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Concept Mapping 101

Heather Miller-Kuhaneck
Sacred Heart University, kuhaneckh@sacredheart.edu

Joanne M. Bortone
Sacred Heart University, bortonej@sacredheart.edu

Lenore Frost
Sacred Heart University, frostl@sacredheart.edu

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Kuhaneck, Heather Miller, MS, OTR/L, BCP; Bortone, Jody; Frost, Lenore
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Full text

Concept maps are visual depictions of information, generally in diagram form, that are used to enhance and document learning (Novak, 1990; Whiteley, 2005). As a learning tool, concept maps have been used for many years in the fields of education and nursing (Novak, 1990; Schuster, 2002). The methods and uses of concept mapping have evolved in the areas of academic education, clinical education, and research since the 1970s (All & Havens, 1997; Novak, 1990; Schuster, 2002; Whiteley, 2005). This article discusses the use of concept mapping in occupational therapy education.

Joseph Novak's research and subsequent development of concept mapping (Novak, 1990, 2004; Novak & Canas, n.d.) builds on Ausubel's (1960) theoretical and empirical work in learning psychology. Ausubel's Assimilation Theory of Learning postulates that learning and recall could be facilitated by introducing relevant "subsuming concepts" or organizers. This theory is based on the premise that learning requires the assimilation of new ideas and concepts into one's existing knowledge base and theoretical frameworks. Whereas outcomes for rote learning are reiteration, comprehension, and application of concepts, objectives for concept mapping extend to a deeper understanding of the concepts and the relationships among them. The process of constructing a concept map both requires and encourages meaningful learning and aids understanding of the relationships between concepts (Novak, 1990, 2004; Novak & Canas, n.d.). Ausubel's (1960) and Novak's (1990) findings suggest that anchoring new and unfamiliar material into familiar subconcepts renders the new learning as meaningful and relevant, thereby increasing learning and retention of new material.

Novak (2004) conceived of the concept map as a visual depiction of knowledge representation. Concepts are placed in individual boxes with "linking words" that depict the relationship between them (Novak, 2004). The concept mapping process involves a series of steps that lead to a final product that demonstrates one's understanding and comprehension of a subject or concept. Therefore, concept maps are most useful to the person who makes them. The general steps for map construction include preparation, development of a skeleton, analysis and categorization of information, and analysis of relationships between the categories of information (Schuster, 2002). Initially, the "mapper" identifies the relevant concepts in the material being learned and links them. Frequently, he or she revises and reconstructs the map in order to create a final version that is useful and satisfying (All & Havens, 1997).

As part of the process of developing a skeleton, one must choose the concept map format (Whiteley, 2005). Multiple forms and formats for concept mapping are used. The form chosen reflects the mapper's style and its "fit" to the content. Styles differ based on positioning, shapes used, and linkage methods. Common formats (Whiteley, 2005) for concept mapping include:

* Basic maps

- Spider (see Figure 1)

- Hierarchical (see Figure 2)

- Network

* Common maps

- Mind maps (a variation of a spider map)

- Institute for Human and Machine Cognition (IHMC) maps (a variation of a hierarchical map)

- Flowcharts

- Fishbone diagrams

- Mandelas

* Advanced maps

- Decision trees

- Logic trees

- Software-based maps

Uses of Concept Mapping

Concept mapping was first used as a research tool to examine students' knowledge and later as a method to enhance meaningful learning (Heinze-Fry & Novak, 1990). It allows students to explore information and concepts in new ways; promotes, reinforces, and assesses student learning; and gathers feedback on teaching strategies based on students' presentation of understanding (Whiteley, 2005). Other researchers contended that specific instructional strategies are needed to teach critical thinking and clinical decision making (Facione, 1990; Straus, Richardson, Glasziou, & Haynes, 2005). Concept mapping requires students to synthesize information from multiple sources and postulate the relationships between concepts. This very process is believed to facilitate higher levels of critical thinking because it demands students to formulate hypotheses and justify their arguments regarding how concepts are related (Facione, 1990).

Occupational therapy practitioners require critical thinking skills to problem solve client issues, prioritize appropriate areas to evaluate, and develop intervention strategies to meet client goals. In clinical education, concept maps have guided novices in creating care plans, enhancing and expanding

critical thinking for client care, and assessing their learning and comprehension (All & Havens, 1997; Harpaz, Balik, & Ehrenfeld, 2004; Hsu & Hsieh, 2005; Schuster, 2002). In addition, concept mapping is a useful means for experienced practitioners to share information and problem solve client issues.

Evidence of Efficacy

Research in the fields of education, nursing, and other health professions has examined the efficacy of concept mapping for student performance (Daly, Shaw, Balistrieri, Glasenapp, & Piacentine, 1999; Edmondson & Smith, 1998; Hsu, 2004; Hsu & Hsieh, 2005; Novak, 1990; Novak & Musonda, 1991). In elementary science education, concept maps have been used extensively to measure changes in levels of comprehension and attainment of new information (Novak, 1990; Novak & Musonda, 1991). Concept maps change the way students organize knowledge and help them "learn to learn." They have been demonstrated to increase students' test scores and decrease test-taking anxiety (Novak, 1990). Edmondson and Smith (1998) concluded that concept mapping is an effective tool for veterinarian students to facilitate discussion, give feedback, and summarize and synthesize findings. In an experiential design study, Hsu (2004) examined the effect of concept mapping on nursing students' learning outcome. The experimental group used concept mapping as a means of learning the course content, whereas the control group engaged in traditional learning. The study's findings indicated that the experimental group scored higher on the final test than the control group.

Concept mapping has been used to measure critical thinking in nursing students, and research has shown that learners' concept maps change significantly from the beginning to the end of a semester of instruction, attributing these changes to increases in critical thinking (Daly et al., 1999). Researchers also have stressed that students must be taught how to use concept maps and be given adequate time to effectively use the technique (Hsu & Hsieh, 2005).

However, not all research findings on the use of concept maps are universally positive. Wheeler and Collins (2003) conducted a quasiexperimental study with undergraduate nursing students to compare critical thinking as measured on the California Critical Thinking Skills Test (CCTST; Facione & Facione, 1993). The experimental group used concept mapping to complete clinical care plans, and the control group used traditional methods. The researchers found that although the two groups did not differ significantly in their CCTST scores, there were significant differences in their Evaluation sub scale scores. Wheeler and Collins concluded that despite the results, they believed that students who used concept mapping improved their critical thinking as evidenced by the significant differences on the Evaluation subscale and statements that the use of concept maps stimulated them to expand on and learn more about a topic. Additionally, Chastonay et al.'s (1999) research in public health education found that although student perceptions of concept mapping are generally positive, the students did not universally accept concept mapping, finding it time consuming and intensive.

An Example of Concept Mapping in Education

At Sacred Heart University's (Fairfield, CT) graduate occupational therapy program, concept mapping is embedded in the three-semester problem-based learning (PBL) curriculum sequence. Following an initial orientation to concept mapping and PBL, students begin using concept mapping in their very first PBL case scenario. With each case, students use the mapping strategy to visually document what they know, what they do not know, and what they wonder. They also use concept mapping to clarify their knowledge of each case using the Occupational Therapy Practice Framework: Domain and Process (American Occupational Therapy Association, 2002). As shown in Figure 1, the program developed a concept map clinical decision-making framework to facilitate the integration of various sources of information to create a new understanding of the clinical case and determine an appropriate course of action (Bortone & Darragh, 2005). Faculty members have found that the use of concept mapping for clinical decision making ensures the inclusion of often-neglected information sources; encourages inquisitive thinking; and fosters the evaluation of ideas, relationships, and arguments.

Our faculty has observed positive learning outcomes with the use of concept mapping and PBL as seen in the literature. Although Sacred Heart University's occupational therapy program has embraced the use of concept mapping within its PBL curriculum, evidence is lacking about its efficacy within our profession. In our efforts to promote evidence-based practice in our students and ourselves, we plan to engage in research on these methods within our department.

Conclusion

In this age of evidence-based practice, the profession must examine its educational and clinical practices. Concept mapping as a tool to facilitate meaningful learning and visualize relationships between categories of information holds promise for occupational therapy education and research. As in other professions, the use of concept mapping in occupational therapy education may prove useful in increasing students' critical thinking skills. Although a small body of literature exists outside our field that indicates the effectiveness of concept mapping as a tool for clinical education, based on our review of the literature, little theoretical or empirical research suggests that occupational therapy educators have embraced this technique. Based on the current state of knowledge, research on the effectiveness of concept mapping for enhancing occupational therapy students' critical thinking and clinical skills is warranted.

Resource:

http://www.enchantedlearning.com/graphicorganizers/fishbone

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Author Affiliation

Heather Miller Kuhaneck, MS, OTR/L, BCP, is Instructor, Graduate Program in Occupational Therapy, Sacred Heart University, 5151 Park Avenue, Fairfield, Connecticut 06825; kuhaneckh@sacredheart.edu.

Jody Bortone, EdD, OTR/L, is Chair and Director, Graduate Program in Occupational Therapy, Sacred Heart University; bortonej@sacredheart.edu.

Lenore Frost, MAOM, OTR/L, CHT, is Academic Fieldwork Education Coordinator, Graduate Program in Occupational Therapy, Sacred Heart University; frostl@sacredheart.edu.

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