

Fall 9-1-2009

The Use and Perceptions of Concept Mapping as a Learning Tool by Dietetic Internship Students and Preceptors

Elaine Fontenot Molaison
University of Southern Mississippi

Kimberly Taylor
Palmetto Senior Care

Dawn Erickson
Louisiana Tech University

Carol Connell
University of Southern Mississippi, carol.connell@usm.edu

Follow this and additional works at: https://aquila.usm.edu/fac_pubs

 Part of the [Nutrition Commons](#)

Recommended Citation

Molaison, E. F., Taylor, K., Erickson, D., Connell, C. (2009). The Use and Perceptions of Concept Mapping as a Learning Tool by Dietetic Internship Students and Preceptors. *Journal of Allied Health*, 38(3), e97-e103.
Available at: https://aquila.usm.edu/fac_pubs/16360

This Article is brought to you for free and open access by The Aquila Digital Community. It has been accepted for inclusion in Faculty Publications by an authorized administrator of The Aquila Digital Community. For more information, please contact Joshua.Cromwell@usm.edu.

POTENTIAL PATTERNS

▲ The Use and Perceptions of Concept Mapping as a Learning Tool by Dietetic Internship Students and Preceptors

Elaine Fontenot Molaison, PhD, RD

Kimberly A. Taylor, MS, RD

Dawn Erickson, MPH, RD

Carol Lawson Connell, PhD, RD

Critical thinking and problem solving skills are currently emphasis areas in the education of allied health professionals. Use of concept maps to teach these skills have been utilized primarily in nursing and medical education, but little has been published about their use in dietetics education. Therefore the purpose of this study was to evaluate the potential efficacy of concept mapping as a learning tool for nutrition assessment among dietetic interns and its acceptability by internship preceptors. Nineteen dietetic interns and 31 preceptors participated in a quasi-experimental pre-/post-design in which the concept mapping strategy was taught as a replacement for the traditional nutrition care plan. The pre-concept map mean score was significantly lower than the post-concept mean score (28.35 vs. 117.96; $p = 0.001$) based on the Student t-test, thus indicating improved critical thinking skills as evidenced through concept mapping. Overall students' perceptions of concept mapping as a teaching-learning method were more positive than the preceptors' perceptions. In conclusion, internship preceptors and dietetic interns perceived concept mapping as effective in assisting interns to engage in critical thinking, to problem solve, and understand relationships among medical nutrition therapy concepts. However, preceptors had more negative attitudes toward concept mapping than the dietetic interns related to time and effort to complete and evaluate the concept map. *J Allied Health* 2009; 38:e97–e103.

Critical thinking has been determined to be an area in health professions education that needs improvement. The notion of critical thinking is based on the constructivist theory of learning that focuses on students' ability to mesh previous conceptual knowledge with new knowledge.¹ This type of thinking requires six essential cognitive skills: interpretation, analysis, evaluation, inference, explanation, and self-regulatory judgment.² In the past, educators have had difficulty

Dr. Molaison and **Dr. Connell** are Associate Professors, Department of Nutrition and Food Systems, University of Southern Mississippi, Hattiesburg, MS; **Ms. Taylor** is Dietitian, Palmetto Senior Care, Columbia, SC; and **Ms. Erickson** is Director, Dietetic Internship, College of Applied and Natural Sciences, Louisiana Tech University, Ruston, LA.

PP777 – Received Nov 28, 2007; accepted Nov 20, 2008.

Address correspondence to: Elaine Fontenot Molaison, Department of Nutrition and Food Systems, The University of Southern Mississippi, 118 College Drive #5172, Hattiesburg, MS 39406-5172. Tel 601-266-6548; fax 601-266-6343; e-mail Elaine.Molaison@usm.edu.

teaching and evaluating critical thinking skills.³ While established evaluative tools that assess students' pre-existing critical thinking abilities have been investigated, the tools available to teach this type of thinking are limited.⁴⁻⁶

Joseph Novak designed concept mapping to help operationalize constructivist learning theory.^{7,8} Concept mapping requires students to place ideas and concepts together within a physical and meaningful framework. These maps display ideas in a hierarchical structure and tie them together with explanatory links. Since their development, concept maps have been used as critical thinking teaching and evaluative tools and have been shown to facilitate communication between teachers and students by helping educators identify the extent of their students' understanding of a particular topic.^{6,9} A recent review of the use of concept mapping in nursing education concludes that concept mapping is an effective teaching-learning method.¹⁰ Concept maps aid students in a three-dimensional level of learning. This benefit helps them incorporate new knowledge with the old and is largely attributed to the map's visual nature.^{3,8,11-15}

Although improved critical thinking skills secondary to concept mapping have been investigated mostly among nursing and medical students, the technique is thought to be of use in other allied health professions, particularly among dietetics students.¹⁶ According to the Commission on Accreditation for Dietetics Education, students in dietetics education programs should gain appropriate dietetics-related knowledge and skills by the completion of their program, all of which require students to apply critical thinking skills. These include specific knowledge and skills that together serve to achieve broader goals of the student: enhancing the quality of life, enabling the student to work as a dietetic professional, and obtain an educational base for continual development of professional knowledge and skills.¹⁷ When entering the working world, dietetic students will need to know how to apply what they have learned to situations and patients, rather than regurgitating facts. Therefore, concept maps may be used to teach critical thinking, ultimately enhancing the students' ability to integrate and synthesize information related to patient nutritional care.

All dietetic students must complete a post-baccalaureate supervised practice program (internship) of at least 1200

TABLE 1. Scoring Criteria for Concept Mapping

| Variable | Criteria | Points Given |
|--|--|----------------|
| Crosslinks WITH directional arrow  | <ul style="list-style-type: none"> • Does the map show meaningful connections between one segment of the concept hierarchy and another segment? • Is the relationship shown significant and valid? • Is there a directional arrow helping to explain the relationship? • Score 10 points for each link that is both valid and significant with a directional arrow • If the cross link is not significant/valid, it will receive zero (0) points. • You will only be evaluating “cross link”. • You do not need to evaluate lines that designate hierarchy. | 10 points each |
| Crosslinks WITH-OUT directional arrow  | <ul style="list-style-type: none"> • Does the map have all of the above components except a directional arrow? • Score 2 points for each link that is valid and significant, yet does not have a directional arrow | 2 points each |
| Linking Terms | <ul style="list-style-type: none"> • Do the connecting line and linking word(s) indicate a meaningful relationship between two concepts? • Is the relationship valid? For each meaningful, valid proposition/linking term, score 2 points. • If the linking term is not meaningful, it will receive zero (0) points. | 2 points each |

hours to be eligible to sit for the registration examination for dietitians. Upon successful completion of the internship and the examination, dietetics graduates become Registered Dietitians.¹⁸ A major objective of dietetic internships is to further develop critical thinking and problem solving skills of students in the program. As noted previously, there is little information published on the use of concept maps for teaching critical thinking skills among dietetic interns. Only one study on the use of concept maps for teaching dietetics students at the undergraduate level has been published. These researchers found that utilizing concept mapping as an instructional strategy not only enhanced students’ perception of knowledge of nutrition therapy concepts, but it also increased critical thinking and problem solving skills.¹⁶ Furthermore, there is little information available related to the perceptions of the usefulness of the concept mapping process in teaching/learning among dietetic interns or internship preceptors who instruct and mentor these interns.

Other researchers have attempted to standardize the process by which concept maps can be used to assess critical thinking skills. Daley et al⁶ developed a scoring technique that evaluated the student’s ability to create hierarchy within the concept map, draw appropriate cross-links, and utilize appropriate propositions to describe the relationship between items. Separately, Hinck and colleagues¹⁹ utilized a scoring technique, which focused on evaluation of patient information and development of treatment goals. In addition, these researchers required that the subjects put this information in a logical sequence, indicating relationships with cross-links.

Therefore, the purpose of this study was to determine the potential efficacy of concept mapping as a tool for teaching/learning nutrition assessment and critical thinking among dietetic interns. In addition, both interns’ and preceptors’ perceptions of the concept mapping process were investigated. For this study, it was expected that the use of concept

maps as a teaching/learning tool would enhance critical thinking skills of dietetic interns. The project was approved by the University Institutional Review Board.

Methods

SAMPLE

This study used a one sample, pre-post design to achieve the research purposes. Nineteen interns and 31 preceptors in a 9-month supervised practice program were asked to participate in the study. All 19 interns and 31 preceptors agreed to participate and gave informed consent.

CONCEPT MAPPING TECHNIQUE

At the beginning of the internship, all interns enrolled in the program were taught the basic concept mapping skills and were required to complete a concept map on a food related topic. The students were then introduced to concept mapping as a replacement for the standard nutrition care plan. The standard nutrition care plan involved gathering information pertinent to a specific disease state case study and summarizing the nutrition-related problems identified in the case. Each intern then completed a “pre-assessment concept map” based on a single patient with end-stage renal disease (case study data on this patient can be found within figure 1 and figure 2 concept maps). Over the next nine months, the interns completed 15 additional concept maps on patients with various disease states/conditions. At the end of the internship, the interns were given the same renal patient data that was used for pre-assessment concept mapping to complete a post-assessment concept map. This methodology was similar to that described by Daley et al⁶ and has been more recently used by Hinck et al.¹⁹

SCORING OF THE CONCEPT MAPS

Internship preceptors were trained on the concept mapping technique and appropriate methods to evaluate the students' maps as part of their clinical rotations. During training, each preceptor was given a sample concept map on an unrelated disease state (not shown) and trained in the concept mapping technique. This helped to establish a framework for nutrition assessment components that should be included and linked in a typical concept map. Three internship preceptors were then selected to evaluate pre- and post-assessment concept maps.³ These preceptors were given scoring criteria to evaluate the renal disease concept maps (Table 1). Scores could range from 0 to an unlimited maximum score depending on the number of correct nutrition components, valid links and appropriate linking terms that were included. There was no "perfect" score since the objective was to determine whether significant improvement was made as opposed to giving the student a "grade" for the concept map used in the research study. The three preceptors' scores were averaged to give each intern a pre- and post-assessment concept map score. The remaining preceptors evaluated the other 15 concept maps over the course of the internship.

PERCEPTION OF CONCEPT MAPPING PROCESS

At the end of the internship, the interns and preceptors completed a questionnaire designed to evaluate their perceptions of the concept mapping technique. The 20-item questionnaire was adapted from that used by Roberts et al.¹⁶ with undergraduate dietetic students and covered 16 knowledge areas related to concept mapping. A five-point Likert scale was used to evaluate each area, with one being strongly disagree to five being strongly agree. Questions asked respondents if they felt concept mapping helped them assess nutrition status, use medical terminology, understand relationships, engage in critical thinking, and enjoy learning about medical nutrition therapy. There also were questions asking the respondents if they thought concept mapping was time consuming, thought provoking, and frustrating.

Descriptive characteristics (e.g. gender, undergraduate university, and race) were collected from the interns as well as the preceptors. Students were also asked whether they had used traditional nutrition care plans as part of their undergraduate dietetics curriculum. In addition, demographic data for preceptors included highest degree held, supervised practice path to registration, years in practice, area of expertise, and any certifications held other than the R.D.

Results

SPSS version 12 (SPSS Inc, Chicago, IL) was used to generate descriptive statistics for demographic variables. Inter-rater reliability coefficients were generated for the pre- and post-assessment concept mapping scores among the three evaluators to determine if the maps were graded similarly and con-

sistently. Paired t-tests were used to determine if concept map scores improved significantly from pre to post.

All subjects were students in the dietetic internship at Louisiana Tech University. Eighteen female interns and one male intern from 7 different undergraduate programs were included. Of the interns, there were 16 Caucasians, one African American, one Hispanic, and one intern who did not report race/ethnicity. Thirteen of the 19 interns (68.4%) had been taught traditional nutrition care plans in their undergraduate program. Thirty-one of the 37 (84%) preceptors who evaluated interns' concept maps throughout the supervised practice program completed the questionnaire. Twenty-eight surveyed preceptors worked in an area of clinical dietetics and 38.7% of the dietitians had a master's degree. Fifty-five percent had completed either an Approved Pre-professional Practice Program (AP4, which has since been re-named "dietetic internship") or a dietetic internship as their supervised practice path to registration eligibility.

Inter-rater reliability coefficients for scores on the renal case pre-concept map was .850 and .764 for the post-concept map. Figure 1 depicts a typical pre-assessment concept map. Pre-assessment concept maps consisted of fewer valid links, missing nutrition assessment components (e.g. current intake missing from pre-assessment concept map, but included in post-assessment concept map), errors in recording laboratory data, data recorded in incorrect components (weight recorded under laboratory values), and incomplete identification of medications/dietary supplements. Figure 2 depicts a typical post-assessment concept map where students made many more links between components, identified more components related to nutrition assessment, and identified more medications and dietary supplements and their impact on laboratory values and their use in disease management. Statistical significance was set at $p \leq .05$. There was a significant difference between the mean score of 28.35 on the pre-assessment concept map versus the post-assessment concept mean score of 117.96 ($t=8.92$, $p=.001$).

Overall students' comments were positive regarding the perception of concept mapping as a learning tool. Fifteen of 20 questions asked of students received mean scores ≥ 4.0 , indicating that the interns either agreed or strongly agreed that concept mapping was an effective learning tool. Through an evaluation of the mean scores (M) it was determined interns felt concept mapping positively influenced their ability to be an independent self-directed learner ($M=4.37$); to assess nutrition status ($M=4.26$); increased their ability to link concepts more than the traditional care plan ($M=4.22$); and engaged them in critical thinking ($M=4.37$). In addition, students tended to disagree that concept mapping was time consuming ($M=2.77$) and frustrating ($M=2.46$). Interns were less positive in their perceptions of concept mapping related to enabling them to discuss controversial dietetic issues ($M=3.63$); exchange ideas with other RDs ($M=3.95$); or enjoy learning about Medical Nutrition Therapy (MNT) ($M=3.95$). However mean scores on these three items were still greater than 3.0.

Step 1: Nutrition Assessment

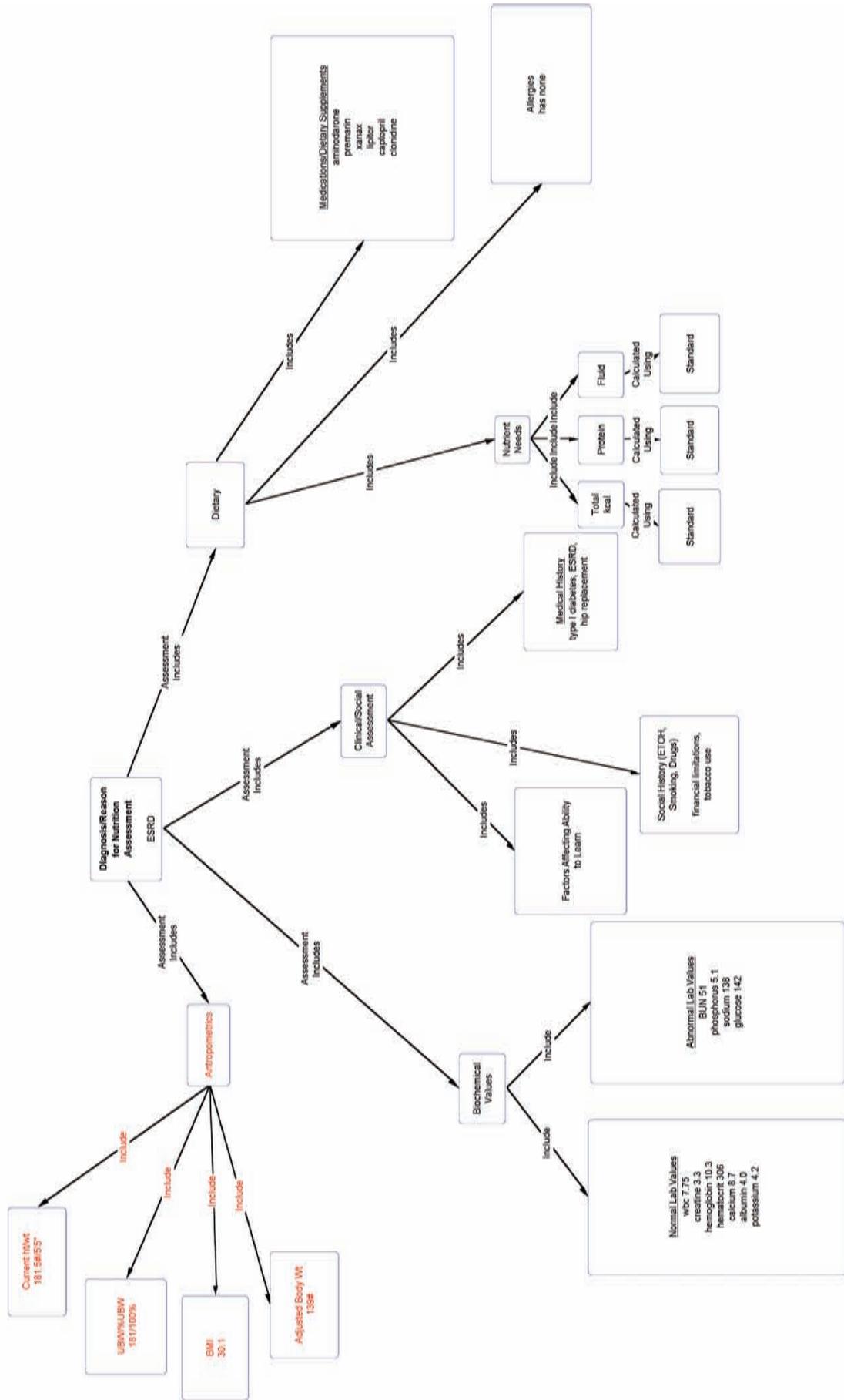


FIGURE 1: Example of a Pre-Concept Map Created by a Dietetic Intern

For preceptors completing the concept mapping perceptions survey, there was only one mean score that ranked 4.0. Overall the preceptors felt that concept mapping was time consuming ($M=3.87$); but that it helped students understand relationships ($M=4.00$). The dietitians' perceptions of concept mapping as serving to aid students in discussing controversial dietetic issues and being a preferable way to learn MNT compared to traditional nutrition care plans were primarily neutral ($M=3.00$ and 3.03 respectively).

Discussion And Conclusions

Similar to previous research on the use of concept maps, dietetic interns mean concept map scores increased significantly from pre to post.^{3,6,11,15,19} In the present study, dietetic interns had positive perceptions regarding concept mapping as a tool to learn connections between concepts related to MNT. The students agreed that concept mapping benefited their learning experience by increasing their knowledge of MNT, increasing their ability to be self-directed learners, helping them to use critical thinking, and requiring them to use problem solving skills. Unlike previous studies,^{15,19} dietetic interns in this study did not perceive concept mapping as excessively time consuming.

Internship preceptors in this study did not view concept mapping as favorably as did the interns. Several studies of concept mapping in the nursing literature have presented favorable faculty views of concept mapping.^{6,11,20,21} However one draw-back that has been cited by both students and faculty in studies of concept mapping is the time required for mapping and for evaluating the maps.^{15,21,22} Shell reported the greatest barrier to implementation of critical thinking teaching strategies among 175 nursing faculty to be student attitudes and expectations including lack of motivation, resistance to active learning, expectations of a lecture format and the desire for good grades versus learning. The second greatest perceived barrier among the nursing faculty was insufficient time to learn a new teaching strategy.²³

For the internship preceptors in this study the concept mapping process was rated positively as helping students understand relationships, problem solve, and think critically, but rated negatively with regard to being time consuming and frustrating. It is possible that part of the preceptors' negative attitudes toward concept mapping could be due to perceived additional time and work in evaluating the concept maps. This may present a barrier for the internship director in the implementation of concept mapping as a teaching/learning tool for critical thinking in MNT rotations. Hicks-Moore noted that as nursing faculty and students became more familiar with developing concept maps the time commitment also decreased.²¹ Therefore presenting concept mapping well in advance of initiating it in an internship setting and allowing preceptors time to develop skill in the process would likely assist internship directors in gaining the support of preceptors in its use.

Another possible explanation for the difference in intern

and preceptor perceptions toward concept mapping could be in the expectations inherent in being a student. Because the interns were still in school, they likely expected assignments such as concept maps as a component of the learning experience in an internship. Additionally, the interns did not consider the concept maps as optional assignments and the time commitment to complete the maps could have been viewed as a necessary part of the learning experience. On the other hand, preceptors agreed to assist in evaluating the concept maps but may have underestimated the initial time investment required to become efficient in the evaluation process.

The complexity of the maps must be considered when assessing the inter-rater reliability for the post-map scores in this study. Inter-rater reliability was good with the pre-concept map at .850. Pre-concept maps had significantly fewer valid links as noted by the lower pre-concept scores. As the students developed knowledge and skill and the ability to think more critically with regard to MNT, more valid links were made between concepts and the complexity of the maps increased. Given the variation in maps among students and large quantity of information on some of the students' maps, an inter-rater reliability of .764, though lower than the pre-mapping coefficient, is deemed acceptable for the post mapping.

The literature on concept mapping reveals some general limitations that should be addressed when implementing concept mapping in dietetics education. The time required to create concept maps and to evaluate them has been one of the most prominent barriers^{15,19,22} and was noted among the preceptors in our study, but not the interns. Fortunately, with practice, time required by the evaluator to grade the maps usually decreases.²⁴ While our study did not reveal this finding, students may interpret the process of learning and using concept maps as busy work.²⁴ This limitation may be minimized by allowing adequate time to learn the process^{8,6,11} and appropriate feedback on what needs to be included in a concept map before assigning a concept map for a graded class project.¹⁹ Additionally, while maps lend themselves to the visual learner, linear thinkers have difficulty seeing the map as anything other than chaotic. Some students may be more comfortable with the written word.²⁵ Anecdotally, students in our study stated that the maps were messy and unorganized.

A couple of possible limitations to the present study should be noted. First a "training effect" may have occurred among the students simply by completing the pre-concept map. An effort was made to minimize this effect by not providing feedback to students on the pre-concept map. Throughout the 9 month internship, the students continued their education and completed other concept maps throughout the internship. As their knowledge and skill increased, it was reflected in the vast improvement in scores on the post-concept maps. However, the purpose of concept mapping is to increase skill in making meaningful and valid connections between related concepts and it is thought that the improved scores on the post-concept maps reflect this improved skill. A second limitation of this study is the small number of dietetic

interns and the setting of only one internship program. In future, research on concept mapping as a teaching-learning strategy for critical thinking should include larger, multi-program samples. To strengthen the argument that concept mapping develops critical thinking skills, another area of needed research is to correlate pre- and post-concept mapping with existing critical thinking measures.

This study provides important information related to the need for effective strategies to develop critical thinking skills among dietetic interns. It also highlights the possible barriers to be overcome when introducing concept mapping as a critical thinking teaching-learning strategy among internship preceptors.

REFERENCES

1. Ausubel DP, Novak JD, Hanesian H. *Educational Psychology: A Cognitive View*, 2nd ed. New York: Werbel and Peck; 1986.
2. Ignatavicus DD. Six crucial thinking skills for at the bedside success. *Dimens Crit Care Nurs*. 2001;20:30-33.
3. West DC, Pomeroy JR, Park JK, Gerstenberger EA, Sandoval J. Critical thinking in graduate medical education. A role for concept mapping assessment? *JAMA*. 2000;284:1105-1110.
4. Facione PA. *California Critical Thinking Skills Test: Forms A and B*. Millbrae, CA: California Academic Press; 1992.
5. Ennis RH, Millman J, Tomko TN. *Cornell Critical Thinking Test (Levels X and Z)*. Pacific Grove, CA: Midwest; 1985.
6. Daley BJ, Shaw CR, Balistrieri T, Glasenapp K, Piacentine L. Concept maps: a strategy to teach and evaluate critical thinking. *J Nurs Educ*. 1999;38:42-47.
7. Novak JD, Gowin DB. *Learning How To Learn*. New York: Cambridge University Press; 1984.
8. Novak J. Concept maps and Vee diagrams: two metacognitive tools to facilitate meaningful learning. *Instructional Sci*. 1990;19: 29-52.
9. Miller MA. Outcomes evaluation: measuring critical thinking. *J Adv Nurs* 1992;17:1401-1407.
10. Clayton, LH. Concept mapping: an effective, active teaching-learning method. *Nurs Educ Perspect*. 2006;27:197-203.
11. Wheeler LA, Collins SKR. The influence of concept mapping on critical thinking in baccalaureate nursing students. *J Professional Nurs*. 2003;19:339-346.
12. Baugh NG, Mellott KG. Clinical concept mapping as preparation for student nurses' clinical experiences. *J Nurs Educ*. 1998;23: 35-41.
13. Buzan T, Buzan B. *The Mind Map Book: How To Use Radiant Thinking To Maximize Your Brain's Untapped Potential*. New York: Dutton;1993.
14. Irvine LMC. Can concept mapping be used to promote meaningful learning in nurse education? *J Adv Nurs*. 1995;21, 1175-1179.
15. Daley BJ. Facilitating learning with adult students through concept mapping. *J Continuing Higher Educ*. 2002;50:21-31.
16. Roberts CM, Sucher K, Perrin DG, Rodriguez S. Concept mapping: an effective instructional strategy for diet therapy. *J Am Diet Assoc*, 1995;95:908-911.
17. Commission on Accreditation for Dietetics Education. 2008 Eligibility Requirements and Accreditation Standards. Chicago, IL: American Dietetic Association; 2008.
18. Commission on Accreditation for Dietetics Education. Accredited or Approved Education Programs. Available at: http://www.eatright.org/cps/rde/xchg/ada/hs.xsl/CADE_401_ENU_HTML.htm. Accessed 16 October 2007
19. Hinck SM, Webb P, Sims-Giddens S, Helton C, Hope KL, Urtley R, Savinske D, Fahey EM, Yarbrough S. Student learning with concept mapping of care plans in community-based education. *J Professional Nurs*, 2006;22:23-29.
20. Harpaz I, Balik C, Ehrenfeld M. Concept mapping: an educational strategy for advancing nursing education. *Nurs Forum*. 2004;39:27-30,36.
21. Hicks-Moore SL. Clinical concept maps in nursing education: an effective way to link theory and practice. *Nurs Educ Pract*. 2005;5:348-352.
22. Mueller A, Johnston M, Bligh D. Mind-mapped care plan: A remarkable alternative to traditional nursing care plans. *Nurs Educ*. 2001;23:35-41.
23. Shell R. Perceived barriers to teaching for critical thinking by BSN nursing facility. *Nurs Educ Perspec*. 2001;22:286-291.
24. All AC, Huycke LI, Fisher MJ. Instructional tools for nursing education: concept maps. *Nurs Educ Perspect*. 2003;24:311-316.
25. Luckowski A. Concept mapping as a critical thinking tool for nurse educators. *J Nurs Staff Dev*. 2003;19:225-230.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.