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EFFECT OF CONCEPT MAPPING ON CRITICAL THINKING SKILLS OF BACCALAUREATE NURSING STUDENTS

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ABSTRACT

Today critical thinking (CT) is the cornerstone of higher education. Traditional teaching techniques, which promote mostly memorization, do not help nursing students think critically and solve problems in the clinical setting. The traditional nursing care plan needs to be replaced with evidenced-based methods of improving critical thinking skills of nursing students. The aim of this study was, to evaluate the effect of concept mapping, on critical thinking skills of baccalaureate nursing students. A quazi-experimental control group study with a pretest and posttest design was used on a convenient sample of 60 students in a selected Nursing Faculty in Cairo-Egypt. Two tools were used in this study: self-administered questionnaire and pre-post test of California Critical Thinking Skills Test (CCTST), modified Arabic version were used. A pre-test was given to the two groups, to determine the baseline category of critical thinking skills. Post-test was given to the two groups at the end of the study after introducing intervention (concept mapping) to the experimental group. The study results revealed a highly statistical significant difference, in the pretest- post-test CT mean scores in the experimental group, with t value of =5.106 at P value =0.000 and the overall mean critical thinking post-test score was statistically significant, between the two groups with t value of 6.571 at P value of 0.000. It can be concluded that, students who were taught with concept mapping showed an increase in their CT scores, than those in the control group and thus, supported the study hypotheses. Nursing students require effective CT skills, in order to make sound knowledge-based assessment and treatment choices during patient care, so the researcher recommended further studies to examine the potential for concept mapping to be taught in pre-requisite courses, as a way to begin learning to critically think prior to their entry into the program.

KEYWORDS: Critical Thinking- Critical Thinking in Nursing- Meaningful Learning- Active Learning Strategies and Concept Mapping

INTRODUCTION

Nurses are expected to perform competently within their scope of practice, in a wide range of situations, from assessing patients with co-morbidities to handling life and death scenarios. Their ability to think critically and problem solving is the basis of what enables them, to manage different situations and provide optimal patient care. As the scope of practice for nurses continues to evolve and expand, those who employ critical thinking (CT), will be able to progress and meet the healthcare needs of complex and acutely ill patients, opposed to nurses who apply memorization of information and protocols to inform their nursing practice (Romanko, 2016).

Critical thinking is a complex cognitive process, broadly defined as the use of purposeful, insightful judgment that involves the development and effective utilization of multiple dimensions of cognition to interpret, analyze a situation, arrive at and act on an appropriate conclusion or solution. Thus, CT involves higher-order reasoning and evaluation (Kaddoura, Van-Dyke, &Yang, 2016). Critical thinking skills allow nurses to comprehend and apply theoretical content, actively analyze pathophysiology, anatomy, the disease process, and guide them in creating and applying appropriate nursing interventions and care plans (Romanko, 2016).

Facilitating CT remains a challenge, faced by both nurse educators and student nurses. The challenge facing them however is the gap that exists between knowing CT concepts and being able to consistently apply the critical-thinking process to real-clinical situations. Also, nurse educators often do not understand the concepts inherent in CT and therefore continue to practice traditional teaching strategies such as lectures and requiring students to memorize (Dwyer, Boswell, & Elliott, 2015& Grieco, 2016).

There are numerous teaching strategies that facilitate CT, especially in relation to knowledge transfer from didactic courses to clinical settings (Brudvig Dirkes, Dutta & Rane, 2013). Concept mapping (CM) is one of the most effective teaching strategies whose effect on developing and promoting CT, has frequently been investigated and confirmed. Concept mapping is a schematic device representing a set of concepts embedded in a framework of propositions, in other words, it is a diagram that shows multiple relationships among concepts (Gerdeman, Lux & Jacko, 2013 & Ghojazadeh, Aghaei, Naghavi-Behzad, Piri, Hazrati & Azami-Aghdash, 2014).

Research has demonstrated that, both students and educators find CM to be useful in visualizing concepts, integrating them into the nursing process, linking theory and practice, and improving CT abilities in nursing students. Whether in a clinical setting or classroom, CM has been established as a useful learning and teaching method for students, to develop their CT abilities (Romanko, 2016). Therefore, the current study will be conducted with the aim of evaluating the effect of concept mapping, on critical thinking skills of baccalaureate nursing students.

SIGNIFICANCE OF THE STUDY

Critical thinking (CT) is currently a highly valued educational outcome, throughout the educational spectrum, especially in relation to higher and professional education. Nursing education worldwide is also embracing the construct of critical thinking, as a desirable educational outcome and realizes the importance of eliciting the evidence of critical thinking, in nurse's reasoning process (Papathanasiou, Kleisiaris, Fradelos, Kakou & Kourkouta, 2014; Kaddoura, Van-Dyke& Yang, 2016).

Several Professional and regulatory bodies in nursing education have required CT, to be central to all nursing curricula. For example, the National League for Nurses included CT as a specific criterion in the accreditation of academic programs. For its part, the Joint Commission for Accreditation for Healthcare Organizations included CT among its norms, as a key skill of great significance in nursing education and in professional practice (Pérez et al, 2014). The American Nurse Association (ANA) also emphasizes that the nurses' CTS should be measured, as a criterion for validating outcomes of nurse education programs (ANA, 2015). Moreover, The National Academic Reference Standards, (NARS) considers CT as one of the main attributes of the graduates of bachelor degree in nursing science in Egypt (NARS, 2009).

Critical thinking skills are very important in the nursing field because they are what nurses use to prioritize and make key decisions that can save lives. Critical thinking skills of nurses can really mean the difference between someone living or dying. Nevertheless, nearly two-thirds of the current nursing graduates worldwide are unable to clinically reason at the most basic level to recognize a worsening change in patient status. This is commonly called “failure to rescue” and happens when the nurse does not recognize trends that reflect a deteriorating status change until it is too late and an adverse outcome or patient death results (Rischer& Channel, 2013).

Although, traditional methods of education can teach the nursing students a certain amount of information, related to many specialties, they do not equip them with the tools that improve graduate nurses’ CT. Therefore it is vital that, educators should learn how to foster the development of critical thinking capacities in students and new nurses so they can incorporate this skill into their practice resulting in better patient care. The nursing educators should inspire from the academic and clinical environment the use of various and appropriate teaching strategies that engage students in the higher order of thinking, and help students' success (Romanko, 2016 & Farrag, 2017).

Concept mapping is among the academic teaching strategies that have proven to be useful, in the development of active learning, utilizing application and analysis-based CTS. Concept mapping facilitate examining the existing knowledge and thought processes of nursing students, by visually arranging concepts hierarchically and identifying their relationships, while ensuring appropriate patient care is provided (Smith, 2016). Furthermore, the American Philosophical Society (APS), incorporated CT into the definition of CM. This society defines CT as a non-linear process of self-regulation and purposive judgment about the facts and concepts, which also represents the definition of the CM (Jaafarpour, Aazami & Mozafari, 2016).

A vast amount of research has been conducted about effectiveness of CM, in promoting critical thinking, with baccalaureate nursing students and nursing students in the final semesters of their program. Concept maps should be implemented, with the sophomore nursing students where the foundation of CT development is established. By fostering CT, especially early in the nursing program, the potential to prepare better qualified nursing graduates is strengthened (Smith, 2016). Lack of specific previous research related to the effectiveness of concept mapping on sophomore nursing students’ CT abilities in Egypt, prompted this research study. Also, the opportunity to conduct this research study could provide more evidence to the usefulness of CM and if it can be a viable solution for the students, to achieve success in the course of their nursing education.

Aim of the Study

The aim of the current study was to evaluate the effect of concept mapping, on critical thinking skills of baccalaureate nursing students.

MATERIALS AND METHODS

Hypotheses

To achieve the aim of this study, two hypotheses were formulated:

- **H1**: There is no significant difference between the mean post-test critical thinking (CT) scores of students in the experimental group after using concept mapping and their mean pre-test CT scores.

- **H2**: There is no significant difference between the mean post-test critical thinking (CT) scores of students in the control and experimental groups.

Research Design

A Quazi-Experimental Control Group Study, with a pretest and posttest design was used to achieve the aim of the current study.

Sample

A convenience sample of 60 sophomore nursing students (male and female), who were 19-20 years old and enrolled in Medical Surgical Nursing Practicum course (NUR 202, 4 credit hours), during the 1st semester, academic year 2016/2017 of a baccalaureate nursing program in a selected faculty were chosen as a study sample. A student, who was repeaters, expectorates, and those who were coming from technical nursing institutes were excluded from the study sample. Participants were divided randomly into two equal groups, experimental (n=30) and control groups (n= 30). The two groups were exposed to the traditional instruction of writing the nursing care plan, while the experimental group was taught the experimental intervention (Concept Mapping). Participants had not previously been exposed to concept mapping in their curriculum.

Setting

The study was conducted at a selected Nursing Faculty in Cairo-Egypt using the classes that are regularly assigned to the sophomore baccalaureate nursing students.

Tools

Two data collection tools were utilized to collect data pertinent to the study variables. Tools were revised by a panel of five experts in nursing education and medical surgical nursing specialties to establish content validity and modifications of the tools were made based on feedback. The study tools consisted of:

Self- Administered Questionnaire Sheet

It was developed by the researcher after reviewing related literature. It is composed of two parts:

- Demographic variables related to study subjects such as: students' age, gender, place of residence, etc.
- Critical thinking related variables such as, type of pre-college schools, 1st year college grade point average (GPA), learning style, the average number of studying hours, extracurricular activities (if any)and studied elective courses.

California Critical Thinking Skills Test (CCTST), Modified Arabic Version (Farrag, 2006)

California Critical Thinking Skills Test is a valid standardized test developed, to assess nursing students' CT skills (Facione, 1990). The CCTST Arabic Version covers "the five cognitive skills identified, by the Delphi experts" representing: Analysis, Inference, Evaluation, Deductive Reasoning, and Inductive Reasoning (Facione & Facione, 1996). The Arabic version of CCTST was translated and modified, by Farrag, 2006.There are two forms of the test; A & B which are composed of different questions, but the same in difficulty and complexity, form A was used in the pretest and form B was used in the posttest. Every form is composed of 25 multiple-choice questions ranging in difficulty and complexity and

the same time limit for the test, which was 45 minutes. This multiple-choice test is composed of questions, in the form of health-oriented scenarios. Each question has a choice of possible answers. The correct answer demonstrates the highest level of CT applied to the scenario, while the incorrect answers reflect plausible but non-optimal responses to the scenario. Each student receives an overall CT score. The test was administered to all participants in both groups at the beginning and end of the course.

Scoring System

A score of one was given for each correct answer and zero for each incorrect or missed answer. The lowest overall score was zero and the highest was 25. Scores were interpreted as follow:- Score from 0- >6 was considered not manifested, 6- >10 was weak, 10- >14 was moderate, 14->18 was strong and superior was 18- ≥25.The higher a student's score, the better his/her ability to think critically, within the discipline of nursing.

Content Validity

Self- Administered questionnaire Sheet was developed by the researcher, after extensive literature review and submitted to a panel of five reviewers and experts in medical surgical nursing and nursing education. Each one of the experts on the panel was asked, to examine the instrument for content coverage, clarity, wording, length, format, and overall appearance. Modifications of the tool were done according to panel judgment. Reliability of the Modified Arabic version of California Critical Thinking Test (CCTST), was measured by test- retest (using Pearson coefficient correlation) which produced internal consistency estimates ranging from 0.68 to 0.80.

Pilot Study

A pilot study was conducted on 10% of total sample with the same inclusion and exclusion criteria for the purpose of assessing the feasibility, and applicability of the study, test the adequacy and internal consistency of the study tools and to determine any possible problems in the methodological approach. The students who were involved in the pilot study were excluded from the main study sample.

ETHICAL CONSIDERATIONS

A written approval was obtained from the Ethics and Research Committee of the Faculty of Nursing. Informed consent was obtained from each student after explaining the nature & purpose of the study. Voluntary participation, confidentiality and anonymity were assured. The student’s grade would not depend upon participation; the researcher also was not the faculty member who issues the grades for these students.

PROCEDURE

The current study was carried out through the following phases; assessment, planning, implementation and evaluation phase.

Assessment Phase

This phase involved preparation of the study sample and environment (clinical settings where the students should be trained and the teaching learning environment were assessed). Moreover, extensive literature review was carried out to explore different aspects of the research area.

Planning Phase

Through which the study design, sample size, inclusion and exclusion criteria, tools for data collection were selected and developed. Face and content validity of the study tools were tested by a panel of experts in the field of medical surgical nursing. Developing a preliminary draft of the instructional materials was done.

Implementation Phase

This phase consisted of specific dynamic iterative activities designed to put the concept mapping into practice effectively. Those activities included a pilot study, followed by its related data analysis as well as pretest of the students' critical thinking skills in both the experimental and control groups and finally implementing the concept mapping teaching strategy for the experimental group. The study sample (60 students) was randomly divided into two equal groups (30 students in each of the experimental and control groups); as well assigning students to the groups was randomly done. The study was conducted over 13 weeks, starting on September 2016. In the 1st week, assessments of the socio-demographic variables of the students were done using the structured questionnaire. Also, pre-test of students' critical thinking skills in both experimental and control groups was done using CCTST (form A), before implementation of concept mapping.

After that, the two groups were given the traditional instruction of writing the nursing care plan. The introduction of the concept mapping to the experimental group was conducted through two interactive presentations over the first two weeks and every presentation lasted for four hours. In these two presentations, the students in the experimental group received sufficient explanation about critical thinking (definition, skills and dispositions) and concept mapping (definition, types, uses, importance and its application) and its application in nursing education.

The students were trained for application of concept maps in a given scenarios previously prepared by the researcher, and they were encouraged to ask questions and to be active participants during sessions through sharing in different, motivational teaching activities e.g. (role play, one minute reflection, individualized written exercises, brain storming and think, pair, share technique).

Starting from the 3rd week to the 5thweek the researcher conducted a meeting with the students two times per week (Sunday& Monday) for two hours each time. On the first day the researcher exposed the students to two constructed concept maps on two predetermined medical conditions. This was done with participation and discussion of the students with the researcher. On the second day the students were divided into five groups (six students in each group), each group was asked to construct a concept map related to a given clinical scenario from the clinical area and delivered it to the researcher.

These maps were discussed with the students by the researcher and feedback was given to them for modifications and more improvement in the subsequent maps. After that, the students were asked to prepare, design and deliver three concept maps individually over the remaining seven weeks, one concept map every two weeks. These concept maps were on real scenarios from the clinical settings.

Evaluation Phase

On the 13th week Post-test was conducted for both the experimental and control groups by administering the CCTST (form B). The results of the pre and the post tests of the two groups were compared to assess the effect of using

concept maps on enhancing the students' critical thinking skills. After the completion of the study, the researcher started to explain and apply concept mapping with the control group to achieve the research ethical principle of "fair treatment".

STATISTICAL ANALYSIS

The Statistical Package for Social Sciences (SPSS ver. 24) was used for data analysis. Descriptive statistics for some data such as gender, age, place of residence... etc were computed using frequencies, percentages, mean and standard deviation. For numerical data such as pre and post test scores; mean and standard deviation was generated. Comparison of the students' pre-test and post-test scores were done using paired t-test to compare the means "before and after" implementation of the concept mapping, and to determine any significant differences between variables.

RESULTS

Table 1: Frequency and Percentage Distribution of Socio-demographic Characteristics of Nursing Students in the Control and Experimental Groups (n=60)

Characteristic	Control	Experimental	X^2	p
	N (%)	N (%)		
Gender				
Male	10(33.30)	12(40)	.287	0.592
Female	20(66.70)	18(60)		
Age				
19 years	24(80)	20(66.70)	1.364	0.243
20 years	6(20)	10(33.30)		
Residence				
Urban	10(33.30)	16(53.30)	2.443	0.118
Rural	20(66.70)	14(46.70)		
Living Situations				
On campus	18(60)	10(33.30)	4.286	0.038*
Off campus	12(40)	20(66.70)		

Table 2: Frequency and Percentage Distribution of Critical Thinking Related Variables among Nursing Students in the Control and Experimental groups (n=60)

	Precollege Schools					X^2	p
	Governmental		Non-Governmental				
Control	30(100%)		0			-	-
Experimental	30(100%)		0			-	-
	GPA					X^2	p
	A	B	C+	C	D+		
Control	4(16%)	13(52%)	5(20%)	1(4%)	2(8%)	2.784	0.595
Experimental	4(13.3%)	19(63.3%)	6(20%)	1(3.3%)	0(0%)		
	Number of Studying Hours					X^2	P
	30-60 min	> 1-3 hrs	>3-5 hrs	≥ 5hrs			
Control	8(29.6%)	14(51.90%)	5(18.5%)	0(0%)		2.552	0.466
Experimental	7(25%)	11(39.30%)	9(32.10%)	1(3.6%)			
	Learning Style					X^2	P
	Visual	Tactile	Auditory	Kinesthetic	Others		
Control	12(40%)	-	2(6.6%)	-	16(53.4%)	1.468	0.832
Experimental	12(40%)	1(3.3%)	-	-	17(56.7%)		

Table 3: .Critical Thinking Pre-test, Post-test Mean scores among Students in the Control and Experimental Groups (n=60)

		Mean± SD	t	P
Control group	Pretest	6.53±1.67	1.065	0.283
	Posttest	5.60±2.25		
Experimental group	Pretest	5.83±2.30	5.106	0.000*
	Posttest	9.60±2.45		

significant<0.05

Table 4: Post-test Critical Thinking Mean Scores among Students in the Control and Experimental Groups (n=60)

Item	Control (n=30)	Experimental(n=30)	t	P value
	Mean± SD			
Overall Critical Thinking Post-test Mean Scores	5.60±2.25	9.60± 2.45	6.571	.000*

Significant<0.05

A high statistical signifiant differences were found between groups, the overall mean critical thinking post-test score was

statistically significant, between the two groups (t=6.571, P= 0.000). The mean critical thinking score difference between the experimental group and the control group was 4.0 scores.

DISCUSSIONS

Table (1), showed that, more than half of students were females in both the experimental and control groups. In Egypt, females constitute the largest number of students in nursing institutions (Mohamed & Mohamed, 2015). Chi- square" test showed no significant differences between the two groups i.e. subjects were homogenous in terms of gender. It is worth mentioning that females comprised 90, 78% of the registered nursing personnel in Egypt while males comprised 9.22% (Ministry of Health and Population, 2013).

Study participants ranged in age from 19-20 years with a mean of19.26±0.4 years. No significant differences were found between the control and experimental groups regarding age. This finding is consistent with Jaafarpour, Aazami & Mozafari, (2016), who reported that, the mean age of their study participants, was 19 ± 1.2 years and there was no significant difference, for age of the participants between the study groups. Correspondingly, this finding is also consistent with Bekeleski (2015), who found the same finding and concluded that, "the participants were adult learners who are capable of developing critical thinking skills". Therefore, it is possible that, the study sample did not adequately reflect a broad range of ages, to detect a significant difference between the control and experimental groups.

In relation to place of residence, more than half of the students in the experimental group were from urban areas, while more than half of the students in the control group were from rural areas, chi-square statistical test did not reveal a significant difference between the two groups. In addition, almost two thirds of the students in the experimental group were living off campus. While, more than half of the students in the control group were living on campus, chi-square statistical test revealed a significant difference between the two groups in relation to living situations.

These findings are consistent with Zarifsanaiey, Amini & Saadat (2016), who conducted a study about a comparison of educational strategies for the acquisition of nursing students' performance and critical thinking, and reported that three quarters of the experimental group compared to one quarter of the control group were respectively living on and off campus. Previous research has suggested that students' living situations while at university can impact students both cognitively and socially (Timmons, 2014).

Critical Thinking Related Variables in the current study were, type of precollege schools, grade point average in the first year (GPA), number of studying hours per day and learning style (As shown in table 2). As regards to precollege schools, all students in the study and control groups were enrolled in Governmental Arabic Schools before college. These findings come in consistence with the results achieved by The Ministry of Education, Egypt (2014), which reported that the total number of schools in Egypt has exceeded 47 thousands schools accommodating more than 18 million pupils, of whom 99.1 % are enrolled in Governmental education (Egypt National Project, 2014).

In relation to students' GPA, more than half of students in both the experimental and control groups got a grade point average of B in the first- year and chi-square statistical test didn't reveal a significant difference between the two groups. These findings come in consistence with Srnka-Debnar (2016), who found in his study about barriers and facilitators to successful completion of a baccalaureate nursing program that, the majority of the nursing students in his study got grades B in their GPA.Moreover, Zarifsanaie, Amini & Saadat (2016), in their study about comparing different

educational strategies, for the acquisition of nursing students' performance and critical thinking found that, there was no significant difference between the experimental and the control groups in terms of GPA.

Regarding the average number of studying hours per day among the study subjects, findings showed that the majority of the students in both the experimental and control groups were studying an hour to less than three hours per day with a mean of 2.5± 1.76 hr/day. In the same context, Arum (2014),in his study to measure the amount of students' improvement in critical thinking and writing skills, found that there were a 50 percent drop in the number of hours a student spent studying and preparing for classes, and commented that with the advent of the Internet, it was not a surprise that students' studying hours were less than before as information is available at the click of a mouse and students are not forced to comb through thick encyclopedias and esoteric reading materials.

As regards to students' learning style, results showed that more than half of the students in both the control and experimental groups had more than one learning style, and nearly one third of students in both the control and experimental groups had visual learning style. In the same context, Mahmoud (2012) in his study about critical thinking dispositions and learning styles of baccalaureate nursing students and its relation to their achievement found that, the majority of nursing students preferred visual learning style and commented that, this may be due to the nursing students tending to look at Power Point presentations and textbook readings, during classroom sessions.

In relation to results of the pre-test/post-test (form A and B of Modified Arabic version of CCTST), table (3) delineated that, there was no statistical difference between the experimental and control groups, in relation to the overall critical thinking pre-test scores. This finding is supported by Maldonado (2014), Kaddoura, Van-Dyke& Yang (2016), Romanko (2016), Yeom (2016), and Aein & Aliakbari (2017), who reported in their studies that, pretest scores of CT skills in the experimental and control groups did not differ, which indicated that the students' critical thinking skills scores were similar when the study was started and before giving intervention.

The present study findings also, revealed low initial scores of critical thinking among nursing students in both the experimental and control groups who were between not manifested and weak level and very small number of students was in the moderate level of overall critical thinking ability. These findings were supported by Mostafa & Elmolla (2012), who conducted a study for improving critical thinking of nursing students by the implementation of problem based learning scenarios in Helwan University, Egypt and reported, low scores of critical thinking before the intervention and added that, low scores of critical thinking among their study subjects can certainly be attributed to the educational system followed in secondary schools in Egypt. It is mainly a pedagogical system with traditional teacher centered rather than student-centered learning, where the student is mostly a passive recipient. Such traditional educational systems do not empower students to be self-confident and have maturity in thinking.

In the same line, Tiruneh, Verburgh, & Elen (2014), in their systematic review, about the effectiveness of critical thinking instruction in higher education, concluded that, the existing evidence indicates that the level of CT displayed by most students is inadequate and they argued that, classroom instruction is mostly inefficient to help students acquire thinking skills that they could apply to solve important problems within disciplinary areas and in everyday life.

In respect to the post-test CT mean score value, the current study results showed, reduction in the CT post-test mean score value in the control group from the original value. While in the experimental group there was an increase from the original value. To evaluate if there is no significant difference between the mean post-test critical thinking (CT) scores

of students in the experimental group after using concept mapping and their mean pre-test CT scores (H1), paired t test was used. Results indicated, statistical significant pretest-posttest differences in the critical thinking mean scores of students in the experimental group (t= 5.106, P= 0.000). On the other hand, there was no statistical significant difference in the pretest-post-test critical thinking mean scores in the control group (t= 1.065, P=0.283).

Furthermore, the researcher used paired t test to evaluate if there is no significant difference between the mean post-test critical thinking (CT) scores of students in the control and experimental groups (H2),(Table,4) the results showed that the overall mean critical thinking post-test score was statistically significant between the two groups as (t=6.571, P= 0.000). The experimental group was significantly associated with a growth in CT score from the initial status, compared to the control group, the experimental group had an average increase of 4.0 points in the growth of CT score. Based on that result, for the post-test critical thinking, H2 was rejected.

These findings come in consistence with Moattari, Soleimani, Moghaddam, & Mehbodi, (2014), who conducted a study to assess the effects of concept mapping on students' critical thinking. They randomly divided a total of 32 participants into a control and experimental groups and found a statistically significant difference between the two groups in relation to overall CT post-test mean scores.

Also, Lee et al. (2013) in their longitudinal study on the concept mapping instruction that was provided to the experimental group during the second semester, the control group presented findings utilizing the nursing process while the experimental group presented findings with concept maps. Over time the experimental group showed significantly higher critical thinking growth rate than the control group. They also added that, concept maps are useful in promoting more in-depth, active, and meaningful learning and more improvement in critical thinking skills may happen over a longer time frame rather than one semester.

A similar study conducted by Atay and Karabacak (2012), with 80 freshman and sophomore nursing students revealed concept mapping improved critical thinking skills of students, upon concept map education and implementation over time, when compared to students completing care plans utilizing the column format. In the same line, Huang, Chen, Yeh, & Chung (2012) in their study, about case studies combined with or without concept maps, to improve critical thinking in hospital-based nurses reported that, the experimental group's scores on the post-CCTST were significantly higher than those of the control group.

In similarity, to the current research study, numerous researchers have displayed a positive outcome in critical thinking scores and concluded that concept mapping can promote critical thinking and enable students to conceptualize treatment strategies in both the classroom and clinical practice settings (Canasi, Amyot & Tira, 2014; Carr- Lopez Galal, Vyas, Patel & Gnesa, 2014., Kalelioglu, Gulbahar, 2014 & Smith, 2016). Moreover, Dawit. Tiruneh, An Verburgh & Elen (2014), conducted a systematic review about effectiveness of critical thinking instruction in higher education found that among 27 studies, sixty percent of the studies yielded significant CT improvement.

Furthermore, Wahl and Thompson (2013), Moattari et al. (2014), and Orique& McCarthy (2015), who explored the effects of concept mapping in developing CT ability and the approach to learning and studying, concluded that concept mapping is an effective tool for improving students' ability to think critically. Also, Farrag (2017) conducted a study about using concept mapping strategy for improving maternity nursing students' achievement and yielded the same results and argued that, these results explained by the fact that exposure to learning through the traditional teaching technique lead to

concrete, dualistic thinking and surface learning, while, the concept map strategy improves the ability of the students to organize and manage the knowledge by encouraging students to process information deeply for understanding.

On the other hand, the current study findings are inconsistent with Carson-Davis, (2012) who conducted a study about relationship between concept mapping and critical thinking skills of vocational nursing students and found that there was no significant marked increase in critical thinking for subjects prior to presentation of the teaching strategy of concept mapping. And the findings revealed that there was no significant increase in CCTST means scores from pre-test to post-test.

In the same line, Sinatra-Wilhelm (2012) compared the use of nursing care plans and concept mapping to improve critical thinking skills as measured by the CCTST in sophomore level baccalaureate students. The findings demonstrated no significant difference in the total critical thinking score. And she added, although this finding, the faculty feedback indicated they felt that the concept mapping students were better at connecting medical diagnoses, assessment data, and nursing interventions.

Also, Maldonado (2014) in his study about effects of concept mapping on the critical thinking skills of baccalaureate nursing students found that no statistically significant difference was observed in CCTST after implementing concept mapping teaching strategy. And argued that, perhaps one semester of using concept mapping may not be sufficient to measure the effects of concept mapping on the critical thinking skill of entry-level students.

Moreover, Romanko (2016) in his quantitative meta-analysis, to explore the effect of concept mapping as a teaching strategy in the development of critical thinking skills among nursing students, concluded that there were no statistically significant differences in the means between the post-test critical thinking scores of the experimental and control groups with the intervention of concept mapping. And in an attempt to explain these findings, Romanko (2016) clarified that, the results of this study were related to the time when the intervention of concept mapping was introduced to the nurses. As, the literature review revealed that the most beneficial time for introducing concept mapping to nursing students is early on in the program, before they have firmly established their preferred studying methods.

In addition, Bixler, Brown, Way, Ledford, Mahan, (2015) found that, there were no significant increase in CT as measured by the CCTST from pretest to posttest when students were educated using a concept mapping approach. And, concluded that although the difference in CT scores was not significant, the study could serve as an important start toward the development of a curriculum devoted to improving CT.

Furthermore,Wahl & Thompson (2013)& Zarifsanaiey, Amini& and Saadat (2016) yielded the same results and concluded that a training course alone is not significantly correlated with the critical thinking, acquiring critical thinking skills needs long period of time and continuing education. Brune(2014) added that absence of significance increase of overall critical thinking post-test scores might be derived from several factors related to the circumstances in conducting the study, the participants' perceptions and comfort level with participating in the study, seriousness in taking tests, the brevity of the experiment, and participants' developmental stages.

CONCLUSIONS

Based on the results of the current study, which showed an increase in critical thinking scores in the experimental group as compared to the control group, the researcher concluded that teaching with concept mapping may foster critical

thinking skills than using traditional care plans. Concept mapping is considered an effective educational method to promote CT skills, as it reflects an image of the learners' thinking process. The results also implied that nursing curricula needs to change to the student centered learning approach where the students should understand concepts, as opposed to rote memorization of facts.

RECOMMENDATIONS

- On the light of the findings of this study, the following recommendations are suggested as implications for future research:-

- This study should be replicated with a larger sample size, and randomly selected from multiple different nursing faculties, in order to provide a more accurate representation of nursing students.
- Disseminate the research results of the current study to the faculty and get feedback from the faculty regarding how best to use concept mapping throughout the curriculum.
- A longitudinal study is recommended, that uses concept mapping throughout the whole nursing program curriculum, not just one course, with a pretest – posttest design at the beginning of the program and the end would be a more effective measure of the actual effect of concept mapping on student nurses' critical thinking skills over time.
- Future studies could examine the potential for concept mapping to be taught in pre-requisite courses as a way to begin learning to critically think prior to their entry into the program.
- It is suggested that future studies should comparing the effect of concept mapping with the effects of other meta-cognitive approaches on different types of learners.
- Additional research to identify teaching strategies that promote the development of critical thinking skills is needed.

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