

INTRODUCTION TO CONCEPT MAPPING

Joseph D. Novak
Professor of Education and
Professor of Biological Sciences
Cornell University

Visiting Professor
The University of West Florida
ERDC/Building 78
11000 University Parkway
Pensacola, Florida 32514-5733
(850) 474-2800

As educators, we often are placed in the challenging position of making the knowledge generated by research available to our audience in a way that makes sense and is useful to them. To do this, we have to understand both 1) the research--judging the validity of its claims and whether they will be useful/helpful to the audience, and 2) the audience--assessing the audience's needs and existing knowledge in order to make the information meaningful to them. While it takes time to investigate both of these, an initial investment of time and thought before developing educative materials and/or teaching helps us to understand more clearly what we are teaching, why we are teaching it, and how we can address more efficiently and effectively the needs of our audience. The last point is based on a key principle of educating, that the most important factor influencing learning is what the learner already knows. We need to ascertain this and teach accordingly if we are to best succeed in helping learners to use new knowledge to make decisions, change their behavior, or achieve a different level of understanding.

WHAT IS CONCEPT MAPPING?

The knowledge that we have about a subject area consists of a construction of the concepts of that knowledge area into a coherent hierarchical system. These concepts are linked together, forming propositions that are distinctive for each individual. This system can be symbolized by concept mapping. Concept mapping is a visual representation of the relationships between concepts held by an individual, materials of a lecture, textbook, or laboratory exercise. By concept mapping even old and familiar material, we often recognize new relationships and meaning. The attached figures show examples of concept maps.

WHAT ARE CONCEPTS?

Concepts are defined as patterns or “regularities” in events or objects. Objects are simply defined as “things” and events as “happenings”. Concepts are denoted by names, symbols or signs of our language. We use concepts when we observe or interpret events and objects. They help us describe and explain the way the world works. We cannot see a concept the way we see an object or experience an event. The object “my dog” evokes an image of a particular dog. The concept “dog” reveals an image of the characters or regularities that identify the concept of dog. Each person’s concept (of dog) may differ slightly from everybody else’s concept to some extent depending on experience, context or perspective. There are usually enough shared regularities among people’s concepts so that they can communicate. We think with concepts. Meanings of our concepts of events

and objects change over time as we learn about a wider variety of examples and as we relate concepts to other concepts in new ways.

WHAT ARE CONCEPT MAPS GOOD FOR IN SCIENCE EDUCATION?

Concept maps can help us to identify, understand, and organize the concepts we plan to teach. They help us specify key relationships (propositions) needed for understanding. When students draw their own concept maps, or when maps are drawn from interviews with students, concept maps can help us identify what our audience already knows. Since a key principle of educating is to begin with what the learner already knows, finding this out is a very important initial step in any educational endeavor. Maps also can help learners comprehend their existing knowledge and aid them in relating new concepts to those they already hold. Since we think with concepts, this representation of the learner's existing cognitive structure helps the teacher design educative events that the students understand. When students are able to relate these educative events to new concepts, meaningful learning has taken place. Teachers and learners can look together at concept maps and discuss the meanings represented by them. Thus, maps become tools for exploring and negotiating meaning.

The teaching event may be a lecture, discussion or laboratory activity. The sequence and inclusion of materials for the educative event can be selected on the basis of the concepts identified from three areas for which concept maps can be constructed: the curriculum, the teacher and the learner. Sharing the meaning of this knowledge with the learner empowers him to make decisions or act based on thinking that is rooted in

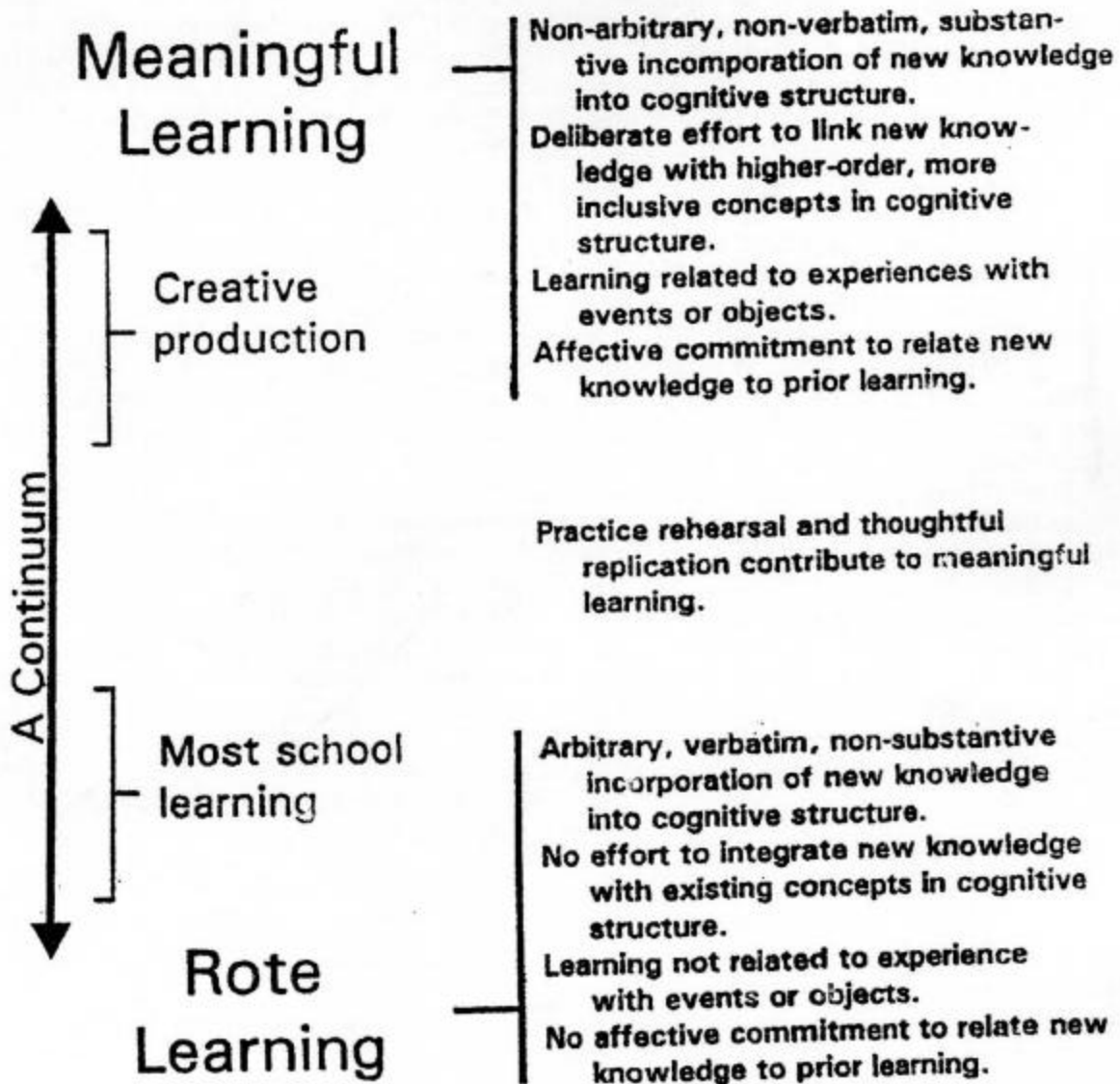
understanding. Positive feelings often accompany the experience of connecting new information to existing knowledge in a meaningful way. We learn by adding new concepts to the existing framework, causing the structure to shift and change over time. As new learning continues to occur, it is strengthened because it is incorporated into this existing system.

WHY SHOULD I BOTHER WITH CONCEPT MAPS?

Our research has shown that many people do not know how to learn effectively. The result is that they too often resort to rote memorization. Although this type of learning might lead to temporary reward, most information is forgotten within 4-6 weeks and is often accompanied by negative feelings. Conversely, positive feelings often accompany the experience of connecting new information to existing knowledge in a meaningful way. Concept mapping can help teachers to teach and students to learn more meaningfully.

HOW TO BUILD A CONCEPT MAP

1. Identify the key concepts in a paragraph, research report, and chapter; or simply think of the concepts of a subject area and list them. Some people find it helpful to write the concept labels on separate cards or small pieces of paper, so that they can be moved around.
2. Rank the concepts by placing the broadest and most inclusive idea at the top of the map. It is sometimes difficult to identify the broadest, most inclusive concept. It is helpful to be aware of the **context** of the concepts we are dealing with or to have some idea of the situation for which these concepts are arranged.
3. Work down the paper and add more specific concepts.
4. Connect the concepts by lines. Label the lines with action or linking words. The linking words should define the relationship between the two concepts so that it reads as a true statement, or proposition. The connection creates meaning. When you can hold together a large number of related ideas, you can see the structure of meaning for a given subject area.
5. Specific examples of concepts can be added below the concept labels. (e.g., golden retriever is a specific example of a dog breed.)
6. Perhaps you can already see ways that the concept map could be made differently. Remember there is no one way to draw a concept map. As your understanding of relationships between concepts changes, so will your maps. This is what gives the map power and flexibility. Refer to your previous maps to help you visualize the evolutionary process of your understanding.



Learning how to learn

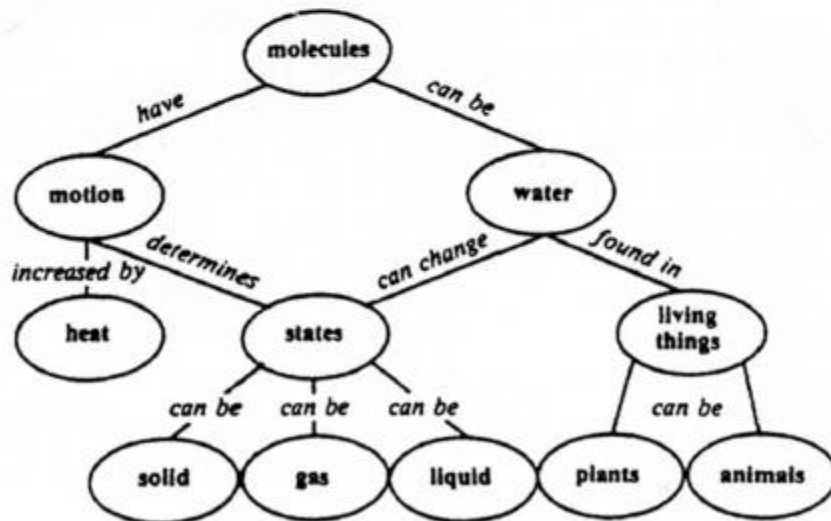
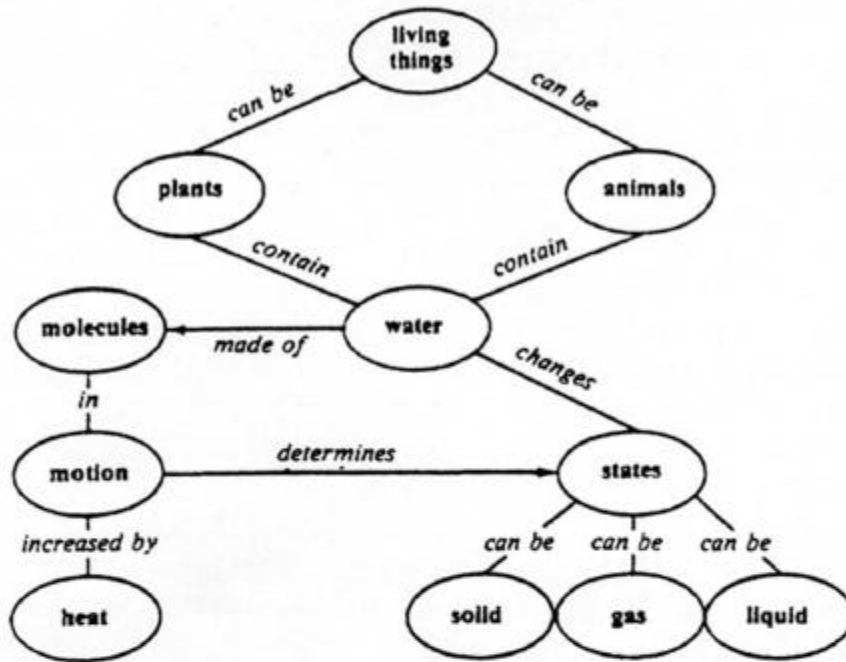


Figure 2.2 Two “rubber map” configurations showing eleven of the concepts in Figure 2.1 in new hierarchical arrangements.

Learning how to learn

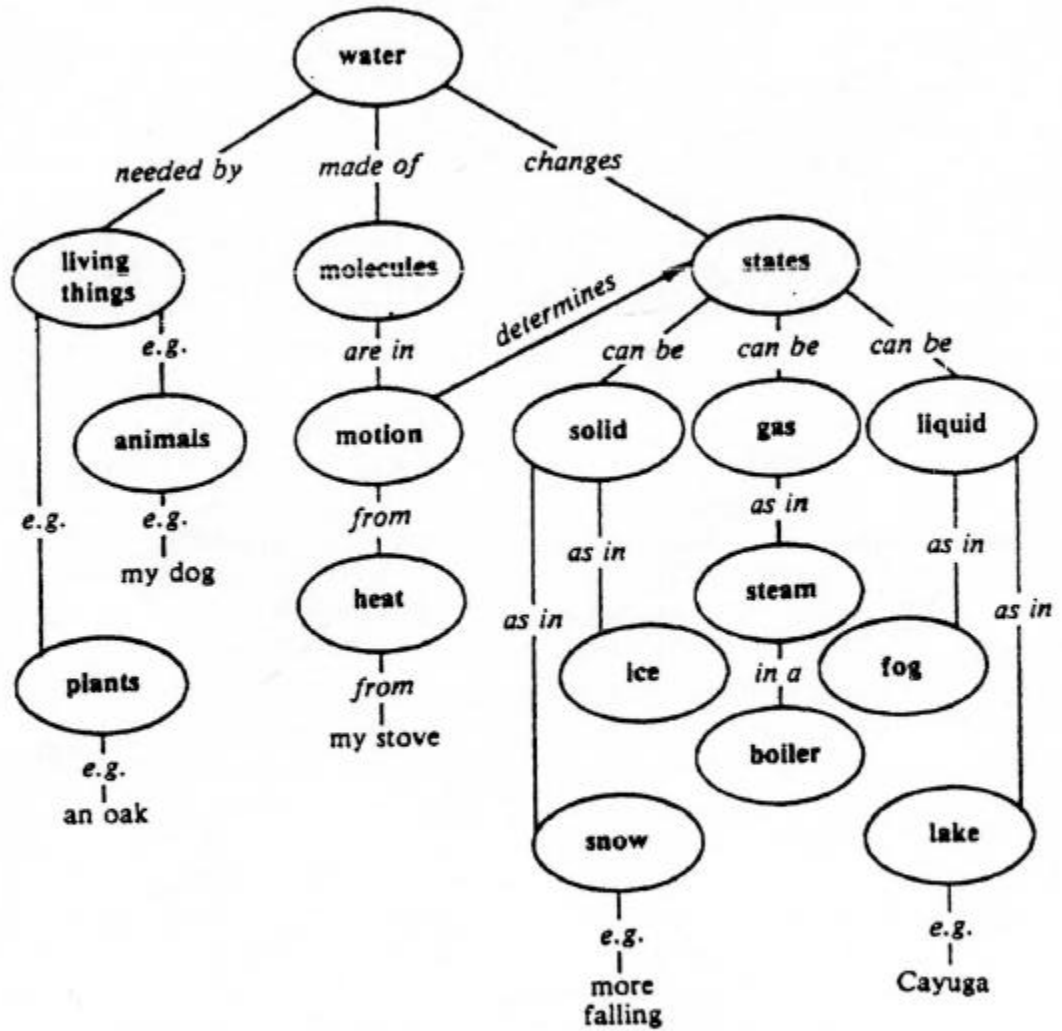


Figure 2.1 A concept map for water showing some related concepts and propositions. Some specific examples of events and objects have been included (in Roman type outside ovals).

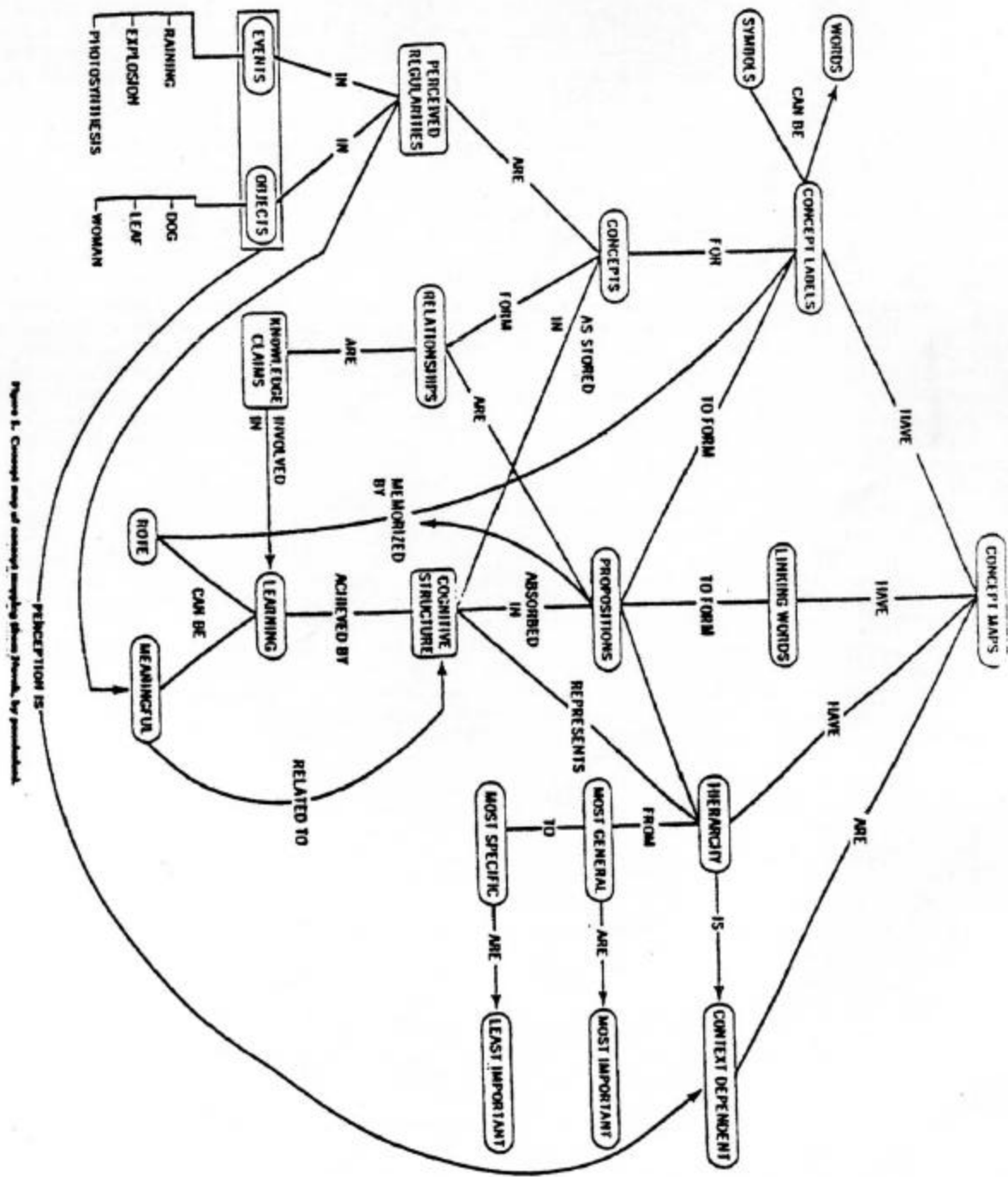


Figure 1. Concept map of concepts involving thinking processes, by Goodenough.

CONCEPT MAP OF
PSYCHOLOGY:
AN INTEGRATIVE
ENVIRO-BIO-PSYCH
APPROACH

JAY E. GOULD
JUNE 2001

(→ INDICATES "AFFECTS")

