Seeing with new eyes: developing visual literacy in the sciences

“The real voyage of discovery consists not in seeking new landscapes but in having new eyes.” M. Proust

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Like the “6 Blind Men” who check out an elephant and attempt to describe him (see link for image), we may only “see” one perspective...


What might we be missing?!
DEEP LEARNING
- daring - (difficult?) - desirable

- "...deep learning involves the critical analysis of new ideas, linking them to already known concepts and principles, and leads to understanding and long-term retention of concepts so that they can be used for problem solving in unfamiliar contexts"

Houghton, 2004
## Ideally, learning involves...

### Authentic experiences
- *Real world complex problems and their solutions* (Lombardi, 2007)

### Active engagement
- *Learning is about conceptual change, not just acquisition of knowledge* (Biggs, 1997)

### Transfer, linking - making connections
- *Building on the familiar, and providing multiple contexts* (Bransford et al., 2000)
  - "...questioning is a key means of becoming critical, of learning to reason..." (Schleffler, 1973)

### Novice-to-expert: Building Autonomy
- "enculturation" into the discipline (Lave and Wenger, 1991)

### Element of fun! (challenge)
Where does the visual come into play?

- Visuals can provide scaffolding (Nilson, 2010)

- Visuals have an effect comparable to collaborative learning and reinforcement and feedback (Nilson, 2010; Marzano, 2003)
Cognitive Theory: The Big Picture

Experts have a hierarchical and weblike structure of discipline, easily retrievable.

Novices need graphics to provide a "big picture" organization of discipline, and provision of mental structures of knowledge.

...provision of mental structures of knowledge
...hierarchical and/or weblike
Dual-coding theory (Paivio, 1971; Vekiri, 2002)

How visuals work with text

2 memories:
  *semantic (verbal)*
  *episodic (visual-spatial)*

Implies learners process material twice in one cognitive event

Visual argument theory (Larkin & Simon, 1987; & others)

Convey information more efficiently, because it...

  *Draws attention to conceptual relationships*
  *Enables pattern-recognition*
  *Aids in integrating new knowledge into existing cognitive structures*

Ideas are not always black and white...
So... what “text” goes with this diagram?
In an ideal world...
Reality...!

Photo: P. Wallace
The Goal
 Moving from this...

Not thinking!

... to this

Thinking!
Student Activity

6 Photographs - *something of relevance to course*

Write a figure caption - *clear, explicit connection*

Indicate your “best” and your “most shaky”
OUTCOMES

- Students’ comment on increased understanding, enjoyment, “fun”, and engagement
- Mastery and misconceptions obvious to instructor
- Heightened interest, skills, confidence
- Students take their class-learning to the “real” world and *visa versa* (authentic activity)

- Additional (not intended)
  - Involvement of others (parents, family, friends)
  - Students continued to bring in / send me photos, materials / connections
Your Task

- **Leave the classroom to locate...**  (15 minutes)
  - 1 and 2: Something VISUAL you can envisage incorporating into your teaching
    - This can be something concrete or something conceptual, large or small, BUT it must be linked to something you see when you leave this room!
  - 3 and 4. As you do this NOTE frustrations, confusion, difficulties, excitement, “fun”...

- **Restrictions**
  - 5. You cannot use either a computer or a book (or your office / department, if from Western!)
  - Please do feel free to work alone, in pairs, in small groups, but each must come up with something related to their discipline

- **When you come back - in groups of 3-4** (10-15 minutes)
  - Indicate your discipline, what you have chosen (but initially, not WHY you chose it!)
  - Discuss all, share ideas, summarize, **CREATE A QUESTION**, and report
Your Task

1. GO!
2. Child taking a photo
3. Bear and skateboard
4. People holding question mark
5. X mark
<table>
<thead>
<tr>
<th><strong>Photography to motivate / create authentic learning experiences</strong></th>
<th><strong>Photography to aid question-generation, communication</strong></th>
<th><strong>Photography to aid evaluation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Scavenger hunt</td>
<td>Sketching from photo</td>
<td>Sketching from photo</td>
</tr>
<tr>
<td>Create a wall of “f(r)ame”</td>
<td>Writing directions</td>
<td>Using photos/diag with instructor-generated questions</td>
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<tr>
<td>Linking in-class learning with “real” world</td>
<td>Poster presentation</td>
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<tr>
<td>How many different ways to look at the same thing? (multiple perspectives!)</td>
<td>Writing photo / figure captions</td>
<td>Writing captions / sketching a different perspective, etc</td>
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<tr>
<td>Develop concept / mind maps</td>
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</table>
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“I am neither especially clever nor especially gifted. I am only very, very curious.”