

## **HOW TO UTILIZE CONCEPT MAPS IN EVALUATING STUDENTS' CONCEPTUALIZATION OF LEADERSHIP**

Cindy Blackwell & Jennifer Williams, Oklahoma State University

### *Introduction*

The process of leadership is a complex phenomenon that is difficult for beginning leadership students to express and even harder for them to define. Concept maps are an advantageous pedagogical activity for instructors to employ when they utilize a constructivist approach in the classroom. "A concept map is a pictorial representation of a domain that consists of concepts represented as nodes (circles) that are connected to each other by arcs (lines)... the connecting arcs represent the conceptual links – stating that the concepts are conceptually and logically related in some manner" (Freeman & Jessup, 2004, p. 151). Students often describe the end product of this activity as a leadership spider web, demonstrating the great interconnectivity of the maps, and demonstrating to the instructor the level at which the concept is understood.

Concept maps have been equated to the pictorial representation of a mental model (Kinchin, Hay, & Adams, 2000). Senge et al. (1994) define a mental model as the "images, assumptions, and stories which we carry in our minds of ourselves, other people, institutions, and every aspect of the world" (p.235). Students come to leadership classes with a vast array of mental models about leadership due to their unique leadership training, education and development experiences (Brungardt, 1996). The concept maps create strong visuals of how students' mental models of leadership are arranged and then how their mental models might change after exposure to the class curriculum and to the collaborative learning environment of the class. Creating the baseline concept maps gives the course instructors a better idea of where the students' mental models of leadership are in relation to the class definition of leadership. "To put it in Ausubelian learning theory terms, a teacher needs to know what relevant concepts can

serve as the framework for subsumption of new material. Concept maps are a simple tool for assessing where the learners are” (Novak & Gowin, 1984, p. 100-101).

### *Background*

Originally utilized by bench science, concepts maps were designed “to represent how students linked hierarchical material together” (Nicoll, Francisco & Nakhelh, 2001, p. 863). For social science subjects, like leadership, concepts maps can make the abstract more visual and concrete. With hundreds of leadership definitions recorded, it is often difficult for leadership students to understand the complexity of the discipline, and concept maps allow students to see and represent the interconnectedness of leadership concepts (Lawless, Smee & O’ Shea, 1998). Seeing this interconnectedness early in the class allows students to assess their perceptions of leadership as compared to the class definition of leadership, and seeing this interconnectedness later in the class allows for assessment of knowledge growth.

The theoretical origins of learning via concept mapping can be related back to constructivism, assimilation, and associationist theories. When utilized in small-groups, concept mapping can be classified as both cognitive and social constructivism. With cognitive constructivism, knowledge results from internalization and reconstruction of external reality. Social constructivism is when knowledge is the result of social interaction (Buriak, McNurlen, & Harper, 1996). Concept maps allow the student and the instructor to see the construction of knowledge at the baseline and then after some progression. Assimilation theory states that new information is processed and then assimilated into already existing structures in the memory and mind (Freeman & Jessup, 2004). Initial concept maps take a new concept and then show how students construct their framework from past knowledge and experiences. Associationist theory

states that as learning occurs, the “network of concepts and relationships becomes more and more elaborate and complex” (Freeman & Jessup, 2004). The nodes and arcs of a concept map, especially one with leadership as its central focus, are extremely complex. One node may connect to five or more other nodes in students’ minds, which offers a visible model of how intricate the seemingly simple discipline of leadership can be.

Concept maps “can both promote and assess conceptual change in a higher education setting” (Kinchin et al., 2005, p.2), and therefore become an innovative tool in the evaluation of students’ learning. Comparative analysis of beginning concept maps to those that evolve at a later point in the semester is also beneficial for the student and the instructor. Through comparative analysis both students and instructor are able to see the progression of knowledge in relation to the topic. While each student’s mental model of leadership is not individually assessed, the dialogue created among the students when considering each concept and each connection between major concepts is of great value (Kinchin, De-Leij & Hay, 2005).

Kinchin, De-Leij, & Hay (2005) have developed a teaching methodology for the utilization of concept maps. Their four-pronged approach was developed to optimize the concept map procedure for the learner. First, the instructor must set up a constructivist and student-centered environment. Having a student-centered philosophy is imperative in allowing students to develop their own connections with leadership and the components that frame the phenomenon. The second condition as described by Kinchin et al. is the collaborative nature of concept mapping. Students must be able to collaborate together as well as with the instructor to fully understand not only the process of concept mapping but also share ideas about the nodes of leadership. This collaboration will lead to new ideas being expressed and shared by the students. The third component is time. Students must be “given sufficient time for reflection and

development” (Kinchin et al., 2005, p.1). Devoting an entire class session for concept mapping is a valuable use of time. The fourth strategy is to “avoid using specific terms that restrict conceptual development by hindering appropriate switching between opposing conceptual frameworks” (Kinchin et al., 2005, p.1). Giving creative license to the students allows them to define the phenomenon as they have constructed it in their minds.

### *Methodology*

The use of concepts maps for this purpose was deemed highly appropriate based on the criteria set forth by Kinchin, De-Leij and Hay. This course often utilizes structured discussions based on written assignments in small group format to promote a collaborative and student-centered teaching environment. The class is based on authentic leadership which “concerns self-exploration, an understanding of the true self, recognizing one’s values, and infusing personal values and leadership specifically as they apply to follower relations” (Pennington, 2006, p. 13). This basis allows for great reflection and offers the students to develop their individual insights into congruence between espoused leadership values and actions. Within the framework of the common language provided by the textbook students share their personal leadership training, education, and development with the instructor as well as with the rest of the class.

Concept maps from two sections of the same sophomore-level academic leadership class during the fall 2007 semester were analyzed. Because the establishment of a definition of leadership was imperative to the entire semester, the first concept maps were completed early in the semester and an entire class period was devoted to the creation and presentation of the maps. Students were first instructed in the methodologies of concept mapping and offered a demonstration with the entire class participating. Students were then broken into groups of 4-6 and given the center word, or starting point, of *leadership*. From that one word, students then

drew nodes and arcs to describe how they conceptualize leadership. Understanding the mental models of leadership held by the students in a personal leadership development course was deemed important by the authors because it (1) allowed them to see where the students were at in their conceptual development of leadership, (2) gave the instructors a frame of orientation to refer back to at the end of the course, and (3) was an opportunity to have a collaborative activity that then could be related back to defining leadership.

At the end of the course, the concept map activity was repeated because “Evaluation of sequences of concept maps will give an illustration of the developmental pathways employed by a student as progress is made from a naïve theory closer towards a shared understanding with the teacher” (Kinchin, Hay & Adams, 2000, p. 52). Students were given a quick refresher about the methodology and construction of concept maps, and then students were divided into their groups from the original concept map activity. Again, they were given the middle concept of *leadership* and instructed to develop a concept map of what they now see as the interrelated concepts of leadership.

The pre and post concept maps were analyzed using the scoring criteria for concept maps developed by Novak and Gowin (1984). With Novak and Gowin’s criteria, each node directly linked to the original concept is a proposition, and should demonstrate a meaningful relationship between the concept and the node. For each valid proposition, 1 point was given. For this analysis, all links were considered valid because “‘invalid’ links may have a value to the student by supporting more valid links (sometimes temporarily) and so contributing to the overall knowledge structure that he or she is using as a basis for further learning” (Kinchin, Hay & Adams, 2000, p. 46). Each hierarchical link made from a proposition, further specifying the proposition earned the map five points per hierarchical link. Finally, cross links were scored at

10 points per significant and valid cross link, which is a connection between propositions or hierarchical elements. While Novak and Gowin also include scoring for examples, students were not instructed to provide examples and therefore points were not awarded for examples.

### *Results to Date*

The differences between the first set of concept maps and the second set were striking. All maps demonstrated a markedly higher score except for one map, in which the students used more creativity, reduced the number of propositions and excluded hierarchies and cross links (see table 1). Qualitative analysis of the maps indicated that the students moved from seeing leadership as a set of personal characteristics or a position to a more complete understanding of leadership as a process. Terms frequently used in the pre concept maps were predominately descriptors of traits, and included *responsibility*, *influential*, *passionate* and *honest*. With the post maps, concepts from the semester class lessons were frequently incorporated with the trait concepts demonstrating an integration of the knowledge with their already formed ideas. Frequently used terms in the post concept maps not found in the pre concept maps included *congruence* (of values and actions), *balance*, and *vision* (which was present on every post map and a major element of the course). While cross link scores were lower in some cases, hierarchy scores increased dramatically demonstrating that students were seeing each proposition in greater depth. For example, *vision* was often linked to *leadership* and *personal* demonstrating that students had a better understanding that leadership often takes different forms in a person's life.

Table 1 – Comparison of pre and post concept maps

	Pre Concept Map				Post Concept Map			
	Proposition Score	Hierarchy Score	Cross Links score	Total Score	Proposition Score	Hierarchy Score	Cross Links score	Total Score
Map A	4	40	0	44	5	50	0	55
Map B	6	35	2	43	8	0	0	8*
Map C	4	30	6	40	8	85	10	103
Map D	5	25	0	30	6	75	10	91
Map E	10	45	10	65	6	165	0	171
Map F	8	40	10	58	10	95	0	105
Map G	12	10	44	66	10	55	40	105
Map H	16	0	50	66	9	65	144	218
Map I	4	50	10	64	1	85	180	266
Map J	12	8	0	20	12	20	100	132

\* Creativity was used in this map which was not reflected in the quantitative analysis

### *Limitations*

Due to student absences and a few dropping the class, not all groups could be exactly the same as their original makeup. In addition, subjectivity in rating did exist due to the freedom of expression allowed to the students in creating the concept maps. According to Novak and Gowin (1984), “There is also an apparent arbitrariness in scoring concept maps” (p. 105). Finally, Some maps seem best served being scored quantitatively while others seem better served qualitatively. “Numerical scoring of concept maps can conceal the essentially subjective basis on which it rest” (Lawless, Smee, O’Shea, 1998, p. 225). A quantitative approach worked best for this analysis, however not all maps showed greater concept understanding with the quantitative rating system.

### *Conclusion*

The use of concept maps to assist in defining the term leadership was found to have great value in this course. The maps offered the class as well as the instructor an excellent starting point for discussing the conceptualization and definition of leadership. It also allowed the students to construct their own leadership reality and then share that with the rest of the class.

Building an open environment where students feel free to express their ideas is imperative to this personal leadership development course.

Another advantage of using concept maps in a leadership classroom is that they promote critical thinking with students because it stimulates a deeper understanding of material (Giddens, 2006). Leadership is a discipline that is learned only through the higher level thinking processes of application and synthesis (Williams, Townsend, and Lindner, 2005). “Concept mapping can be a helpful metacognitive tool, promoting understanding in which new material interacts with the students’ existing cognitive structure” (Kinchin, Hay, & Adams, 2000, p.44). This allows students to integrate and retain leadership concepts as well as the interconnectedness of leadership themes.

Analysis of these maps not only allowed the instructors to see which concepts were integrated and how they were integrated, they are also a useful tool in the assessment and revision of the course for subsequent semesters. Concept maps “illustrate not only the extent of what students knew, but how they organized their knowledge” (Lawless, Smee, & O’Shea, 1998, p.225). It was rewarding for the instructors to see the growth of the students in their conceptualization of leadership. It was also rewarding for the students to see how their leadership knowledge had developed over the course of the semester. The scoring technique, as described by Novak and Gowin (1984) aided the instructors in giving their qualitative results backing by quantitative numbers.

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