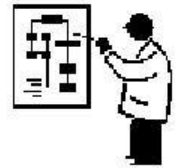


Concept Mapping

Purpose:

The purpose of this activity is to teach students a research and organizational tool for understanding and retaining information and applying it to the subject of sustainable transportation.



Description:

Concept Mapping is a graphic organizer technique used to show the hierarchical relationships between and among concepts through the creation of a visual map of connections. Concept Mapping is similar to formal outlining except the information is presented in a hierarchy of vertical strands (called propositions) with connections between concepts shown on lines linking the concepts. For different individuals, different concept maps can be created from the same information depending on the perceived interrelationships. As long as the propositions (see "Vocabulary" below) created make sense and are accurate when read vertically, they indicate that the student understands the relationships.

While it may seem difficult at first to teach concept mapping, the results will be worth it. So often students perceive schoolwork to be a string of unrelated facts to be memorized and promptly forgotten. Learning to create concept maps requires students to engage actively with the material they are studying and to think actively about the relationships within the information understanding and retaining more in the process. Teaching students how to concept map can mean the difference between rote learning and meaningful learning and can promote integration of new concepts with existing understandings.

Materials:

- Student sheets ("Student Sheet #1 " and a one page reading for practice)
- Self-adhesive notes
- Large sheets of paper - ledger size (28 cm x 43 cm at least)

Grade Level and Curricular Connections:

This strategy is suitable for grades 4-12. Students need to be able to read and to think through the connections among concepts. Any subject matter dealing with concepts can be used as material for teaching and using concept mapping. Science, social studies, language arts, or any topic where students are expected to learn content is appropriate. This strategy can be used at the beginning of units to discover students' prior knowledge and at the end of a unit to assess understanding of the material presented. Instead of assigning questions on readings that students need to do, ask them to create a concept map of the information.



Educators' Guide - Lesson Plan 2

Concept Mapping

www.science-west.ca/GettingAround

January 2004

Preparation Time:

- Time for teacher to read and understand background material and prepare student sheets. (30 to 60 minutes).

Activity Time:

- Total of three classes of 45-60 minutes.

Timeline:

Day 1

- Introduce concept mapping.
- Students practice in pairs to create a map of the practice reading.

Day 2

- Students work in quads to create a combined map. Have students hand in their combined maps.

Day 3

- Return maps with comments written on the back.
- Post maps on the wall and provide time for students to look at them.

Day 4 and beyond.

- Continue to use concept mapping when assigning readings to students or assessing understanding of concepts.

Vocabulary:

See "Generalized Concept Map – What do Concept Mapping Terms Mean"

- **Concept maps**

*"Tools for organizing and representing knowledge"*¹

- **Proposition**

*"Two or more concepts connected with other words to form a meaningful statement."*¹

- **Linking words**

*"(Verbs, prepositions and conjunctions) used to describe the relationships between two linked terms."*²

- **Cross-link**

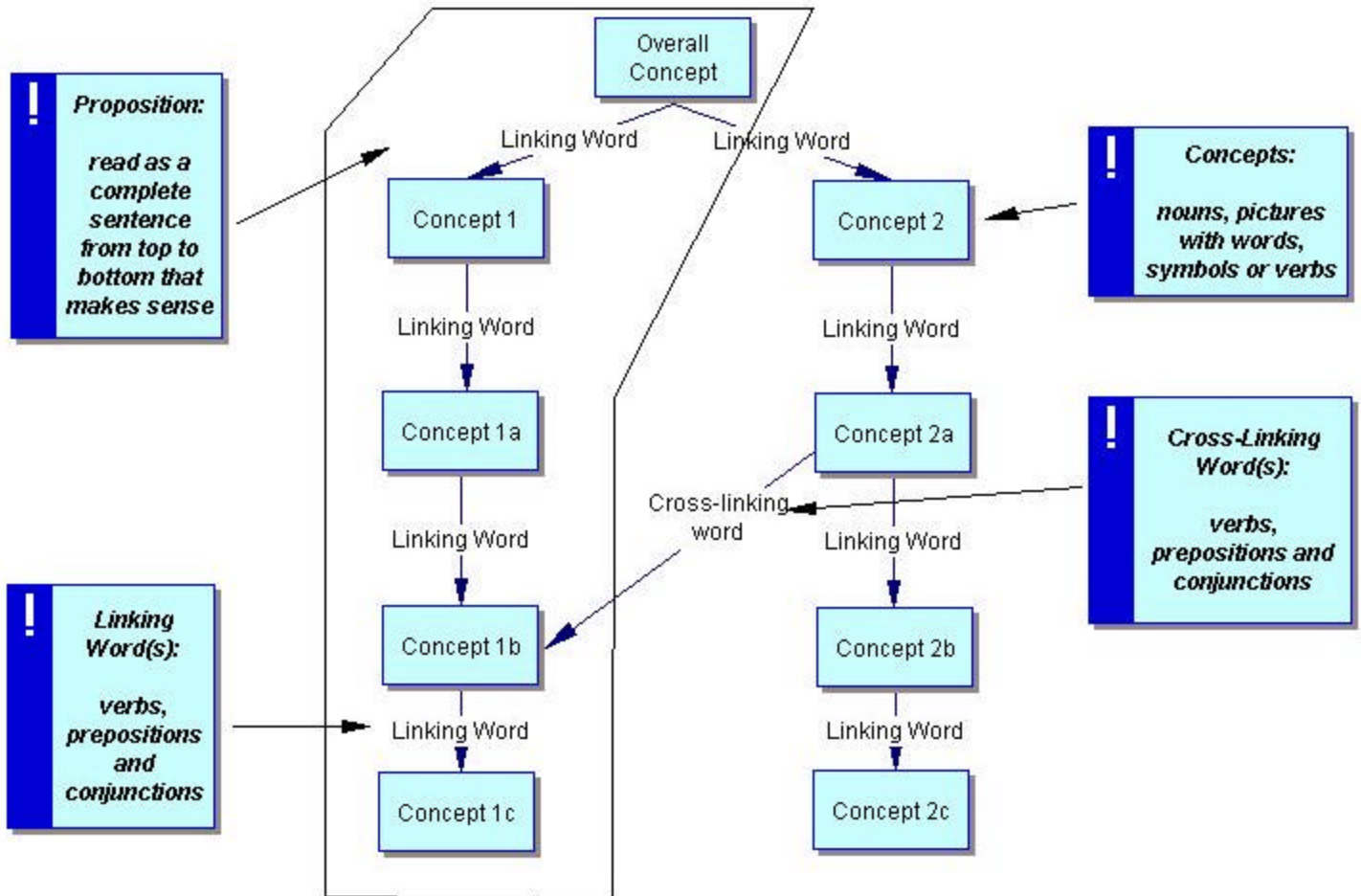
*"Relationships between different sections or domains of a concept map."*¹

1. Novak, J. P. The Theory Underlying Concept Maps and How to Construct Them. *University of Western Florida – Institute for Human and Machine Cognition:* <http://cmap.coginst.uwf.edu/info/>

2. Dorough, D. & Rye, J. (1997); Mapping for Understanding. *The Science Teacher*, 64, Jan. 1997:



Generalized Concept Map What do Concept Mapping Terms Mean?



TEACHER BACKGROUND

1. When teaching concept mapping it is best to use information that is familiar to students so that they are not dealing with both the content and the process while learning to concept map. Perhaps use the tool to review a section of information from a recently taught unit. This lesson uses an Educational Brief on BioDiesel fuel in order to illustrate the steps in the process. It is recommended that you choose your own content pertinent to what you are currently studying.
2. If students are just learning how to map it is best to present them with one or two major sub topics and a list of the concepts under each. As they read and begin to understand the information, they can create their maps using the lists of words you've given them. They can be expected to provide their own linking words indicating the relationships amongst the words given. Concept mapping is a very individualized process and individuals will build maps that represent their own unique understanding of the topic under study. However, the understandings that are presented by students must be accurate. As you read down a map following the logic of the propositions, the statements must



represent an accurate understanding in the context of the material under study even if they are expressed in an individual way.

3. This skill is a process that needs to be practiced over time. Introduce concept mapping over 3-4 days and then require students to use it regularly.
4. Before presenting the idea to students, read the material and determine two or three sub topics and phrase them as questions. These questions are based on the BioDiesel Educational Brief.
 - What is biodiesel?
 - How is biodiesel produced?
 - What are the advantages of using biodiesel?
5. Go through the article and identify 10-15 concepts. These are the ones you will give to students for them to use to construct the map. See "Teacher Page: Concept List".

Teaching Concept Mapping:

Day One

1. Present the idea of Concept Mapping and walk through the steps of how to carry it out (See "Student Sheet #1"). Demonstrate the creation of the first proposition.
2. Have the students work in pairs to create a map of the assigned reading (BioDiesel Educational Brief). It's important to have students work in pairs because the discussion that goes on helps both students to clarify their understanding of the concepts and their relationships.
3. Students hand in their maps at the end of the period.
4. In Preparation for Day Two, read over the maps and make up groups of 4.

Day Two

1. The quads work together to combine their maps. Again, the group interaction is important in the clarification of concepts. The idea here is to improve on the existing two maps so group students accordingly.
2. Quads create combined maps and hand them in.
3. Review the maps and write some brief comments on the back (see "Assessment" for some general ideas for comments).

Day Three

1. Return maps so students can read the comments.
2. Post the maps and allow students 15 minutes or so to read those created by their classmates.

Day Four and Beyond

1. Use concept mapping as often as appropriate to provide practice for students (and you!).



Teacher Page: Concept List

Sample Concept List and Concept Map for "Educational Brief: Biodiesel"

Concept List		
--------------	--	--

Alcohol

Blend

Biodiesel

Soy beans

Canola Oil

Oils & Fats

Air Pollutants

560 litres/
hectare

Carbon
Monoxide

40% Oil

Engine Life

Toxicity

Emissions

Mechanical
Efficiency

Fuel costs

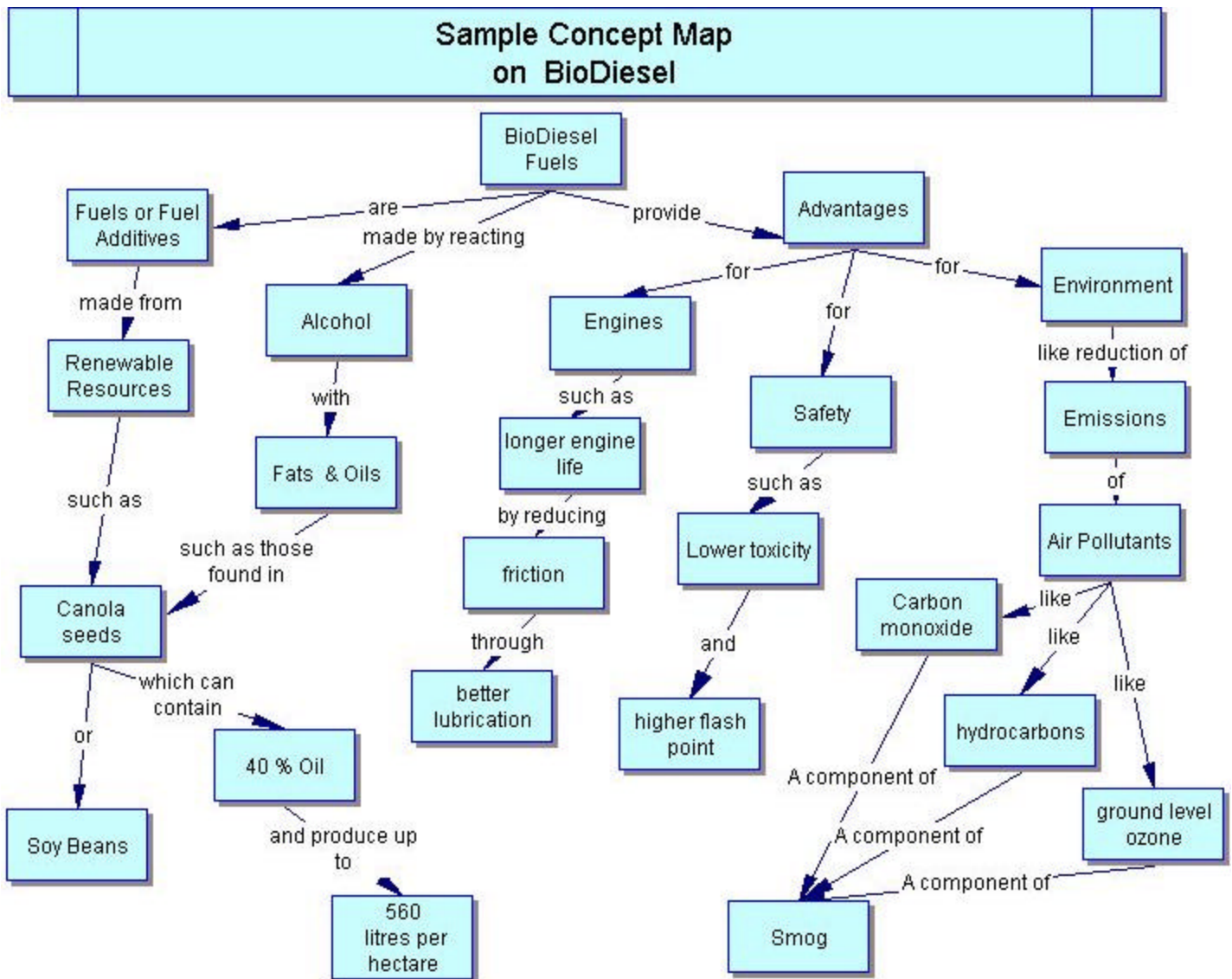
Safety

Air Quality

Smog



Teacher Page: Sample Concept Map for BioDiesel





Assessment

Concept maps that are used at the beginning of a unit to assess the students' pre-instructional knowledge should not be graded. Students need to feel comfortable putting down ideas on paper that are new to them.

However, if the concept maps are to be used to assess students' understanding of particular content, they can be assessed using a teacher-developed scoring rubric. The criteria used to develop a concept map scoring rubric may include any of the following factors:

1. Number of relevant concepts: use this factor if the students have been expected to provide the majority of the concepts for the map. The teacher provides the overarching topic concept and one or two seed concepts to get students going. The number of relevant concepts can simply be counted or the concepts can be weighted with the broader ones receiving more points.
2. Number of valid propositions: This is particularly important to look at when assessing concept maps because it indicates understanding of relationships among concepts. Each should be correct in the context of the subject matter under study. Propositions can be weighted differently depending upon the importance the teacher ascribes to the relationship.
3. Branching: This factor recognizes the progressive differentiation of concepts. A branch is created when a concept at one level in the hierarchy is connected to one or more at the next level. Again, instances of branching can be weighted equally or differently depending on the teacher's objectives.
4. Number of appropriate cross-links: This factor allows a teacher to assess how well students understand how the different strands of information are related.
5. Number of examples illustrating specific concepts: Including examples allows students to connect the concepts to their own understanding. It will also assess whether they can identify objects or events represented by the concept labels.



STUDENT SHEET #1

1. Read the information your teacher assigned to you.
2. Find the three main ideas you think are most important in the information. Each one of these will be a branch in your concept map.
3. Use the list of concepts your teacher has given you and write them on separate slips of paper (self-adhesive notes work well).
4. Decide which main idea each term fits with and put them together.
5. Arrange papers with the most general ideas at the top and most specific ideas at the bottom.
6. Draw lines from the upper concepts to the lower ones. You might need to rearrange the papers.
7. On the lines connecting the concepts write a short phrase that explains how the concepts are connected. This step is very important and might be hard. As you read down these lines the sentence should make sense to you. These statements that result from reading down the vertical lines are called "propositions". See example at right.
8. Transfer the results to a single sheet of paper and draw circles or other shapes around the different concepts and complete your map.

**Sample Proposition
Answering the
Question:
"What is Biodiesel?"**

