Chapter 9
Teaching Critical Thinking and Team Based Concept Mapping

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ABSTRACT

Critical thinking cannot be fully developed without involvement in collaborative learning activities that elicit problem solving dialogue. Concept maps are effective tools for dialogue because they require decisions about the organization of and the relationships between facts and concepts. This active decision making process develops both long term memory and the ability to apply that knowledge. The authors describe a new method for incorporating scored concept maps into an established collaborative learning method, Team-Based Learning, as a way to improve the effectiveness of individual preparation and for enhancing the problem solving dialogue during group activities. Their new method, Team-Based Concept Mapping, has advantages for students with different personality types and with different backgrounds because it provides greater clarity and precision in the group dialogue. The effect of concept mapping on the interaction between different personality types is discussed and suggestions for future studies to develop this method are offered.

INTRODUCTION

Collaborative learning is necessary to help students move beyond assimilative learning to become, as described by Mezirow (1991, p. 167), "…critically aware of how and why our assumptions have come to constrain the way we perceive, understand, and feel about our world…" This "critical awareness" by students is revealed to us when we observe the dialogue that occurs during team problem solving. Dialogue allows team members to hear alternative ways of perceiving a situation and to reflect on their own approach to solving a problem. During the collaborative learning process, the individual team members use the critical thinking skills of analysis, interpretation, inference, evaluation, and

DOI: 10.4018/978-1-59904-992-2.ch009

explanation (Facione & Facione, 1997) to reach decisions that produce a new understanding for all members. New understanding by the students, in turn, converts their "working memory" into long-term memory. Thus, students participating in the process of team problem solving avoid the pitfalls of assimilative learning which simply layers new information onto old understanding. The process of using current knowledge to create new knowledge has been termed transformative learning (Boyd & Myers, 1988), and this functional transformation is accompanied by a parallel anatomical transformation occurring in the brain itself (Zull, 2002). Collaborative learning physically transforms the brain by establishing a greater number of long lasting synaptic connections through the growth of nerve cell dendrites. This physical transformation occurs in two interactive areas of the brain: 1) the temporal area and 2) the prefrontal area. The temporal area accesses existing memory and adds to that memory when new learning takes place. The prefrontal area uses knowledge from the temporal area to establish new possibilities and to make logical decisions about them. The active use of both of these areas of the brain is necessary to develop critical thinking skills thus indicating that the growth of dendrites occurs both in the area of the brain that stores memory and in the area of the brain that uses that memory for decision making (Zull, 2002; Bransford, Brown, & Cocking, 2000).

Prior to our research on team problem solving, we discovered that individual preparation for participation in team problem solving exercises is enhanced by concept mapping. This is because the construction of a concept map requires analytic reading through the constant formulation of focused questions (Cañas & Novak, 2006). The back-and-forth process of asking a question ("Where does this go in my map?") and then answering it ("It is connected here…and here…") helps the student discover how new knowledge can be organized. This facilitates, in turn, the retrieval of this knowledge during the team dialog when each student must defend their decisions to the rest of the team members. The formulation of a rationale for suggesting new possibilities, or for choosing among optional solutions, requires more than recall knowledge of factual content. Such a rationale also requires an understanding of the meaning of factual content and the construction of a concept map reveals that meaning through patterns and organization.

Concept maps are effective tools for helping students understand their individual learning style and how their preference for processing information affects their individual learning strategy, both for remembering information and for using it in problem solving. Students who are either Sensing or Intuitive personality types, as determined by the Myers-Briggs Type Indicator (MBTI), process information very differently with dramatically different outcomes in learning and test achievement (Pelley & Dalley, 1997). If the Sensing type students follow their preferences, their learning is focused on facts and details that are committed to recall memory (a temporal area brain function). They learn in linear order and consequently do not spontaneously look for patterns and relationships. This is in contrast to their opposite, the Intuitive type student, that spontaneously seeks out new patterns and relationships (a prefrontal area brain function). Because they tend to emphasize the use of one area of the brain over others, both types can have learning "blind spots" that are corrected by the use of concept maps. The concept mapping process motivates the Sensing type to seek out relationships in order to construct a concept map complete with cross-links and it motivates the Intuitive type to seek out details that are overlooked when they focus on the "big picture." The use of concept maps has led to improvement in learning skills by both types of students in health care professional education (Pelley & Steele, 2002)

We have found an exciting new way to extend the use of concept maps in individual learning to group learning by incorporating them in a highly effective collaborative learning method, Team-