sequence**
1. Lecture – didactic – auditory and visual
2. Practical – 3D model of chloroplast – visual and kinesthetic
3. Reteach – lecture – kinesthetic and visual

**Photosynthesis**
- Students have misunderstandings and misconceptions
- Conceptually abstract and non intuitive
- Difficult to visualise the submicroscopic
Towards conceptual understanding in the teaching of tertiary Science

3. Kinesthetic lecture

1. Overhead projector – photons of light
2. OEC – \(4\text{H}^+ + 4\text{e}^- + 2\text{O} \rightarrow 2\text{H}_2\text{O}\) on board
3. Light on PSI – student ejects an electron from PSI, replace from OEC
4. Diffusion of \(\text{O}_2\)
5. Tiered theatre - electron transport chain
6. Students eject electrons from their hands

Coupled with

Concept diagram

Evaluation

Open-ended question

Please indicate the important characteristics of this lecture/class that have been most valuable to your overall learning experience

Results - 203 students

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No response</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Some aspect of teaching positive to learning</td>
<td>80</td>
<td>42.7</td>
</tr>
<tr>
<td>Teaching/learning increased conceptual understanding</td>
<td>37</td>
<td>19.3</td>
</tr>
<tr>
<td>Interactivity increased conceptual understanding</td>
<td>27</td>
<td>13.7</td>
</tr>
<tr>
<td>Identified learning styles increased conceptual understanding</td>
<td>45</td>
<td>24.1</td>
</tr>
</tbody>
</table>

What can I do?

- Provide opportunities for students to actively engage with content
- Use kinesthetic activities
- Close our eyes visualise
- Build models
What will assist my learner understand?

Be the learner