

## THE EFFECT OF CONCEPT MAPPING ON CRITICAL THINKING SKILLS AND DISPOSITIONS OF JUNIOR AND SENIOR BACCALAUREATE NURSING STUDENTS

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**Abstract.** Teaching and assessing critical thinking have great professional benefit to nursing education (Daley, 1996, Facione, 1996). Major issues still center on and are discussed by nurse educators about the importance of teaching strategies that enhance critical thinking skills and measurements of critical thinking (Adams, 1999; Daley, Shaw, & Balistrieri, 1999; Facione & Facione, 1997). The purposes of this quasi experimental study, using a pretest – posttest control group design were twofold. The first purpose was to explore the effect of concept mapping, as a metacognitive teaching strategy on the critical thinking skills and dispositions of junior and senior level baccalaureate nursing students. The second purpose was to evaluate the changes in students' concept mapping skills over time. This research was based upon David Ausubel's theory of meaningful learning (1968) and Joseph Novak and Bob Gowin's (1984) work on the application of meaningful learning using concept mapping. The convenience sample included 32 students in the experimental group and 45 students in the control group. The participants were enrolled in accredited generic baccalaureate nursing programs. The students in the experimental group developed two concept maps over the course of a full academic semester. The California Critical Skills Test (CCTST) and the California Critical Thinking Disposition Inventory (CCTDI) were used to measure the variables. Novak and Gowin's (1984) scoring criteria were used to score the concept maps. The pretest scores of the two groups did not differ significantly. The experimental and control groups did not differ on CCTST or CCTDI posttest scores. There was no relationship between critical thinking skills and dispositions scores. Nursing students who used concept mapping showed no increase in their CCTST and CCTDI on posttest scores. The first concept maps showed fewer concepts, and less connecting of concepts than the second concept maps, supporting Ausubel's Meaningful Learning Theory. The findings of this study suggest that concept mapping triggers critical thinking, which guides the student to engage in meaningful learning. However, the need still exists for researchers to use other critical thinking tools that may capture students' growth of critical thinking over time.

### 1 Introduction

In nursing education, educators are challenged to explore innovative teaching strategies that teach students the skills to think critically. Paul (1995) strongly emphasized that, to foster students' critical thinking, faculty must provide the opportunity for students to engage in critical thinking. The literature suggests concept mapping as a teaching strategy may contribute to critical thinking abilities of nursing students (Beitz, 1998; Daley, 1996). Yet, limited nursing research has investigated the effect of concept mapping on student critical thinking skills and dispositions and evaluated the students' performance in a specific course where concept mapping was introduced. The purposes of this quasi experimental study using a pretest – posttest control group design were twofold. First, the researcher explored the effect of concept mapping, a metacognition teaching strategy, on the critical thinking skills and dispositions of junior level baccalaureate nursing students. Second, this researcher evaluated the changes in students' concept mapping skills over time.

### 2 Methods

This study explored the effect of concept mapping, the independent variable, on two dependent variables, critical thinking disposition and critical thinking skills. The design was a quasi-experimental, non-equivalent control group, pretest-posttest design. This design examined the effect of an intervention between two groups, the experimental and control groups, and was acceptable to evaluate the effect of a treatment since randomization was not feasible. The concept mapping intervention is illustrated in Figure 1 by an "X", and concept mapping measures (cm1, cm2) are the independent variables. Posttest measurements of the two CT dependent variables skills and dispositions  $O_{2a}$  and  $O_{2b}$  were done at the end of the semester. Over the course of the semester, students were required to individually complete two concept maps on a topic, either assigned by faculty or chosen by the student, relative to the content covered in the course. The faculty teaching the course evaluated the original concept maps using Novak's and Gowin's scoring criteria (1984). This strategy assured that students received faculty feedback on the completed concept maps, however, the course grades were not collected for this research project. Table 1. shows the Number of Participants at Each Data Collection Site.

Figure 1. Non-equivalent control group pretest-posttest design

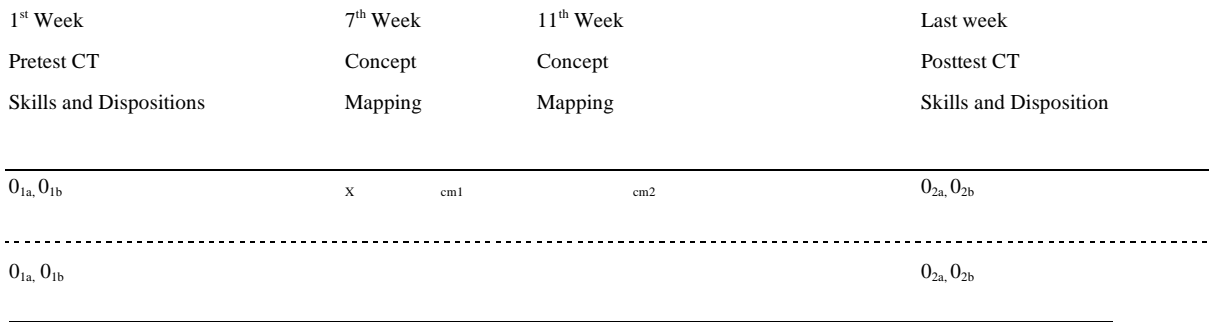


Table 1. The Number of Participants at Each Data Collection Site (N = 77)

	<u>Final Sample n =</u>
Experimental Site	
Illinois	32
Control Sites	
Illinois	29
Pennsylvania	4
Idaho	12
<u>Total</u>	<u>45</u>
Sites Total	77

**2.1 Intervention**

The purpose for introducing the intervention as part of their theory class was to enhance students’ understanding of theoretical concepts, correct misconceptions, and facilitate their clinical learning, although this function was not evaluated in this study. Novak and Gowin’s (1984) concept mapping method and scoring criteria were used. Over the course of the semester, students were required to individually complete two concept maps on a topic, either assigned by faculty or chosen by the student, relative to the content covered in the course. The faculty teaching the course evaluated the original concept maps. The control group only received the lecture. This research used the CCTST developed by Facione and Facione (1990) and CCTDI instruments developed by Facione, Facione, and Sanchez (1994b) to measure the variables critical thinking skills and dispositions.

**2.2 Research Questions:**

1. Is there a difference between control and experimental groups of junior and senior level baccalaureate nursing students on posttest critical thinking skills subscales and total scores using the California Critical Thinking Skills Test (CCTST)?
2. Is there a difference between control and experimental groups of junior and senior level baccalaureate nursing students on posttest critical thinking disposition subscale scores and total scores using the California Critical Thinking Disposition Inventory (CCTDI)?
3. Is there a relationship between CCTST posttest scores of the experimental group and second concept mapping score when the influence of the CCTST pretest is accounted for by partial correlation?
4. Is there a relationship between CCTDI posttest scores of the experimental group and second concept mapping score when the influence of the CCTDI pretest is accounted for by partial correlation?
5. Is there a difference between the first concept map scores and the second concept map scores developed by the students in the experimental group?

### 3 Results and Discussion

This study revealed no statistically significant differences in group means between the experimental group and the control group, on posttest critical thinking skills total and subscale scores ( $t = -1.26$ ,  $df = 75$ ,  $p = .213$ ) and on posttest critical thinking disposition total and subscale scores ( $t = 67$ ,  $df = 75$ ,  $p = .507$ ). CCTST and CCTDI posttest scores and the second concept map scores of the experimental group when the influence of pretest CCTST and CCTDI posttest scores was accounted for by partial correlation. After extracting the influence of CCTST pre-test scores, the relationship between CCTST post-test scores and second CM scores was not significant ( $r = .001$ ,  $p = .994$ ) and after extracting the influence of the pretest CCTDI scores, the relationship between CCTDI post-test scores and second CM scores was not significant ( $r = .39$ ,  $p = .832$ ).

These findings are consistent with the findings of other researchers. Wheeler and Collins (2003) also used descriptive design to evaluate the effectiveness of concept mapping on baccalaureate nursing students' critical thinking skills. They reported no significant difference between the experimental and control groups. Leppa (1997) reported non-significant difference in critical thinking skills of RN-BSN students at entry and on exit of the program. Possible explanations for the findings of this study may stem from several factors, such as the small sample size, measurement error, instrumentation, the curriculum, students' learning process, the impact on study results of students' seriousness in answering the questions and length of the study. The findings of Leppa (1997) and Wheeler and Collins (2003) and the findings of this study may suggest that the CCTST may not be the best instrument to use to measure the effect of concept mapping on students' critical thinking skills. If critical thinking, as defined by Paul (1995), is a way of thinking about a situation or a content-related knowledge, then the students in this study were indeed thinking critically, considering the improvement in their scores between concept maps 1 and 2 (Tables 1 and 2). The finding of this study is consistent with the findings of August-Brady's research (2002) and that of Daley et al. (1999). Their analysis revealed that the mean scores for concept maps increased over time. The concept map scoring criteria according to Novak and Gowin (1984) has no limited scoring range; the higher the score the more comprehensive and complex the concept map. Therefore, variability among the scores was evident in this study, as in August-Brady's research and Daley et al.'s research. This study's findings are consistent with the literature that concept maps grow in complexity over time

Table 2

Means, Standard Deviations, Ranges and t-test Results for Concept Maps, Propositions, Hierarchy, Link, Pathophysiology, and Comprehension.

	Concept Map 1			Concept Map 2			t	p
	M	SD	Range	M	SD	Range		
Prop	12.09	5.67	1-20	15.22	6.36	5-25	-5.34	<.001
Hier	33.13	7.37	15-40	35.69	5.94	15-40	-2.43	.021
Link	21.87	5.97	12-32	24.34	5.67	12-32	-3.04	.005
Patho	32.03	6.07	20-40	35.63	3.75	10-30	-5.58	.000
Comp	8.44	.91	6-10	8.84	1.11	6-10	-1.98	.057

Table 3

Means, Standard Deviations, Ranges and t-test Results for Total Concept Map Scores

	M	SD	Range	t	p
Map 1	107.06	22.59	61-138	-5.32	<.001
Map 2	119.56	20.47	72-143		

### 4 Conclusions and Recommendations

The experimental and the control groups scored low on CCTST. Students overall scored moderately high on CCTDI. Nursing students who used concept mapping showed no increase in their CCTST, CCTDI and posttest scores at the end of the semester. The first concept maps showed fewer concepts, and less connecting of concepts

than the second concept maps. This study supported the Meaningful Learning Theory (Ausubel, 1968), as described in the literature, as a framework to explain the complexity difference from the first to the second concept map.

## 5 Limitations

The main limitation of this study lies in its generalizability. The findings cannot be generalized due to the small sample size. The sample was a nonrandom, convenience sample drawn from schools in Pennsylvania, Idaho and Illinois. Race and gender may not be accurately represented because the majority of the participants in this study were Caucasian or African American and predominately female. However, the gender characteristic reflects the national characteristic of the nursing profession at the present time. The sample size of this study was a major limitation in relation to the findings.

## 6 Implications

This research contributes to nursing research and science given the limited studies that investigated the relationship between critical thinking measurement before and after a teaching intervention such as the concept mapping as a metacognitive intervention early in the nursing program. Moreover the value of concept mapping as a metacognitive intervention has been identified in the nursing literature as a strategy to facilitate meaningful learning. However, there is limited empirical research support for its effectiveness (August-Brady, 2002; Beitz, 1998; Daley, 1996, Wheeler & Collins 2003). In addition, the study by Wheeler and Collins was the only research reported in the literature that used the same research variables, excluding the CCTDI instrument. Thus, this study's findings contribute to the empirical research in nursing on concept mapping as a teaching intervention.

## 7 Recommendations

Replicate this study using a random sample, from randomly selected nursing schools in different regions of the country, to provide a broader, more accurate representation of nursing students in the United States and using a larger class size. Moreover, examine the effect of concept mapping using both quantitative and qualitative research methods.

## 8 References

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