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Does concept mapping enhance learning outcome of nursing students?

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SUMMARY

Aim: The aim of this study was to assess the concept mapping as a teaching method in the academic achievement of nursing students.
Method: This quasi-experimental study was conducted using a crossover design among two groups of total 64 nursing students. Participants were asked to create concept maps (group A) or were evaluated with the traditional method of quiz (group B) for eight weeks and then take a cumulative test (no. 1). Consequently, subjects used the alternate method for another eight weeks and then take the second cumulative test (no. 2).
Results: The results of this study showed that the mean scores for cumulative tests (both no. 1 and no. 2) was higher in the group that engaged in map construction compared to the group that only take the quizzes. In addition, there was a gradual increase in the mean scores of developed map during the eight sessions of intervention.
Conclusion: In conclusion, concept mapping has a positive effect on students' academic achievement. These findings could provide valuable evidence for establishing concept mapping as a continuous teaching strategy for nursing students.

Introduction

One of the challenges in the area of nursing education is the identification and use of innovative teaching methods to improve learning and critical thinking skills of nursing students (Cañas et al., 2007). Educational programs, which are designed to empower nurses, should contemplate careful selection of relevant contents as well as appropriate teaching strategies and methods. However, there are several limitations in the nursing educational methods (Akinsanya and Williams, 2004). One of these weaknesses is great emphasis on learning outcomes with little or no attention toward approaches employed by students in their learning process (Tanner, 2001). There is little information about the learning approaches used by nursing students (August-Brady, 2005).

Learning approaches are mental activities that learners apply to effectively receive, organize and recall information (Park, 1995). Learning approaches are expected to create advanced cognitive skills such as construction, analysis as well as meta-cognitive skills among students at higher education (Emig, 1977). In particular, university students are expected to practice higher order skills such as synthesis, analysis and meta-cognitive skills (Villalon and Calvo, 2011). Meta-cognitive skills are visualization techniques (Jacobson, 2004) that make the flow of thinking more visible and allow learners to express their understanding in a graphical model (Collins et al., 2009).

One of the meta-cognitive techniques is the conceptual map in which students draw their understanding in an explicit graphical map. Four basic and three specialized concept maps have been described in the literature (All et al., 2003; Ferrario, 2004; Glendon and Ulrich, 2004). Nevertheless, there are some advantages and limitations in all seven kinds of maps. One of the basic conceptual maps is termed hierarchical that recognizes the concept and attributes in a hierarchical structure (Novak and Gowin, 1972) . Concepts in a hierarchical structure have communication from top-to-bottom and side-to-side relations (Chang et al., 2002; Hinck et al., 2006). There are two dimensions in a map: the node, which corresponds to the concept, and links, which corresponds to the relationships.

This educational approach leads to a meaningful learning by allowing students to add the new graphical concept to their cognitive scaffold (Eitel et al., 2000; Hicks-Moore, 2005; Senita, 2008). Moreover, concept map is a visual representation of what students think and thus can be used as a method for faculty evaluation (All et al., 2003; King and Shell, 2002). Research evidences showed that CM could improve the critical thinking of students (Chularut and DeBacker, 2004; Luckowski, 2003). Furthermore, the American Philosophical Society incorporated critical thinking into the definition of CM. This society defines critical thinking as a non-linear process of self-regulation and purposive judgment about the facts and concepts which also represents the definition of the CM (Abel and Freeze, 2006).

Concept mapping has been developed by Novak and Gowin (1972) based on cognitive theory adapted from Ausubel, which has been used in various fields of education systems (Abel and Freeze, 2006; Hinck et al., 2006). In nursing education, CM has been used as the way to

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improve learning, teaching and assessment of critical thinking (Akinsanya and Williams, 2004; Chularut and DeBacker, 2004; Ghanbari et al., 2012). Chang et al. (2002) conducted a case–control study and revealed that concept mapping enhances the students' comprehension and summarization ability. In addition, Chang's study found that map-correction method facilitated both the comprehension and summarization ability while scaffold-fading method enhanced summarization ability. Another study by Hauser et al. (2006) found that studying a worked-out map and generating one's own map effectively enhance students' learning ability. Changes in the classroom instructions along with qualities of students call for a tool that support meaningful learning while providing an instrument for faculty evaluation (Dobbin, 2001; Hsu, 2004; Luckowski, 2003). Mapping is a tool that allows educators to observe a concept from students' perspective and track students' learning over time (All et al., 2003; Glendon and Ulrich, 2004; Kinchin and Hay, 2005; Schuster, 2000).

Valerio and Leake (2006) recognize prerequisites for generating a CM for educational purposes. These prerequisites are categorized in three general domains: educational use, simplicity and subjectivity. Educational use refers to the monitoring construction of concepts, relating them to produce presumptions, respect the hierarchy and systematic concepts as well as parallel placement of the component in terms of the level of generality. For simplicity, the individuals should show their understanding from the topic in a concise, summarized and organized plan in maximal 25 concepts. Lastly, subjectivity refers to certain and unique terms used by the learner to express concepts extracted from the text. Therefore, CM influenced by the content and ability of the learners to understand and nomenclature the concepts (Valerio and Leake, 2006; Villalon and Calvo, 2008).

Two problems have been reported for constructing a CM. The first problem is attributed to the map generation. Some students may extract concepts which do not fit the definition of a CM proposed by Novak (1984), largely because of the lack of precise definition of the CM. The second problem is lack of a coherent method for evaluating the maps. These two mentioned problems resulted in administration of various and unique methods in each particular study (Kinchin et al., 2008).

Iranian scholars recently paid more attention toward conceptual map in the field of nursing education (Ghanbari et al., 2012; Nejat et al., 2011; Sarhangi et al., 2011). These studies mainly focus on academic achievement and critical thinking. However, further evidences are required to expand our knowledge about concept mapping in variety of topics and among different levels of nursing students. The purpose of this study was to evaluate the usefulness of map construction as a teaching strategy on learning outcomes for nursing students. Students in this study were enabled to construct their own maps. Furthermore, we aimed at assessing the students' opinion about the CM method for modification, implementation and deployment as a student-centered educational process at the relevant School of Nursing.

Method

In this quasi-experiment study, 64 nursing freshman in a case-control crossover design were examined to assess effect of the concept mapping on their academic achievement. To accomplish this, two modules of nursing courses, including fundamental of nursing and introduction to cancer nursing (parts of medical surgical nursing 1), was offered to second semester nursing students (first year) in the academic year 2013–2014.

Students were divided into two groups of 32 participants. The first group (group A), were asked to construct a map from the contents of each sessions. The second group (group B) was not engaged in mapping construction and was examined by a multiple-choice test (quiz) about the contents of each session. Initially, group A received a two-hour lecture about the definition and instruction on how to construct a map. Then, both groups received 8 weeks lecture on fundamentals of nursing such as nursing process, stress, shock, body image, chronic disease, geriatric nursing, nosocomial infection and essential of rehabilitation. Upon finishing the eight sessions, a cumulative test was taken (no. 1) by both groups. At this stage, the teaching strategy was exchanged between the two groups in a way that group A was examined by a multiple-choice test (quiz) while group B was asked to construct a map from the contents of each session. At this stage, group B received a two-hour lecture about the definition and instruction on how to construct a map. Students received eight weeks lectures on cancer nursing topic and then a cumulative test (no. 2) was taken by all students regardless of their group. Besides, students were notified about feedback on their constructed map as well as their grades in each quiz.

Two experts in the area of concept mapping evaluated and scored the constructed maps. The evaluation was based on the method proposed by Novak and Cañas (2006), called the Annotation protocol. According to this method, Novak proposed six steps in the construction of CMs. These steps include identifying the topic or title, rank the concepts by placing the most general concepts at the top, add more specific concepts under more inclusive ones, connect concepts via appropriate labeled lines, transverse linking between general and detailed concepts and reorganize maps in accordance with the novel linkage between the concepts, discussion, reflection and ultimately generate the corrected map (Novak and Cañas, 2006).

The kappa statistic that measures the extent to which two experts agree on chance and information retrieval for Ontology Learning from Text (OLT) was obtained (Dellschaft and Staab, 2006). A measure first proposed in the information retrieval literature corresponds to the lexical layer, which is the identification of “concepts” in the text. These methods are evaluated using the lexical term precision (LP). The hierarchical layer corresponds to relationships between concepts. Several measures have been proposed and discussed for this, and the current state of the art corresponds to taxonomic overlap precision (TP) based on the common semantic copy proposed by Dellschaft and Staab (2006). LP measures how well the learned lexical terms (concepts for CM) cover the target scope and TP measures how well the concepts are deployed in the hierarchy defined by ontology. For evaluating TP, Each of the maps was scored based on a structural scoring rubric developed by Miller and Cañas (2006). The rubric evaluates each map based on the following four components: (a) one point for each meaningful proposition, (b) five points for each valid level of hierarchy, (c) ten points for each crosslink, and (d) one point for each example. A proposition involves two concept nodes connected with linking words and represents the relationship between the concepts. The number of propositions demonstrates the extent of knowledge in each domain. Hierarchy refers to the organization of concepts in the order of generalization to specification and represents the differentiation of concepts. A crosslink is a meaningful proposition between different segments of the hierarchy and represents the reconciliation of concepts. An example is a proposition between a concept and its specific events or objects indicated by the labeled links. The scores for each of these components were compiled to produce a total score for each map. After scoring all maps, a composite variable was created by summing up the scores of eight concept maps for each student.

A questionnaire to evaluate students' perception with the CMs was administered at the end of each eight-week course. The instrument had two parts. In the first part, participants were asked to indicate their demographic characteristics (e.g., age, gender), whether they had prior experience with CM and how they generate their concept maps (paper-based or computer-based). The second part included eleven items about their learning experience with the integration of CM strategy (see Table 3). These items were adapted and modified from the related studies in the literature (Chiou, 2008; Hinck et al., 2006; Koc, 2012; Kwon and Cifuentes, 2007). Four PhD candidates, who were not involved in the study, reviewed a draft of the questionnaire for clarity, appropriateness of the content, format, and style. Participants were asked to rate each item by using a five-point Likert-type scale ranging from “strongly disagree” (1) to “strongly agree” (5). Internal