



Concept Mapping: Higher Reasoning Skills

Designed by

Jim Rohan [jrohan@garlic.com]

Background

This activity provides a potential scaffolding for the understanding and development of concept mapping for use by all students in the middle school science classroom. Starting with simple maps and linking them to mappings already mastered, students will develop an intuitive understanding of the power and beauty of making visible their understanding of concepts in science. Concept maps are not only an effective learning tool in the science classroom, but once learned can enhance all areas of higher level reasoning skills in all subject areas.

Description of Audience:

This biotechnology/bioinformatics activity is designed for use in all levels of middle school science courses.

State Standards:

This biotechnology/bioinformatics activity fulfills the following State of California Science Standards:

Investigation and Experimentation: Grade 7d

Ecology: Grade 6: 5a,5b, and 5c

Genetics: Grade 7: 2e

Life Sciences: Grade 8: 6c

National Science Standards:

This biotechnology/bioinformatics activity fulfills the following National Science Standards:

Content Standard A: Science as Inquiry

Content Standard C: Life Science

Content Standard E: Science and Technology

STEM Connection:

Concept Mapping is a tool that helps organize information for oneself and for presentation that can be used in all of science, technology, and mathematics fields including research and publication of results of research.

Technology Integration:

This lesson suggests use of an online available concept mapping program. Both shareware and costware options are given. Once a basic understanding of the software is developed, students are able to use the various tools and skills to create their own concepts maps in a variety of contexts. The topic of concept mapping itself is the object of ongoing research in the emerging

field of cognitive theory. In addition, paper and pencil options are offered for those unable to learn the software program in time for the presentation of the lesson.

Goals(s):

The goals of this lesson are to:

- Expose students to various tools and technology used in concept mapping.
- Allow students to visualize and organize scientific content.
- Reinforce the connection between learning, integration, and knowledge acquisition.
- Show students how to create their own concept maps moving from simple to more complex models. In the last part of the lesson, students are asked to create a concept map based on notes of a lesson on research into important activities/functions of biological molecules.

Learning Objective(s)

Upon completion of this lesson, students will be able to:

- Construct a concept map following middle school concept mapping guidelines
- Use Inspiration or Freeware (at home or at school) to construct a concept map of a simple food chain
- Construct a concept map for a simple food web
- Construct a concept map of concepts related to ecological principles and one on biological molecules

Purpose/Rationale

Note: Why am I teaching this lesson this way? What is the significance, relevance, reason for teaching & learning this lesson? What are the standards that are addressed in this lesson?

I am teaching this lesson so that students become accustomed to using concept mapping as a resource for self study and reflection and for developing higher reasoning skills in science. Since higher reasoning skills are most beneficial in the fields of science and technology, concept mapping offers students of science a means of moving to these higher levels. It is important for students to be exposed early on to concept maps in order for them to become integrated (second nature) and useful tools for understanding the "how I learn question?"

Materials/Resources

Note: Make a vertical list. Include quantities, resources, & websites

In order to complete this lesson, the following materials are needed:

- Student access to computers with internet (ideally, 1 computer per student)
- The following websites may prove useful:
<http://www.inspiration.com/Freetrial> (free trial of Inspiration-costware)
<http://biogreen.pbwiki.com/>
- <http://app.spinscape.com> (free trial of Spinscape-freeware)

Teacher Preparation

Note: What did you have to do to get ready for this lesson? (research, purchases, organization)

Before this lesson, the teacher should test out the websites and software to make sure they are accessible and that they have a working understanding of how to create a simple concept map.

This lesson assumes that students already have had an introduction to human macromolecules: carbohydrates, lipids, protein, and nucleic acids; food webs, and food chains.

3-Step Procedure

#1 Introduction

- Begin the lesson with a review of food webs and food chains from their ecology of 6th grade. In the lesson there are links to these on biogreen.pbwiki

#2 Exploration

- Students will be working individually or with a computer partner to work through the lesson activities

#3 Application

- The last part of the student worksheet requires students to do outside web research to expand on the biological molecules that they will use to then create their own concept maps.
- Students will be encouraged to try the software to create their concept maps.

Assessment

Note: How do you know if they GOT IT?

- The seven worksheet assignments will be saved to disc or printed and assessed for comprehension and correct links and design
- For those who have trouble with the later assignments on the worksheet, individual student helpers will assist them in understanding as well as myself as coach.
- The lesson can easily be extended by asking (reviewing first) them to create a concept map of a previous lesson or set of notes on a particular topic.
These all give feedback as to whether they were able to follow directions and understand what they were doing.

Please include several copies of students' work, ideas, journals, and completed lab sheets. Include copies of any text pages you used as well as any handouts, lab sheets, and workbook pages

Teachers' Self Evaluation

Note: Reflect on strengths and weaknesses of the lesson based on how it was taught.

- Students reacted very positively to the lesson introduction which went through assignment four.
- Student thinking and ideas were enhanced as evidenced through their discussions with each other, their questions, and their work examples. These can be viewed on biogreen.pbwiki.com
- I did ask students how the lesson went but did this informally. The results were very positive. They said they liked it and thought it was useful.
- I did notice that some students were challenged to get started. The seventh graders in the test group have not studied or reviewed food webs for four months.
- My expectations were fulfilled as I felt students' learning and understanding of the topics were enhanced and their initial foray into concept maps seemed positively received. The surprise was that we were not able to download the software for trial in our lab but I am hoping to have them try it at home with a follow up lesson.

- In retrospect, I might modify this lesson by starting with concept mapping earlier in the year and then integrating it naturally as units are finished.