Concept Mapping: ChemEd 2013

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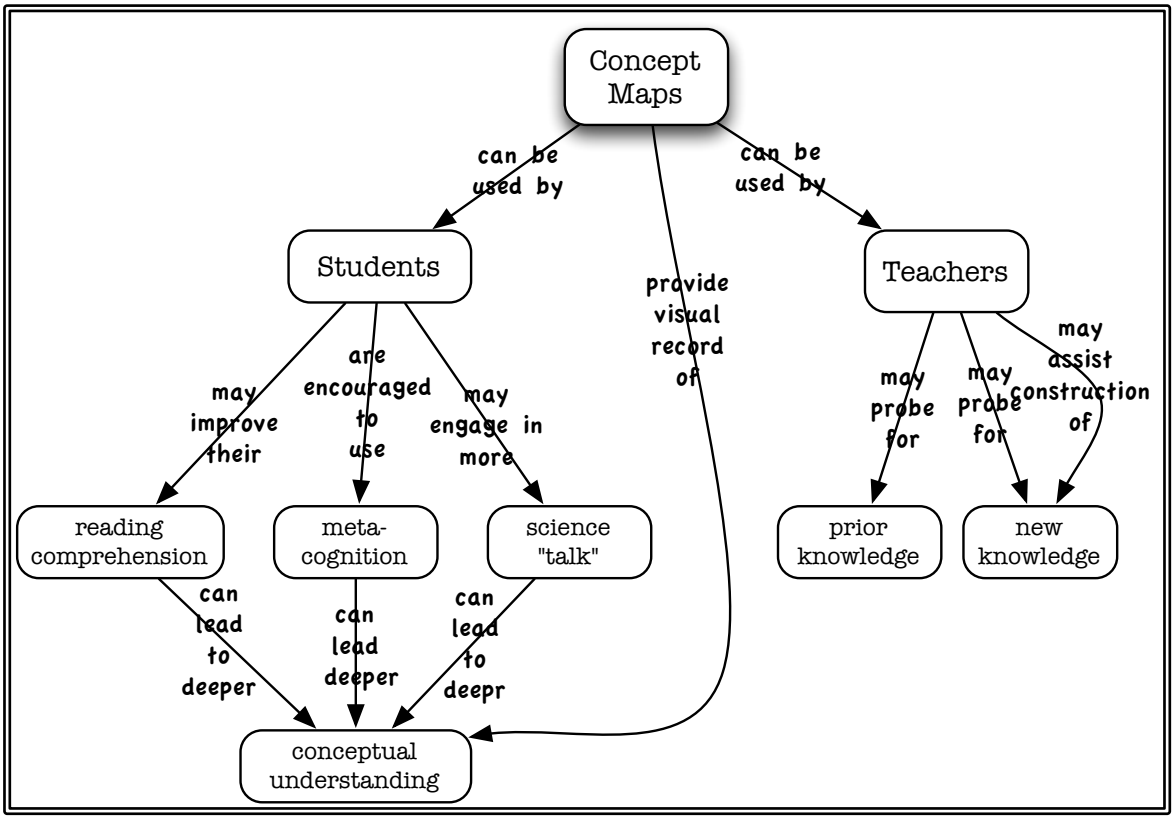


Resources:

Learning How to Learn by Novak & Gowin (1984)

Learning, Creating, and Using Knowledge: Concept Maps as Facilitative Tools in Schools and Corporations by Joseph Novak (2010)

A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas National Research Council (2010) *(free download!)*

How Students Learn: Science in the Classroom by the Committee on How People Learn: A Targeted Report for Teachers, National Research Council (2005)

Embedded Formative Assessment by Dylan William (2011)

What's a concept map?

- ✓ concept maps show **relationships** between ideas, rather than definitions or sequences of events
  maps are visual tools that **organize knowledge**
- ✓ maps must have:
  - concepts: ideas in bubbles; nouns
  - links: labeled lines; verbs
  - these connect as "concept-link-concept" sentences

Maps & the Framework (NGSS)

"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" Framework pg. 26

- ✓ **creating** and **editing** maps aids students in constructing knowledge and reflecting on what they know (metacognition)
- ✓ **sharing** maps aids students in "science talk"(tools for building scientific arguments and explanations) as well as testing and refining their ideas

Maps need a purpose

- ✓ avoid "mapping for mapping sake": where's the chemistry?
- ✓ know the purpose before you map
  - are you probing students' prior knowledge?
  - are you helping students get main ideas from a reading or activity?
  - are you helping students pull different lessons together for review?

Map Technologies *good technologies are easily edited & shared*

1. paper & pencil
2. whiteboards /benchtops
3. sticky notes & string or chalk
4. word processors
5. software
   a. "Inspirations"
   b. "Omnigraffle" ME-MLTI
   c. iPads ???

for #1-3 consider photographing maps to provide a record of students' ideas

Early Maps:

1. *first maps should be simple & structured*
    a. "Make a map from these 3 words: ___"
    b. "Make a map from these 3 words (___) plus two more concepts of your own from your reading/lab/video.
    c. "Make a map of 4-5 key words from this week's notes/web article, etc."
2. consider ways to increase "buy in" for students
    a. low stakes or no stakes grading lowers fear
    b. peer editing & sharing provides practice as well as expectation that "this this what we do"
    c. post exemplars & unusual maps to provide "pat on the back" as well as examples/alternatives for struggling students
    d. focus on content, not mapping ("where's the chemistry?")
3. typical novice errors
    a. trying to turn the map into "term-and-definitions"
    b. "dependent links": links that only make sense after reading another part of the map

Basic Concept Map Rubric

- ✓ KISS! 4-5 concepts are easier for students to make & for teacher and students to discuss and assess
- ✓ keep the stakes low
    - there's no "$\surd_e$ = exceeds" on my rubrics
    - either no grade or a generic completion grade
- ✓ Consider the purpose and tailor the feedback:
    - is it about the map?
    - is it about the content?
- ✓ always remember that MAPS ARE FOR THE STUDENTS

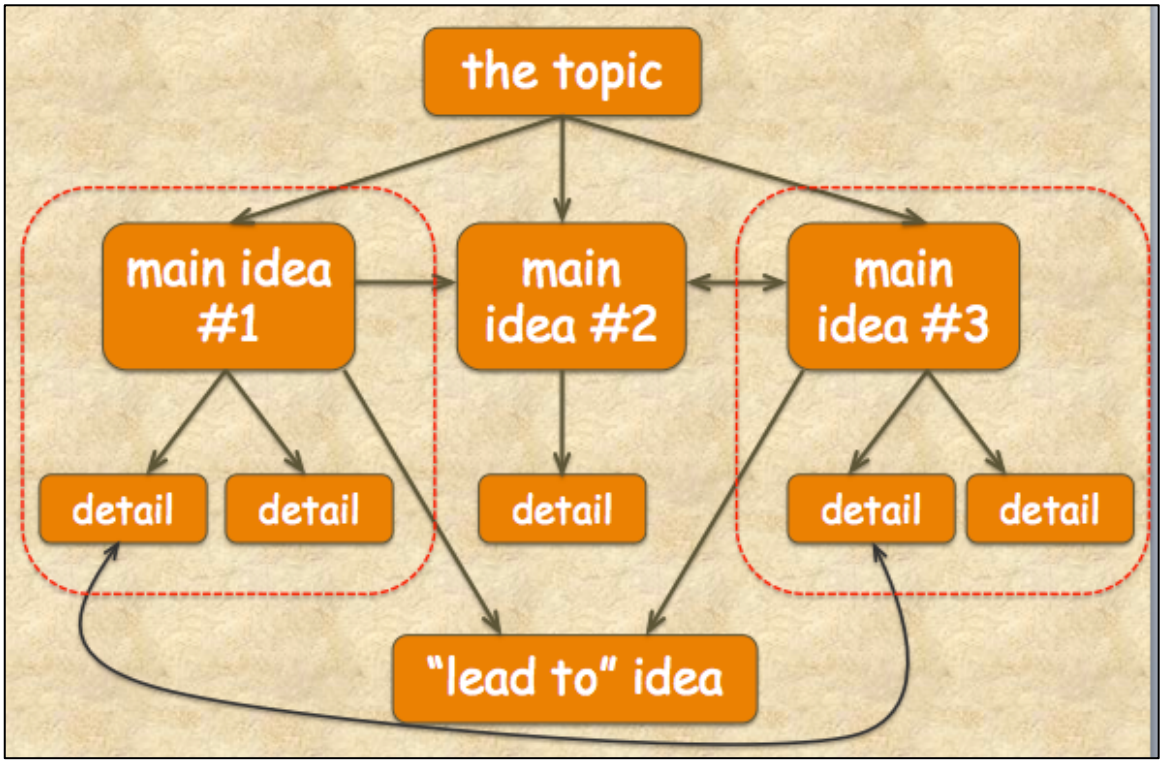
four kinds of feedback	+ specific things I like	Δ specific things to improve
the chemistry		
the map		

Possible Map Sequences

- bring draft map to class → share preliminary ideas with partner → lesson with opportunity to ask questions and revise thinking on concepts → revise map and turn in for teacher feedback
- make summary "unit maps" & post in room → review, revise, and hunt for cross-connections before final exams

Hierarchy & Symmetry (Advanced Maps)

- ✓ HIERARCHY requires students to prioritize the importance of ideas.
- ✓ SYMMETRY requires students to "chunk" knowledge into parallel pieces.
- ✓ This builds "HOTS" [higher order thinking skills].
- ✓ Some students will do this intuitively, **but it should not be pushed until basic skills are mastered.** *Consider letting students choose either the "basic" or "advanced" rubric for their feedback. This reminds both teacher & student that the map is about what the student is learning, not what the teacher is teaching.*



Basic Concept Map Rubric

$\surd_m$ = standard met $\surd_p$ = standard partially met $\surd_n$ = standard not met

$\surd_m$ $\surd_p$ $\surd_n$ All concepts are connected to another concept.

$\surd_m$ $\surd_p$ $\surd_n$ All links are labeled.

$\surd_m$ $\surd_p$ $\surd_n$ All links make grammatical sense.

$\surd_m$ $\surd_p$ $\surd_n$ All links make scientific sense.

$\surd_m$ $\surd_p$ $\surd_n$ All required concepts are present.

Advanced Concept Map Rubric

$\surd_m$ = standard met $\surd_p$ = standard partially met $\surd_n$ = standard not met

$\surd_{met}$ $\surd_{part}$ $\surd_{not}$ all required concepts are present

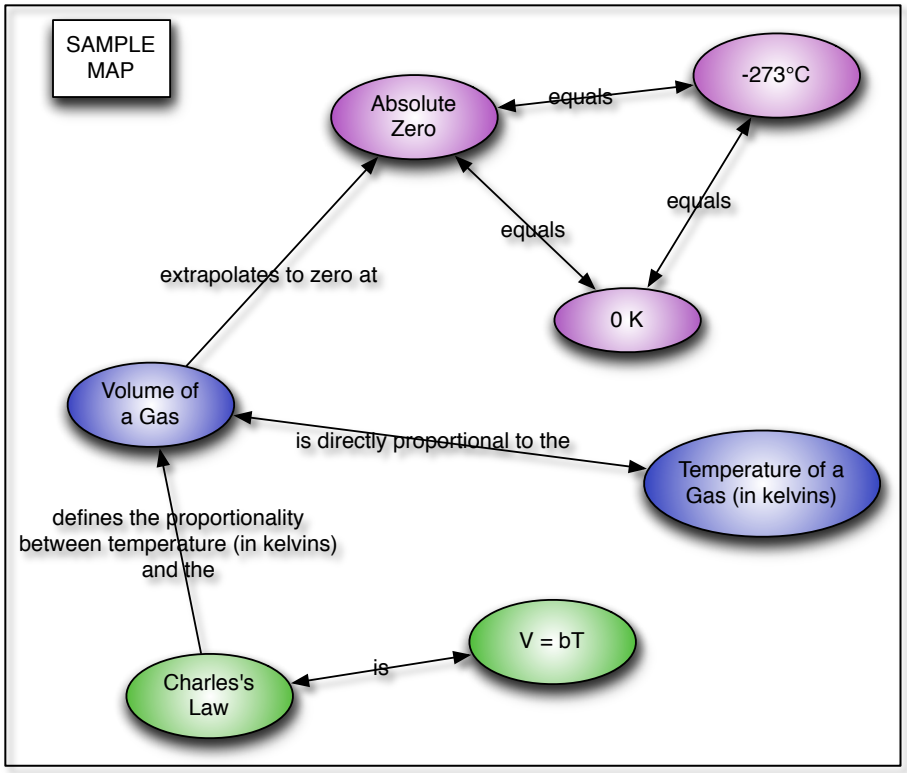
$\surd_{met}$ $\surd_{part}$ $\surd_{not}$ all concepts are linked to at least one other concept

$\surd_{met}$ $\surd_{part}$ $\surd_{not}$ there are a few multiply-linked concepts that highlight key relationships

$\surd_{met}$ $\surd_{part}$ $\surd_{not}$ all links have grammatically correct labels

$\surd_{met}$ $\surd_{part}$ $\surd_{not}$ all links are scientifically valid and non-trivial

$\surd_{met}$ $\surd_{part}$ $\surd_{not}$ the map makes use of hierarchy (to show the relative importance of different ideas) OR symmetry (to show the "chunking" of ideas)



Sample Map Rubric

$\surd_m$ = standard met $\surd_p$ = standard partially met $\surd_n$ = standard not met

$\surd_m$ $\surd_p$ $\surd_n$ All concepts are connected to another concept.

$\surd_m$ $\surd_p$ $\surd_n$ All links are labeled.

$\surd_m$ $\surd_p$ $\surd_n$ All links make grammatical sense.

$\surd_m$ $\surd_p$ $\surd_n$ All links make scientific sense.

$\surd_m$ $\surd_p$ $\surd_n$ All required concepts are present.

four kinds of feedback	+ specific things I like	Δ specific things to improve
the chemistry		
the map		

Sticky Notes

"Exit Slip"

Concept Mapping Workshop
ChemEd 2013 * Sue Klemmer

I teach: *Check all that apply.*

___ middle school
___ high school
___ college

___ chemistry
___ other sciences
____ mathematics

other:

My knowledge about concept mapping before this workshop was:

My knowledge about concept mapping after the workshop is:

I learned new skills in this workshop.

My attitude towards concept mapping has changed after this workshop.

I am likely to have my students use concept mapping this year.

Optional Comment:

Thank You!