

What does it mean when a student says, *I understand?*....

Does *understanding* mean the same thing to that student that it does to another student or to you, the professor?.....

How can students demonstrate their *understanding* to others?

Good Assignments Provide Accountability

Students can demonstrate what they understand.

Instructors can assess how well students understand.

What is a Concept Map?

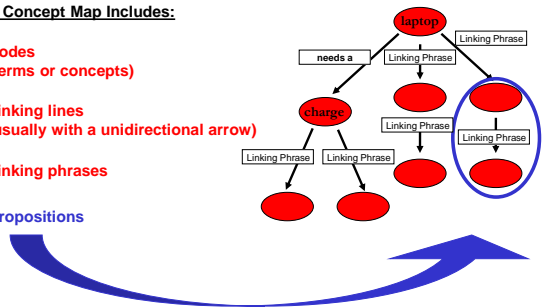
A Concept Map Includes:

Nodes
(terms or concepts)

Linking lines
(usually with a unidirectional arrow)

Linking phrases

Propositions



Why Use Concept Mapping?

Concept maps help students to organize and use course content in a meaningful way

Concept mapping is a good active-learning technique that helps to reach students with diverse learning styles

When used in a cooperative manner, concept maps help students to evaluate and communicate their understanding of the material

Reinforces the constructivist approach to learning = student-centered

It is low tech!

From Clarissa Dirks, University of Washington

Purposes for Concept Mapping

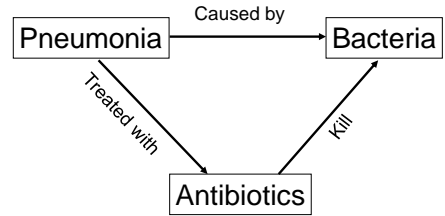
- Generate ideas (brainstorming)
- Design complex structures (long texts, web-sites)
- Communicate complex ideas
- Aid learning by explicitly integrating new and old knowledge
- Assess understanding or diagnose misunderstanding

Short Assignment

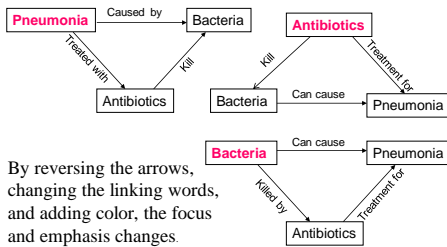
Arrange the following three terms and connect them with arrows and linking phrases

Bacteria Pneumonia Antibiotics

A Mini Concept Map



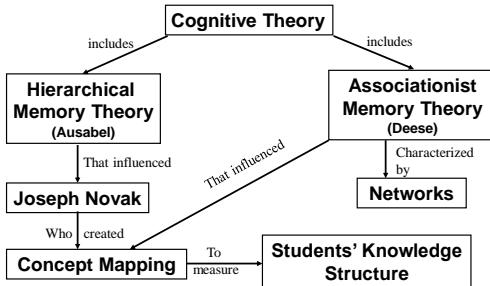
Variations on a Theme



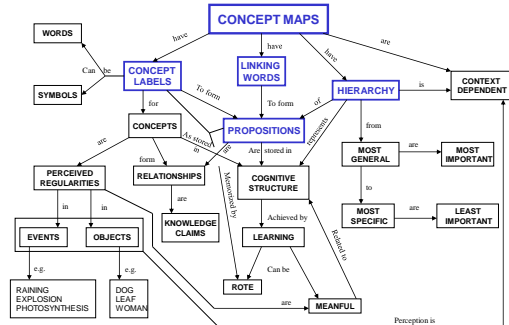
History of Concept Mapping

- Developed by Joseph D. Novak at Cornell University in the 1960's
- Based on the ideas of David Ausubel who stressed the importance of prior knowledge for constructing new understanding

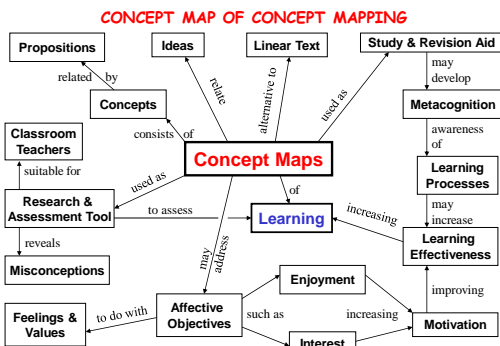
Origin of Concept Mapping



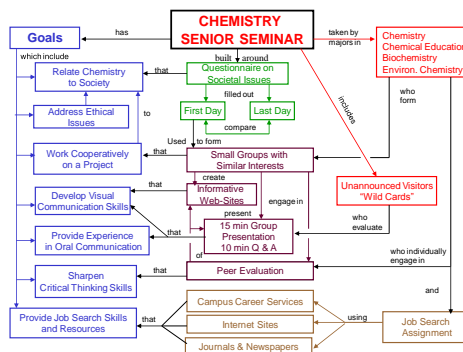
Concept Map Showing Key Concepts in Concept Mapping



Adapted from: Joseph Novak (1991) Clarify with Concept Maps, The Science Teacher 58(7), 45-49.

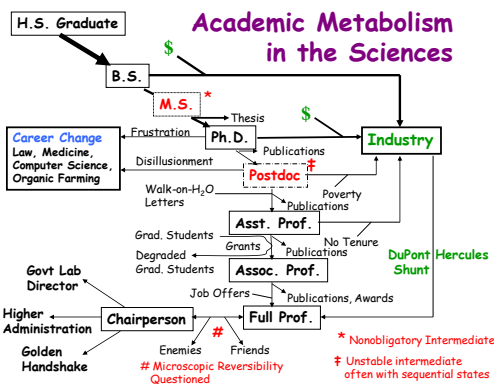
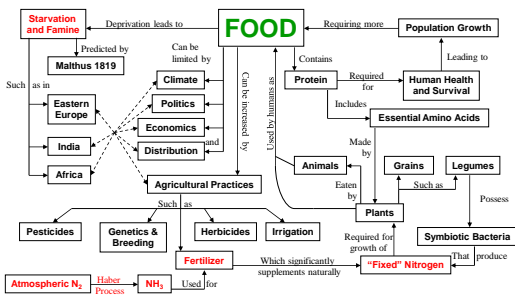


Adapted from K. S. Taber (1994) *Physics Education* 29(5) 276-281



Structure of Chemistry Senior Seminar Displayed as a Concept Map

A Concept Map Based on the Proposition:
Without the industrial chemical reduction of atmospheric nitrogen, starvation would be rampant in third world countries.



Stages in the Construction of a Concept Map

- Brainstorming Stage
- Organizing Stage
- Layout Stage
- Linking Stage
- Revising Stage
- Finalizing Stage

Brainstorming Stage

- List any and all terms and concepts associated with the topic of interest.
- Write them on Post It® Notes, one word or phrase per note.
- Don't worry about redundancy, relative importance, or relationships at this point.
- The objective is to generate the largest possible list.

Brainstorming Stage



Organizing Stage

- Spread concepts on a table or blackboard so that all can be read easily.
- Create groups and sub-groups of related items. Try to group items to emphasize hierarchies.
- Identify terms that represent higher categories and add them.
- Feel free to rearrange items and introduce new items omitted initially.
- Some concepts will fall into multiple groupings. This will become important in the linking stage.

Organizing Stage



Layout Stage

- Arrange terms so that they represent your collective understanding of the interrelationships and connections among groupings.
- Use a consistent hierarchy in which the most important concepts are in the center or at the top.
- Within sub-grouping, place closely related items near to each other.
- Think in terms of connecting the items in a simple sentence that shows the relationship between them.
- Feel free to rearrange things at any time during this phase.
- Do not expect your layout to be like that of other groups.

Layout Stage



Layout Stage



Linking Stage

- Use arrows to connect and show the relationship between connected items.
- Write a word or short phrase by each arrow to specify the relationship.
- Many arrows can originate or terminate on particularly important concepts.

Revising Stage

- Carefully examine the draft concept map.
- Rearrange sections to emphasize organization and appearance.
- Remove or combine items to simplify.
- Consider adding color or different fonts.
- Discuss any aspects where opinions differ

Finalizing the Concept Map

- After your group has agreed on an arrangement of items that conveys your understanding, convert the concept map into a permanent form that others can view and discuss.
- Be creative in a constructive way through the use of colors, fonts, shapes.

Finalizing the Concept Map



Assignment

In your groups, begin constructing a concept map for

Good Teaching