Norms

- minimize side talk
- get up whenever!
- ask questions any time

... and?
Why bother...

"Students do not learn what we teach. If they did, we would not need to keep grade books. We could, simply, record what we have taught."

Dylan William Embedded Formative Assessment pp. 47-48
In the next 2 hours ...

★ **what’s a concept map?**
  • map properties
  • maps & NGSS
  • map technologies
  • make a basic map & discuss

★ **what’s a map do?**
  • different uses for maps
  • grading vs. feedback; rubrics & progressions
  • brief look at student work
  • make, share, and grade a map

★ **mapping power**
  • hierarchy & symmetry

★ **resources**
What’s a Concept Map?

✓ concept maps show relationships between ideas, rather than definitions or sequences (flow charts)

✓ maps are visual tools that organize knowledge

✓ maps must have:
  1. concepts: ideas in bubbles; nouns
  2. links: labeled lines; verbs
  3. these connect as “concept-link-concept” sentences
Concept maps contain concepts and links to relationships.
School Capacity

- requires quality
- depends on building

motivation for change

- intrinsic rewards
- behavior

leadership

- provides
- establishes conditions for
- monitors

Successful experiences

- provides
- lead to changes in
- belief

Professional learning communities

- need to avoid reinforcing ineffective methods
- conservative ideas

- create
- provide

Program coherence

- requires
- clear
- must work towards
- takes sustained time

Goals

- should have a flexible
- plans

Individual teachers

- have
- should tap

Technical resources

- includes
- provides

Leadership

- requires
- communication
- must be two-way

Leadership

- technical resources
- individual teachers

Knowledge, skills, disposition

- are gained through increase
- help build
- replace

Culture of expectations

- culture of risk-taking

Leadership

- provides increase
- lead to new

Communication

- must be
- constant two-way

Leadership

- monitors
- requires

Institutional hierarchy

- can be
- can be

Implementation dip

- "simple & sticky"
- "fat & forgettable"

- are only type useful
- sent LOWER in
- sent HIGHER in
“deep exploration of important concepts, as well as time for students to develop meaningful understanding, to actually practice science and engineering, and to reflect on their nature”

“students need sustained opportunities to work with and develop the underlying ideas and to appreciate those ideas’ interconnections over a period of years rather than weeks or months”

“science is fundamentally a social enterprise, and scientific knowledge advances through collaboration and in the context of a social system with well-developed norms”
Map Technologies

a good technology is easily *edited* & easily *shared*

1. paper & pencil
2. whiteboards / bench tops
3. sticky notes & string or chalk
4. word processors
5. software
   - “Inspirations”
   - “Omnigraffle” ME-MLTI
   - iPads ??? a new adventure ...
Task: Make a Map

1. Find a partner.
2. Swap maps with your partner.
3. Have one partner read out loud each “concept-link-concept”. Do they make grammatical sense? Edit if needed.
4. Repeat for the other partner.
5. Compare your maps. What do you notice?
6. Discuss: what insight or question do you want to share with the larger group?

instructional practice
professional development
student learning
Early Maps: KISS!

Keep first efforts small and structured. This is hard work!

1. “Make a map from these 3 words: ___”
2. “Make a map from these 3 words (___) plus two more concepts of your own from your reading/lab/notes.”
3. “Make a map of 4-5 key words from ....”
Early Maps: “Buy In”

Keep first efforts enjoyable and useful.

✓ low stakes or no stakes grading
✓ opportunities to share and edit
✓ USE THEM! avoid “mapping for mapping sake”; where’s the chemistry?
  • probe students’ prior knowledge
  • get main ideas from a reading or activity
  • pull different lessons together for review or to strengthen connections
Simple Map Rubric

- All required concepts are present.
- All concepts are connected to another concept.
- All links are labeled.
- All links make grammatical sense & scientific sense.
- Required concepts represent important ideas.
# Map Feedback

<table>
<thead>
<tr>
<th>Feedback about</th>
<th>(+) specific thing I like</th>
<th>(Δ) specific things to improve</th>
</tr>
</thead>
<tbody>
<tr>
<td>the chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the map</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Typical Error #1: Definitions

- Observation
  - Produce new observations
  - State problem to formulate possible explanation

- Experiment
  - Gather new information to test the validity of the hypothesis

- Hypothesis
Typical Error #1: Definitions

- **Observation** (recognize & state the problem)
- **Hypothesis** (possible solutions to problem)
- **Experiment** (searching for new information)

Is needed to make a...

Which focuses questions to create an...
Typical Error #2: Dependency

Models

Eventually can be lead to Theories

Or

Laws
Task: Student Work

• Find the “Sample Map” in your packet.
• Evaluate the sample map using the rubric.
• Write 4 sticky note feedback comments for this student:
  o “plus” & “delta”
  o on science & on the map

IN PAIRS/TRIOS:
1. Find a partner and share your rubric values. Come to consensus!
2. Share your feedback for this student. Select the 2-3 you think most helpful to the student.
3. Be prepared to share an insight or a question.
Absolute Zero equals 0 K equals -273°C.

Volume of a Gas is directly proportional to the Temperature of a Gas (in kelvins) and defines the proportionality between temperature (in kelvins) and the Charles's Law.

\[ V = bT \]
Hierarchy & Symmetry

✓ HIERARCHY requires students to **prioritize** the importance of ideas.

✓ SYMMETRY requires students to “**chunk**” knowledge into parallel pieces. This builds “HOTS”.

✓ Some students will do this intuitively, but it should not be pushed until basic skills are mastered. *Consider differentiated rubrics.*
Hierarchy & Symmetry

the topic

main idea #1
  detail
  detail

main idea #2
  detail

main idea #3
  detail
  detail

“lead to” idea
Arrhenius concept of acids and bases

conjugate base
creating a proton acceptors
are

Bases
produce
states that

hydroxide ions

Bronsted-Lowry model

Acids
produce
states that

hydrogen ions in aqueous solution
a more advanced rubric

- All required concepts are present.
- All concepts are connected to \textit{at least one other concept}.
- Multiple links highlight a \textit{few} significant cross-connections.
- All links are labeled and \textit{substantial}.
- All links make grammatical sense \& scientific sense.
- The map uses one of the following strategies:
  - hierarchy to show the relative importance of different concepts.
  - symmetry to show “chunking” of ideas into groups.
Task: Make a Map

- Select a topic in chemistry you would be interested in having students map.
- Brainstorm a list of key concepts. Select 3-4 concepts all maps must have.
- Make a map of 6-10 concepts on your own, using your choice of “basic” or “advanced” rubric.

Editing:
1. Swap maps with a partner. Tell him/her what rubric to use.
2. Evaluate your partner’s map using the correct rubric.
3. Provide “+” and “Δ” feedback on his/her mapmaking.
5. Discuss the process with your partner.
Survey says ...

### 2. What do you think about CONCEPT MAPS?

<table>
<thead>
<tr>
<th>Perception</th>
<th>Strongly Agree</th>
<th>Somewhat Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Somewhat Disagree</th>
<th>Strongly Disagree</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>They help me understand what I read.</td>
<td>23.6% (17)</td>
<td>44.4% (32)</td>
<td>16.7% (12)</td>
<td>8.3% (6)</td>
<td>6.9% (5)</td>
<td>72</td>
</tr>
<tr>
<td>They are easy to do.</td>
<td>30.6% (22)</td>
<td>38.9% (28)</td>
<td>18.1% (13)</td>
<td>5.6% (4)</td>
<td>6.9% (5)</td>
<td>72</td>
</tr>
<tr>
<td>They take a lot of time.</td>
<td>6.9% (5)</td>
<td>33.3% (24)</td>
<td>19.4% (14)</td>
<td>27.8% (20)</td>
<td>12.5% (9)</td>
<td>72</td>
</tr>
<tr>
<td>I like doing them.</td>
<td>11.1% (8)</td>
<td>25.0% (18)</td>
<td>29.2% (21)</td>
<td>20.8% (15)</td>
<td>13.9% (10)</td>
<td>72</td>
</tr>
<tr>
<td>Doing them changes the way I read an assignment.</td>
<td>22.5% (16)</td>
<td>35.2% (25)</td>
<td>23.9% (17)</td>
<td>11.3% (8)</td>
<td>7.0% (5)</td>
<td>71</td>
</tr>
</tbody>
</table>

### 7. "My favorite way to take non-mathematical notes is ..."

<table>
<thead>
<tr>
<th>Method</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>a concept map</td>
<td>20.8%</td>
<td>15</td>
</tr>
<tr>
<td>a Frayer Square</td>
<td>9.7%</td>
<td>7</td>
</tr>
<tr>
<td>an Anticipation-Reaction Guide</td>
<td>2.8%</td>
<td>2</td>
</tr>
<tr>
<td>my own format</td>
<td>66.7%</td>
<td>48</td>
</tr>
</tbody>
</table>
Using Maps: a Review

Concept Maps

Students

- Reading comprehension
- Metacognition
- Science "talk"
- Conceptual understanding

Can be used by

Teachers

- Prior knowledge
- New knowledge

May probe for

Provide visual record of

May assist construction of

May encourage to use

May engage in more

May improve their reading comprehension

Can lead to deeper

Can lead to deeper

Can lead to deeper
Resources