Chapter 3

Concept Maps as Tools for Learning Scientific Language

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EXECUTIVE SUMMARY

Learning scientific language continues to be challenging for many students because of its inherent complexity, volume of specific terminology, and many fields of science which incorporate the same terminology for different applications. In order to more effectively learn and apply the language of science, the authors propose the use of concept mapping. Research on concept mapping suggests that it is more effective than traditional teaching methods in students' knowledge retention and transfer when compared to control groups that did not use concept mapping, but rather participated in class discussions, attended lectures, and read text passages regardless of educational level, settings, or subject domain (Nesbit & Adesope, 2006). Based on this synthesis of research, teachers are encouraged to adopt concept mapping as a pedagogical strategy in their science classrooms as no detrimental findings have been found related to its use. By providing students with a concept map of the terms which explains how the terms are related to the overarching concept or allowing them to build their own, students can begin to develop a deeper understanding of the language of science.

DOI: 10.4018/978-1-4666-0068-3.ch003

BACKGROUND

"An awareness of the explicit role that language plays in the exchange of information is central to understanding the value and purpose of concept mapping and, indeed, central to educating."

(Novak & Gowin, 1984)

Science is often viewed as a challenging and difficult subject for many students (White & Fredrikson, 1998). This is due, in part, to science classes exposing students to familiar language that holds an entirely new meaning. Additionally, each field of science often uses complex language and terminology in both broad and narrow contexts to explain difficult concepts. For example, the term *photosynthetic* has multiple broad and narrow applications. It can be used to describe any animal which utilizes photosynthesis, or it can be used to specify an organism or group of organisms, such as photosynthetic plankton or photosynthetic cyanobacteria. This creates a situation where students have difficulty learning and using the new terminology (Rundgren, Hirsh & Tibell, 2009). In order to ascertain the confidence to facilitate scientific learning, the student must first become comfortable with the terminology of the field they are learning.

As such, we propose a possible solution: concept mapping as a strategy to learn scientific language. Concept maps are node-link diagrams that show concepts as nodes, which are circular place holders, and relationships among the concepts as labeled links (Nesbit & Adesope, 2006). Concept maps have been used for different activities including graphic organizers in lectures, and as study materials in individual and collaborative learning environments, especially in science education (Cañas et al., 2003; Newbern, Dansereau, & Dees, 1997; Okebukola, 1992). Research on the instructional use of concept maps has grown over the last three decades and has produced some consistent findings (Adesope & Nesbit, 2009; Holley & Dansereau, 1984; Nesbit & Adesope, 2006, 2011; O'Donnell, Dansereau & Hall, 2002). Generally, researchers have found that, under different instructional conditions, settings and experimental features, the use of concept maps produced increased retention and transfer of knowledge when compared with control conditions where students studied with text passages, outlines, lists or listened to lectures (Nesbit & Adesope, 2006).

There is evidence that rudimentary memorization techniques for learning terminology provide a simple, on the surface, solution (Ausubel, 1960). By providing the students with a concept map of the terms which explains how the terms are related to the overarching concept, students can begin to develop a deeper understanding of the language of science.