THE USE OF CONCEPT MAPPING TO FACILITATE CRITICAL THINKING SKILLS IN

NURSING STUDENTS

An Evidence-based Practice Capstone Project

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Title of Capstone Project: The Use of Concept Mapping to Facilitate Critical Thinking Skills
in Nursing Students

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Abstract

Background: Many prelicensure nursing students lack the critical thinking abilities to safely
care for patients in today's healthcare environments. Concept mapping is an active learning
strategy that emphasizes a visual relationship between concepts that have the potential to
promote meaningful learning and development of critical thinking. Therefore, the purpose of
this evidence-synthesizing project was to review and synthesize current evidence to determine
the best practices in nursing education to promote critical thinking abilities in prelicensure
nursing students.

Methods: A literature search was conducted using CINAHL, Education Source, and ERIC
databases which resulted in seven articles selected for review. The evidence included full-text
research evidence published in peer reviewed journals between 2013 to 2020 in the English
language. The evidence was critiqued using the John's Hopkins Evidence-based Nursing model
and guidelines.

Results: The seven pieces of evidence revealed consistent results that support the use of concept
mapping in nursing education to facilitate critical thinking in prelicensure nursing students.
Three themes emerged from the evidence including making meaningful connections between
theory and practice, combining pedagogies within nursing education, and a holistic viewpoint.

Implications: Nurse educators may use concept mapping to facilitate critical thinking, however combining concept mapping with other pedagogies and providing concept mapping education to students may provide additional benefits. Future research is warranted regarding the specific environment in which concept mapping should be used, other populations of interest, and the development of one holistic critical thinking measure.

Keywords: concept mapping, critical thinking, nursing education, prelicensure nursing student

DEDICATION

This capstone project is dedicated to my mother, Linda Frederick, my father, Richard Frederick, as well as many other family members and friends. Thank you for your love and support throughout this journey. I know I would not be who I am today without you.

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CHAPTER I

INTRODUCTION

Critical thinking skills are necessary characteristics of the prelicensure nursing student to be prepared to care for patients with a variety of acute and chronic conditions that may be encountered in today's healthcare settings. According to the Institute of Medicine (2010), the patients in current health care environments are sicker and have more complex health problems than patients in previous years. One hundred thirty-three million Americans suffer from at least one chronic condition including diabetes, hypertension, stroke, heart disease, respiratory disease, arthritis, obesity, and cancer (Raghupathi & Raghupathi, 2018). Older adults are more likely to have a diagnosis of one or more chronic conditions. Also, the number of Americans over the age of 65 will comprise almost 20 percent of the population by the year 2030 (Institute of Medicine, 2010). Therefore, not only is the number of older adults in America unprecedented, but the acuity of each patient is also increasing due to the overwhelming number of patients with chronic diseases (Healthy People 2020, 2019).

Due to the current trends in health care, as well as the increased number of patients and the higher patient acuity, the responsibilities of the registered nurse are increasing (Mutean, 2012). Registered nurses must provide care to promote high-quality patient outcomes including the prevention of hospital-acquired infections. As the cost of health care remains a priority of patients, nurses, and health care organizations, the responsibility of patient education to prevent hospital readmissions remains a vital responsibility of the nurse. Registered nurses must also be competent to engage in the complex health care environment, which includes competency in leadership, health policy, system improvement, research and evidence-based practice, communication, teamwork and collaboration, and technology (Institute of Medicine, 2010). In

addition to the increased responsibilities of the registered nurse, decreasing length of stay in the acute care setting allows less time for registered nurses to detect subtle warning signs of patient deterioration which has a negative effect on patient outcomes (Kavanagh & Szweda, 2017). Therefore, the current health care environment requires prelicensure nursing students to critically think and provide competent nursing care.

Registered nurses are in an unique position to affect patient care outcomes with almost every decision that is made. Although nurses strive to positively affect patients during care, the potential for adverse events exists. According to Muntean (2012), 65% of adverse events that have occurred in hospitals are preventable which is consistent with poor critical thinking and clinical decision-making skills. Furthermore, employers believe many prelicensure nursing students are inadequately prepared to enter in to practice because about 50% of novice nurses are involved in nursing care errors. Therefore, the importance of critical thinking should be reinforced in the prelicensure nursing student population.

To emphasize sound critical thinking skills in prelicensure nursing students, the National Council of State Boards of Nursing (NCSBN) has started to create the innovative Next Generation National Council Licensure Examination – Registered Nurse (NCLEX-RN) due to the increase in complex decision making of the novice nurse (National Council of State Boards of Nursing, 2019). Specifically, the Next Generation NCLEX-RN will focus on evaluation of entry-level nursing competence, primarily clinical judgement abilities. According to Kaddoura, VanDyke, Cheng, and Shea-Foisy (2016), the primary goal of nursing education programs and nurse educators is to prepare nursing students to critically think and engage in appropriate clinical judgement. Therefore, it is the nurse educator's responsibility to facilitate critical thinking, clinical reasoning, and clinical judgement in prelicensure nursing students.

Statement of the Problem

According to Muntean (2012), many new graduate nurses lack critical thinking skills and abilities to provide safe and effective care to patients. Kavanagh and Szweda (2017) reported only 23% of new graduate nurses in 2015 were able to practice nursing in a safe and independent manner, as displayed by an acceptable level in a performance-based development system. Concepts that were included in the evaluation of safe nursing practice were recognition and management of clinical problems, interprofessional communication, along with other competencies associated with critical thinking and clinical judgement. Similarly, Killam, Luhanga, and Bakker (2011) noted that unsafe students displayed ineffective interpersonal relations, an unprofessional image, and skill and knowledge incompetence as evidence by lack of critical thinking. Furthermore, the deficiency of critical thinking skills in prelicensure nursing students may be attributed to three issues that occur in nursing education including passive learning strategies, linear thought processes, and the theory-practice gap in nursing (Abdullah, Zeb, Ullah, & Bano, 2017; Akram, Mohama, & Akram, 2018; Cook, Dover, Dickson, & Colton, 2012).

Prelicensure nursing students learn an immense amount of information while preparing to be a registered nurse. To efficiently teach the large amount of information nursing students should understand to be a registered nurse, passive learning strategies are often used in nursing education. Passive learning strategies are methods in which students receive information from educators in a passive manner through senses to be recalled at another time, which does not encourage active participation from the learner (Wittmann-Price, Godshall, & Wilson, 2017). Conversely, active learning strategies encourage active participation, engagement, and involvement in learning, which is similar to the skills used while actively caring for patients in

the clinical setting (Wittmann-Price et al., 2017). Abdullah, Zeb, Ullah, and Bano (2017) suggested that active learning strategies were consistent with higher scores on a post-test in comparison to passive learning strategies because students are required to critically think and use appropriate clinical decision-making skills during active learning strategies. Therefore, passive learning strategies may not promote the critical thinking skills prelicensure nursing students should have prior to entrance into the nursing profession.

In addition to passive learning strategies, the linear thought process supported by traditional nursing education practices also contributes to the lack of critical thinking in prelicensure nursing students. Traditional six-column care plan models are linear in nature and do not encourage students to use dynamic thinking which is essential to safe patient care (Cook et al., 2012). Furthermore, the interconnectedness and holistic view of the patient is lacking in traditional care plan models which does not encourage students to develop critical thinking skills necessary to care for patients in a holistic manner.

Lastly, the gap between nursing theory and nursing practice is wide and challenging for prelicensure nursing students to overcome. Akram, Mohama, and Akram (2018) argued the theory-practice-gap phenomena exists, and identified the nurse educator as a priority role in overcoming the gap. The wide theory practice gap in nursing can be related to student inability to connect vital relationships and to critically reflect on nursing practice (Garwood, Ahmed, & McComb, 2018). Therefore, nurse educators should use strategies to close the gap between nursing theory and nursing practice.

In summary, critical thinking skills and abilities are extremely important for prelicensure nursing students to develop to provide safe and effective care to patients. The use of passive teaching methods, such as lecture, do not encourage active engagement with learning material,

which does not support the development of critical thinking abilities. Furthermore, the linear thought processes used primarily in nursing education, such as traditional six-column care plans, limit students' ability to think in a holistic and dynamic manner. Lastly, the gap between nursing theory and practice creates difficulty for students to apply knowledge learned in the classroom to clinical practice. All three concerns, passive learning strategies, linear thought processes, and the nursing theory and practice gap, contribute to the overarching problem that prelicensure nursing students lack the critical thinking skills necessary to provide safe and effective care to patients. Therefore, a problem exists because there is a lack of synthesized literature to determine the best practices for nurse educators to develop and foster critical thinking in prelicensure nursing students.

Background and Need

According to Kavanagh and Szweda (2017) and Muntean (2012), many prelicensure nursing students lack the necessary critical thinking skills to be a safe and effective nurse. Increasing responsibilities of the registered nurse and increasing patient acuity are only two reasons why prelicensure nursing students, now more than ever, must develop critical thinking skills (Healthy People 2020, 2019; Mutean, 2012). Concept mapping is a teaching and learning method that has been thought to promote critical thinking and meaningful learning (Kaddoura, VanDyke, Cheng, & Shea-Foisy, 2016). Concept mapping is a graphic arrangement of concepts and ideas linked together to assist students in organizing, analyzing, and synthesizing patient data to expand on current knowledge (Burrell, 2014; Kaddoura et al., 2016). Therefore, concept mapping may be an effective teaching and learning strategy to promote critical thinking in prelicensure nursing students.

Passive learning strategies may contribute to the lack of critical thinking skills in prelicensure nursing students due to the lack of engagement in learning. Concept mapping is an active learning strategy used to promote interaction and engagement with learning (Wittmann-Price et al., 2017). According to Garwood, Ahmed, and McComb (2018), the process of concept mapping allows students to connect previous knowledge to current concepts, creating relationships, which results in active learning. Active learning strategies, in comparison to passive learning strategies, are consistent with higher post-test scores, indicating increased student learning (Abdullah et al., 2017). Increased learning, and the ability for students to connect new ideas to previous knowledge and expand on concepts, promotes critical thinking (Burrell, 2014). Additionally, active learning strategies give students opportunities to apply and to react to what the students have learned. Therefore, concept mapping may be an active learning strategy used to promote critical thinking in prelicensure nursing students.

Traditional six-column care plans promote linear thinking which may contribute to the lack of critical thinking in prelicensure nursing students (Cook et al., 2012). Concept mapping is a teaching and learning strategy that uses colorful diagrams with text and pictures that assist students to change from a linear to a dynamic thought process (Burrell, 2014). Additionally, concept mapping allows students to visualize the holistic care of patients on one page, which promotes integration of ideas and previous knowledge. Therefore, concept mapping may provide a visual, non-linear, learning strategy for prelicensure nursing students to develop critical thinking.

The nursing theory and nursing practice gap exists which may contribute to the lack of critical thinking in prelicensure nursing students (Garwood et al., 2018). Concept mapping is helpful for students to connect theoretical material to the clinical practice setting which is

necessary for prelicensure nursing students to generate critical thinking skills (Garwood et al.,

2018). Additionally, concept mapping can be used to assist students in organizing existing

knowledge as well as incorporating new knowledge to increase critical thinking. Therefore,

concept mapping may be a potential way to reduce the theory and practice gap within nursing

education.

In summary, many prelicensure nursing students lack the critical thinking skills necessary

to safely and effectively care for patients when they enter the nursing profession. Passive

learning strategies, linear thought processes, and the gap between nursing theory and practice

may be contributing factors towards the lack of critical thinking abilities in prelicensure nursing

students. Concept mapping is a possible solution for the lack of critical thinking skills and

abilities in many prelicensure nursing students because it is an active learning strategy that

focuses on a visual, non-linear thought process, and is used to connect nursing theory to nursing

practice. Despite the positive qualities of concept mapping and the potential use in nursing

education, the visual nature of concept mapping may not be the most effective solution for the

auditory, reading and writing, or kinesthetic learner. Therefore, there is a need to review and

synthesize current evidence to identify if concept mapping is a valuable strategy to impact

critical thinking abilities in prelicensure nursing students.

Purpose Statement

The lack of critical thinking skills and abilities in many prelicensure nursing students is

an emerging area of research within nursing education literature. Strategies to promote critical

thinking skills in prelicensure nursing students is a developing body of evidence. Therefore, the

purpose of this Capstone project is to review and synthesize current evidence to determine the

best practices in nursing education to promote critical thinking abilities in prelicensure nursing students.

Evidence-based Practice Question

The evidence-based practice question for this evidence-synthesizing project is: In prelicensure nursing students, what is the impact of concept mapping, in comparison to traditional teaching methods on students' critical thinking abilities?

Significance to Nursing Education

Critical thinking is a necessary competency of all prelicensure nursing students (National Council of State Boards of Nursing, 2019). Therefore, all nurse educators should strive to educate students in a way that promotes critical thinking, clinical reasoning, and clinical judgment (Kaddoura, et al., 2016). In the short term, the review and synthesis of current evidence to determine the best practices in nursing education to promote critical thinking abilities in prelicensure nursing students will potentially impact student performance on the Next-Generation NCLEX-RN, which is focused on the critical thinking, clinical reasoning, and clinical judgement skills of prelicensure nursing students. Not only does NCLEX-RN failure affect the prelicensure nursing student, but jeopardizes the status of the nursing program the student attended. Additionally, in the long-term, if students lack the critical thinking skills necessary to provide safe care to patients, they may not be successful on the NCLEX-RN examination, and as a result, will further contribute to the shortage of nurses in the profession. Not only is determining the best practices in nursing education to promote critical thinking skills necessary for students to pass an examination; but even if students pass the NCLEX-RN, the increasing patient acuity, increasing responsibilities of the registered nurse, and the focus on positive patient outcomes all require the prelicensure nursing student to have proficient critical

thinking skills. Therefore, reviewing and synthesizing current evidence to determine the best practices in nursing education to promote critical thinking abilities in prelicensure nursing students is significant to nursing education.

Definition of Terms

In the discussion concerning critical thinking abilities in prelicensure nursing students, several terms are used with varying definitions in current evidence. To provide clarification, the following terms are defined for this evidence-synthesizing project: active learning strategy, concept mapping, critical thinking, clinical reasoning, clinical judgment, linear thinking, passive learning strategy, and prelicensure nursing student.

Active learning strategy. A Learning strategy that encourages active participation, engagement, and involvement in learning and also promotes dynamic thinking (Wittmann-Price et al., 2017).

Concept mapping. A schematic device for organizing and relating concepts to facilitate meaningful learning in a visual representation by use of text, pictures, symbols, and colors to identify relationships (Burrell, 2014; Daley, Morgan, & Black, 2016; Yue, Zhang, Zhang, & Jin, 2017).

Critical thinking. A purposeful, systematic, cognitive, outcome-driven practice used to analyze, interpret, and infer knowledge based on science and evidence. Critical thinking is an overarching concept and is a foundation for clinical reasoning and clinical judgment (Cooke, Stroup, & Harrington, 2019; Victor-Chmil, 2013).

Clinical reasoning. A complex, context-dependent process that applies critical thinking to a specific clinical situation. Clinical reasoning synthesizes knowledge, experience, and social relationships to analyze, evaluate, and consider alternative actions

in light of contextual influences. Clinical reasoning is the cognitive process behind clinical judgment (Simmons, 2010; Tanner, 2006; Victor-Chmil, 2013).

   Clinical judgement. A multi-faceted conceptual thought process that is derived from critical thinking and clinical reasoning and is characterized by a decision or judgement about a patient's needs, concerns, or health problems. Science, evidence, past experiences, specific clinical situations, and patient assessment data are synthesized to conclude a decision that is the basis for safe patient care (Tanner, 2006; Victor-Chmil, 2013).

   Linear thinking. A sequential thought process, used often in traditional six-column care plan models, that does not encourage dynamic or holistic thinking (Cook et al., 2012).

   Passive learning strategy. A learning strategy in which students receive information from educators in a passive manner through senses to be recalled at another time (Wittmann-Price et al., 2017).

   Prelicensure nursing student. A student at the end of a diploma, associate degree, or baccalaureate degree nursing curriculum that has not yet taken or passed the NCLEX-RN examination.

Chapter Summary

   Chapter One is comprised of background information regarding the lack of critical thinking skills in many prelicensure nursing students. The statement of the problem indicated the lack of critical thinking skills in many prelicensure nursing students may be contributed to passive learning strategies, linear thought processes, and the gap between nursing theory and practice (Abdullah et al., 2017; Akram et al., 2018; Cook et al., 2012). The background and need section identified concept mapping as a potential solution to improve prelicensure nursing

students' critical thinking skills. The purpose statement and evidence-based practice question were included in the chapter. The significance of critical thinking and implementation of concept mapping in nursing education were discussed. Lastly, a list of defined terms were included to provide clarification specific to this evidence-synthesizing project concerning concept mapping and the influence on prelicensure nursing students' critical thinking abilities.

CHAPTER II

METHODS

Critical thinking skills and abilities are necessary characteristics for all prelicensure nursing students to safely and effectively care for patients within today's healthcare environment. Unfortunately, many prelicensure nursing students are unprepared to care for high-acuity patients due to the lack of critical thinking abilities (Muntean, 2012). Concept mapping is an active learning strategy that has the potential to influence the critical thinking skills and abilities of the prelicensure nursing student (Kaddoura et al., 2016). The body of evidence regarding concept mapping and critical thinking within the prelicensure nursing student population has breadth and depth, thus an evidence-synthesizing project was completed. The purpose of this evidence-synthesizing project was to review and synthesize current evidence to determine the best practices in nursing education to promote critical thinking abilities in prelicensure nursing students. Additionally, the evidence-based practice question that guided this project was: In prelicensure nursing students, what is the impact of concept mapping, in comparison to traditional teaching methods on students' critical thinking abilities?

Data Collection of Evidence: Setting

An evidence-synthesizing project is designed to collect, synthesize, and report best evidence regarding a specific topic of significance (Bonnel & Smith, 2018). Therefore, current research and non-research evidence was gathered from three reputable databases including Cumulative Index to Nursing and Allied Health Literature (CINAHL), Education Source, and ERIC. "Concept map", "nursing education", "critical thinking", "clinical reasoning", "clinical judgement", and "prelicensure nursing student" were the keywords used to search the specified

databases. Evidence published between the years 2013 through 2020 were considered for data collection due to the necessity for current evidence.

Data Collection of Evidence: Sample

The sample for this evidence-synthesizing project consisted of seven pieces of evidence derived from a methodical search strategy to collect the best evidence regarding concept mapping and critical thinking abilities of prelicensure nursing students. Inclusion and exclusion criteria were necessary to gather the most pertinent evidence for analysis and synthesis. Inclusion criteria for this project included date published, language, and availability. Evidence published between the years 2013 and 2020 were considered for data collection. Additionally, evidence was required to be published in the English language, and have full-text availability. Exclusion criteria was also necessary to use to further narrow the evidence collected. Evidence that was not published in peer-reviewed journals was eliminated from this evidence-synthesizing project. Furthermore, evidence published prior to 2013 was omitted as well as evidence published in a language other than English.

Data Collection of Evidence: Procedure

To start the evidence collection process, three databases, CINAHL, Education Source, and ERIC were searched using the aforementioned key terms. The initial search results yielded 339 pieces of evidence. One hundred and ninety-seven pieces of evidence were excluded due to the publication year, while 19 pieces of evidence were also excluded due to a publication language other than English. Fourteen additional pieces of evidence were excluded due to the lack of full-text availability and published outside of peer reviewed journals. Upon further investigation, 102 pieces of evidence did not thoroughly answer the evidence-based practice question and therefore, were excluded. Thus, seven pieces of evidence were selected for analysis

and synthesis as part of this evidence-synthesizing project. Please refer to Figure 1 for a visual representation of the data collection of evidence procedure.

Explanation of Evidence-based Practice Model

The evidence-based practice model used to guide this evidence-synthesizing project was the Johns Hopkins Evidence-based Nursing Model and Guidelines (JHNEBP) (Dang & Dearholt, 2018). The JHNEBP Model is a 19-step process divided into three phases to support the nurse through developing a practice question, searching for evidence, and translating evidence to practice (Dang & Dearholt, 2018). The eighth step of the JHNEBP Model is to appraise the level and quality of the evidence. The JHNEBP Model contains a 5-level scale, which ranks the pieces of evidence from highest (Level I) to lowest (Level V) based on the type of evidence. Evidence is classified into two main categories; research and nonresearch evidence. Within the research category, research evidence can be further classified into three levels: Level I, Level II, and Level III, while nonresearch evidence is assigned to Level IV or Level V (Dang & Dearholt, 2018). Level I evidence includes experimental research studies, randomized controlled trials, explanatory mixed methods with only level I quantitative studies, or systematic review of randomized controlled trials (Dang & Dearholt, 2018). In addition, Level II evidence includes quasi-experimental studies, explanatory mixed methods with only level II quantitative studies, or a systematic review of a combination of randomized controlled trials and quasi-experimental studies. Furthermore, Level III evidence includes a nonexperimental quantitative study, explanatory mixed methods with only level III quantitative studies, exploratory studies, systematic review of a combination of randomized controlled trials, quasi-experimental and nonexperimental studies. Additionally, qualitative studies or systematic reviews of qualitative studies are level III evidence. Level IV evidence includes clinical practice guidelines, and

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┌─────────────────────────────────────────┐
│         Databases Searched:             │
│   CINAHL, Education Source, ERIC        │
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│     Initial Evidence Resulted: n=339    │
└─────────────────────────────────────────┘
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┌─────────────────────────────────────────────────────────────┐
│            Evidence Excluded: n=332                          │
│           (Published before 2013; n=197)                    │
│     (Published in language other than English; n=19)        │
│ (Unavailable in full-text or not published in a peer reviewed journal; n=14) │
│    (Did not answer Evidence-Based Practice Question; n=102)  │
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│   Evidence Analyzed and Synthesized: n=7 │
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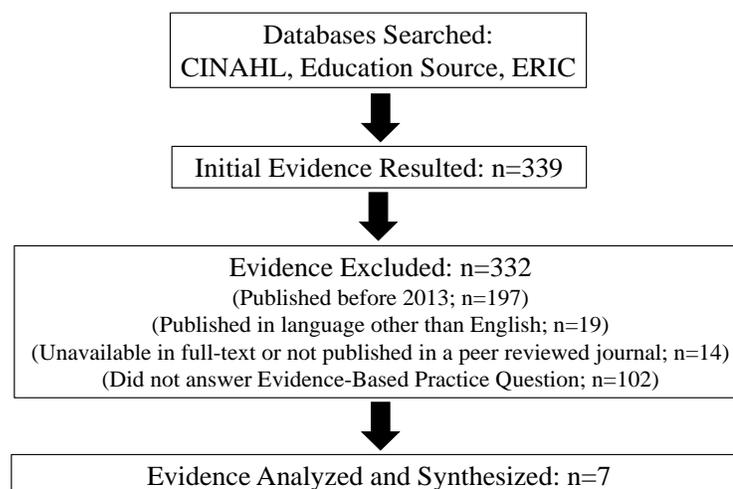
Figure 1. Data Collection of Evidence

consensus panels or position statements (Dang & Dearholt, 2018). Lastly, level V evidence

includes integrative reviews, literature reviews, published quality improvement projects, case

reports, and expert opinion. After the level of evidence has been assigned based on the type of

evidence, the evidence is then critically appraised.

Critical Appraisal of Evidence

The critical appraisal of evidence is relative to the assigned level and type of evidence.

After quantitative research evidence is assigned level I, II, or III, a quality grade of A, B, or C is

appointed to the evidence. Quality A rating for quantitative research indicates high quality

consistent and generalizable results that stem from an adequate sample size, sufficient control,

comprehensive literature review, and provide definitive conclusions (Dang & Dearholt, 2018).

Next, Quality B rating for quantitative research indicates good quality with reasonably consistent

results, sufficient sample size, fairly definitive conclusions, and reasonably consistent

recommendations. Lastly, Quality C rating for quantitative research indicates low quality or

evidence with major flaws due to inconsistent results, insufficient sample size, and lack of conclusions regarding the evidence.

Qualitative research evidence is assigned as level III evidence according to the JHNEBP model and is graded for quality differently than quantitative research evidence (Dang & Dearholt, 2018). An A/B, and C scale is used to represent high/good, and low quality respectfully, however the criteria used to assign a quality grade is different because qualitative and quantitative research is conducted differently (Dang & Dearholt, 2018). First, Quality A/B, high/good quality evidence is evidence that has sufficient support and detail that enhances the quality of the research. Furthermore, to obtain a quality A/B the authors should state the necessary features of qualitative research including, transparency, diligence, verification, self-reflection and scrutiny, participant-driven inquiry, and insightful interpretation. Next, Quality C, or low quality is assigned to qualitative research that does not display any, or only few, of the necessary features of qualitative research.

Nonresearch evidence, Level IV and Level V evidence, is also critically appraised and given a quality grade of A, B, or C, corresponding to High quality, good quality, or low quality (Dang & Dearholt, 2018). First, Quality A evidence is evidence with definitive conclusions, consistent recommendations with scientific rationale, and the author is an expert in the field. Next, Quality B evidence is good evidence with fairly consistent results and recommendations, but may be limited to a single setting or the expert only appears credible. Lastly, Quality C evidence is low quality evidence that has insufficient evidence, inconsistent results, and lack of recommendations or conclusions.

Chapter Summary

In this chapter the data collection methods for this evidence-synthesizing project were presented and discussed along with a visual representation of the data collection methods. The JHNEBP evidence-based practice model was defined and explained. Examples of each level of evidence in the JHNEBP model were presented. Additionally, the quality appraisal of quantitative research, qualitative research, and nonresearch evidence was discussed according to the JHNEBP model.

CHAPTER III

LITERATURE REVIEW AND ANALYSIS

Many prelicensure nursing students lack the critical thinking skills and abilities necessary to safely and effectively care for patients in today's healthcare environment (Kavanagh & Szweda, 2017). It is necessary to review and synthesize the best evidence regarding methods to impact critical thinking skills among prelicensure nursing students so nurse educators can effectively educate students to successfully care for patients and their families. As an active teaching and learning strategy, concept mapping has the potential to influence the critical thinking skills and abilities of the prelicensure nursing student (Kaddoura et al., 2016). The purpose of this evidence-synthesizing project was to review and synthesize current evidence to determine the best practices in nursing education to promote critical thinking abilities in prelicensure nursing students. Additionally, the evidence-based practice question that guided this project was: In prelicensure nursing students, what is the impact of concept mapping, in comparison to traditional teaching methods on students' critical thinking abilities?

Review of Literature

The literature review addressed three areas of evidence related to the impact of concept mapping on the lack of critical thinking abilities of many prelicensure nursing students at the end of a nursing curriculum. In the first section, evidence related to making meaningful connections between theory and practice was presented. The second section was focused on evidence regarding the combination of pedagogies in nursing education. Finally, the third section discussed evidence related to a holistic viewpoint. Appendix A contains a matrix that summarizes the evidence presented and critically appraised in the following chapter.

Meaningful Connections Between Theory and Practice

Lee, Chiang, Liao, Lee, Chen and Liang (2013) conducted a longitudinal quasi-experimental research design where the authors aimed to evaluate the longitudinal effects of concept mapping on critical thinking using the technique of hierarchical linear model and to explore the factors that influenced the growth pattern of critical thinking of nursing students. Lee et al. (2013) used the intervention of a concept map teaching strategy in a 15-week medical-surgical nursing course while the control group received lectures as the primary teaching strategy. A purposive sample was used for the study in which participants were selected from two classes in the second semester of a two-year registered nurse baccalaureate program located in a university in central Taiwan (Lee, Chiang, Liao, Lee, Chen, & Liang, 2013). Forty-seven students were included in the experimental group while 48 students were in the control group (Lee et al., 2013). Therefore, the sample size was appropriate for the study because it met the sample size range of 30 to 50 students.

After the aims, intervention, and sample were described, data collection methods were discussed. The data were collected by a research assistant on four occasions over a two-year period of time; the first, at the beginning of the first semester, the second, before the intervention, the third after the intervention, and the fourth, before graduation (Lee et al., 2013). Furthermore, at each occasion, the participants completed a structured questionnaire consisting of the Critical Thinking Scale, developed by Cheng, Wang, Wu, and Hwang (1996), and the Approaches to Learning and Studying developed by Entwistle, McCune, and Hounsell (2002). The Critical Thinking Scale was determined to have known group validity and adequate reliability (Lee et al., 2013). However, validity was not discussed for the Approaches to Learning and Studying

questionnaire, and the effort management subscale had inadequate reliability due to a Cronbach's alpha of 0.62.

Lee et al. (2013) used SPSS version 13 to conduct descriptive and inferential statistics for data analysis. Baseline differences between the experimental and the control groups were assessed using independent sample *t*-tests while a two-level HLM growth pattern was used to describe and predict the variability in the individual linear growth trajectories of critical thinking (Lee et al., 2013). Furthermore, a random-effects ANOVA model was used to asses random variability in the intercept. The first variable entered into the ANOVA was time, followed by group, next time invariant variables, and, finally both time variant and time invariant variables (Lee et al., 2013). Additionally, p-values <0.05 were considered statistically significant. According to Lee et al. (2013), there were no statistically significant differences between the experimental and control groups except for age, with the students in the experimental group being an average of 0.65 years older than those in the control group ($t= -2.75$, $p=0.007$). Therefore, age was entered as a covariant variable in the model estimation.

According to Lee et al. (2013), the experimental and control group were compared at the four time periods to assess if any significant differences in critical thinking were observed. The students in the concept map experimental group (M= 6.15, SD= 2.08) showed a statistically significant difference in the inference score ($t=-2.55$, $p=0.05$) compared to the control group (M=4.98, SD=2.37) at the third time period. Furthermore, there was also a statistically significant difference in the deduction ($t=-2.56$, $p=0.05$) score for the intervention group (M=10.20, SD=1.8) of the critical thinking scale compared to the control group (M=9.15, SD=2.15) at the third time period. Additionally, the mean of the critical thinking total score was also statistically significant ($p=0.05$), but the growth rate of critical thinking was not significant.

Lastly, variables of pretest critical thinking score, surface approach, and organized study were statistically significant (p=0.05) related to the growth of critical thinking.

In an effort to explain the statistical results, Lee et al. (2013) presented a discussion regarding the data. Overall, Lee et al. (2013) suggested that the concept map teaching had significantly higher critical thinking scores in areas of inference and deduction than the lecture-based control group. Additionally, the statistically significant higher deductive score of critical thinking in comparison to the control group, could be related to the process of concept mapping in which hierarchical order is a necessary component. Furthermore, surface learning is a likely occurrence in students with clinical experience due to their lower initial critical thinking scores. However, organized studying, which may be involved in concept mapping may yield deep learning, which can lead to critical thinking abilities. In addition, deep, meaningful learning may aid nursing students in making meaningful connections that improve critical thinking. Overall, Lee et al. (2013) concluded based on the findings of the study that concept mapping should be used in teaching prelicensure nursing students due to the positive effects on critical thinking over time.

The quantitative research conducted by Lee et al. (2013) is Level II evidence because it is a quasi-experimental study due to the manipulation of an independent variable and a control group, but the lack of randomization to groups. The evidence is a quality B- due to several threats to internal and external validity, and thus is used with caution. Despite the threats, the research conducted by Lee et al. (2013) had several positive aspects as well. Lee et al. (2013) thoroughly reviewed current literature, provided a clear purpose of the study, had at least 25% response rates for questionnaires, described data collection methods clearly, presented tables consistent with the narrative, identified some limitations, and presented conclusions on results.

The threats to internal validity for the research conducted by Lee et al. (2013) include selection bias, maturation, and instrumentation bias. First, selection bias is present because there was a significant difference ($t=-2.75$, $p=0.007$) between the age of the control and intervention group. However, Lee et al. (2013) added age as a covariate in the ANOVA to limit the threat posed by selection. In addition, Lee et al. (2013) stated the sample size was appropriate for the study, however a power analysis was not reported, thus the adequacy of the sample size is unable to be confirmed. Furthermore, maturation threat is possible for the research conducted by Lee et al. (2013). Since the critical thinking scores were measured over two years, it is possible that the increase in critical thinking scores was due to time rather than the intervention of concept mapping. Although the potential exists for maturation threat, the decrease in critical thinking scores for the control group over the same two-year time span indicates that maturation threat is limited. Instrumentation bias is also present for several reasons. First, Lee et al. (2013) did not report the Cronbach's alpha for the Critical Thinking Scale, which is a limitation. Additionally, the Effort Management subscale of the Approaches to Learning and Studying had a Cronbach's alpha < 0.7, which indicates a lack of reliability. Furthermore, Lee et al. (2013) did not discuss face validity, content validity, or criterion validity for either the Approaches to Learning and Studying or the Critical Thinking Scale. Mortality, a threat to internal validity, is not likely since Lee et al. (2013) suggested that there were no significant differences in the participants that withdrew from the study. In addition, the results of the research study were not presented clearly and some statistical measures were not reported. Overall, the significant difference between intervention and control groups, lack of a power analysis, as well as the use of invalid and unreliable instruments propose threats to internal validity including selection bias, maturation threat and instrumentation bias.

In addition to threats to internal validity, threats to external validity exist for the research conducted by Lee et al. (2013). The research study was conducted at one university in central Taiwan and included all female students (Lee et al., 2013). Therefore, there is limited generalizability to male prelicensure nursing students and those students in the United States of America due to selection effects. Furthermore, the measurement effects threat is also present due to the lack of validity and reliability with the two scales used during the study. Overall, the threats to external validity for the research conducted by Lee et al. (2013) include selection effects and measurement effects.

To improve the validity of the research conducted by Lee et al. (2013), the researchers could have provided a power analysis so the reader could assess if the sample size was appropriate for the study. Additionally, the researchers could have reported additional reliability and validity data for the two instruments used throughout the study to limit instrumentation threat. To minimize the external validity threats, the researchers could have broadened the sample to include multiple countries and both male and female students to increase the generalizability of the findings. Therefore, according to the JHNEBP model and guidelines, the evidence presented by Lee et al. (2013) is Level II, Quality B- due to the lack of generalizable results, limited control, but reasonably consistent recommendations.

Odreman and Clyens (2020) conducted a randomized controlled trial in which the authors aimed to examine the use of concept mapping during simulation debriefing. Odreman and Clyens (2020) compared the intervention of concept mapping during simulation debriefing to the control of traditional group discussion debriefing. According to Odreman and Clyens (2020), after students viewed a 20-minute simulation video of nurses caring for a simulated patient in respiratory distress, both the control and experimental group completed a 50-minute debriefing

session. The control group completed a traditional group discussion debriefing while the

experimental group created a concept map that traced the clinical events observed in the

simulation (Odreman & Clyens, 2020). A convenience sample, consisting of 34 participants, 17

in each the experimental and control group, was used for the study (Odreman & Clyens, 2020).

Furthermore, the sample consisted of prelicensure nursing students in the final year of one

institution's nursing program. A power analysis was not reported by Odreman and Clyens

(2020), therefore the sample size of 34 cannot be considered sufficient for the study.

Following the debriefing sessions, the participants completed the Debriefing Experience

Scale (DES), which contains four subscales: 1) analyzing thoughts and feelings, 2) learning and

making connections, 3) facilitator skill in conducting the debriefing, and 4) appropriate facilitator

guidance (Odreman & Clyens, 2020). In addition, the DES is a reliable instrument as evidenced

by a Cronbach's alpha of .93 for all items in the scale area of experience and .91 for all items in

the scale area of importance. Furthermore, the DES was determined to have face validity by

nationally known experts in simulation, and a two-step factor analysis process also suggested the

tool is valid. Odreman and Clyens (2020) only used the first and second subscale of the DES to

better align with the focus of the pilot study that was conducted.

Odreman and Clyens (2020) conducted an independent samples *t*-test to examine if the

means of the Analyzing Thoughts and Feelings subscale and the Learning and Making

Connections subscale were significantly different between the control group and the intervention

group. The independent samples *t*-test did show a statistically significant difference in the

Analyzing Thoughts and Feelings subscale between the traditional group discussion debriefing

(*M*=12.69) and the concept mapping debriefing (*M*=18.53, $t(26) = -8.17$, $p<0.001$) (Odreman &

Clyens, 2020). Furthermore, the differences between the Learning and Making Connections

subscale in the control group (*M*=30.15) and the experimental group (*M*=34.47), were also statistically significant (*t*(26)= -5.08, *p*< 0.001). Therefore, Odreman and Clyens (2020) concluded that concept mapping, as a form of active learning, assisted prelicensure nursing students in critical thinking and making meaningful connections between theory and clinical concepts.

The quantitative research conducted by Odreman and Clyens (2020) is Level I evidence because it is a randomized controlled trial due to the manipulation of an independent variable, control group, and randomization to groups. The evidence is quality B+ due to a few threats to internal and external validity. Although some threats exist, the research conducted by Odreman and Clyens (2020) had several positive parts as well. First, Odreman and Clyens (2020) conducted a current and comprehensive literature review, used a valid and reliable instrument, clearly described data collection method, provided some limitations to the research, and presented clear and consistent conclusions that were based on clearly described results.

Odreman and Clyens (2020) identified a few limitations to the research including the use of a small sample size and convenience sample. Therefore, a threat to internal validity is selection bias. Furthermore, a power analysis was not reported, so it is unable to be determined if the sample size was sufficient for the study design. In addition, the authors did not state if there was a significant difference between the eight prelicensure nursing students that did not participate in the research and the 34 students that signed consent and were enrolled in the study. The authors did not report demographic data of the participants; therefore, it cannot be determined if the intervention and control groups were similar or if there were significant differences between the groups that may contribute to the findings in the research.

The threat to external validity for the research conducted by Odreman and Clyens (2020) is that of selection effects. The research was conducted at one nursing program, and the authors did not report demographical data to support the population in which the results would be generalizable to. In order to improve the generalizability of the research results, Odreman and Clyens (2020) could have provided a stronger sampling procedure to include prelicensure nursing students from multiple nursing programs. Additionally, a power analysis should have been reported to assess the sample size. With the additional demographic information Odreman and Clyens (2020) also should have confirmed the lack of significant differences between the intervention and control groups to eliminate any confounding variables to the statistically significant results. In addition, the authors could have presented a more clearly articulated purpose to the study. Therefore, according to the JHNEBP model and guidelines, the evidence presented by Odreman and Clyens (2020) is Level I, Quality B+ due to the reasonably consistent results, some control, and fairly definitive conclusions based on results.

Garwood et al. (2018) conducted a systematic review aimed to examine literature published since 2005 to determine the utility of concept mapping regarding critical thinking, as well as students' perception concerning the concept mapping learning tool. Garwood et al. (2018) conducted a systematic search of the literature, selected evidence that met inclusion and exclusion criteria, critically appraised the evidence, extracted and analyzed data from each study, and lastly, synthesized the evidence and presented conclusions. To begin, a systematic literature search was conducted using three specific search terms including concept maps, nursing education, and critical thinking. Next, the three search terms were entered into a variety of databases including CINAHL, PubMed, EBSCO, MEDLINE, Health Source: Nursing, and Web of Science, Wiley Online Library, Cochrane Library, and ACADEMIC SEARCH. In addition,

the references of reviewed articles were examined to identify additional publications for review. The inclusion criteria specified for the review included evidence from peer-reviewed journals, published between January 2005 to March 2016, written in the English language, nursing students identified as the population, concept maps identified as the intervention, and critical thinking as the outcome variable (Garwood et al., 2018). Furthermore, exclusion criteria for the review included research conducted in disciplines other than nursing, and research containing registered nurses or nurse graduates in the population. Therefore, as a result of the systematic literature search, 58 studies were identified for review, however, only 17 research articles were included in the systematic review.

Once the sample of evidence was systematically chosen for review, Garwood et al. (2018), used the Melnyk and Fineout-Overholt criteria (as cited in Garwood et al., 2018) for quality analysis to critique the evidence selected. A thorough analysis of each research study in relation to all seven criteria included in the Melnyk and Fineout-Overholt critical appraisal method was conducted by Garwood et al. (2018). The seven criteria assessed were the clear statement of purpose, adequacy of the sample, validity and reliability of instruments, approach to data analysis, reporting of untoward events, alignment with previous research, and importance for clinical practice. After the critical appraisal was completed, the researchers extracted and summarized each study in a systematic fashion and was presented in a succinct and clear table, which included the framework or theory that supported the research, type of study, critical appraisal, level of evidence, sample size, population, instruments, statistical results, study limitations, and conclusions. The 17 research studies had a total sample size of 1,150 participants and were conducted in a variety of geographical locations (Garwood et al., 2018).

After the critical appraisal and analysis of each research study was completed, Garwood et al. (2018) presented several findings of the systematic review. First, it was evident that there are many instruments used to measure critical thinking. Throughout the review, a total of seven different instruments were used to measure critical thinking and various aspects of critical thinking. Although various methods to evaluate students' critical thinking were presented throughout the review, students also reported an improved critical thinking with the use of concept maps. Specifically, students reported that by using concept maps, they were able to understand relationships between concepts, and relate classroom theory to clinical practice (Garwood et al., 2018).

Garwood et al. (2018) concluded in the systematic review that students find concept maps to be a useful teaching and learning strategy and therefore, may have a positive impact on critical thinking. Furthermore, by building meaningful relationships between concepts, students are able to effectively apply theory to practice. Although, one out of the 17 research studies reviewed suggested that concept mapping did not have a positive impact on critical thinking, there is overwhelming support to suggest that concept maps are an effective teaching and learning tool within nursing education. Garwood et al. (2018) also suggested that a single, valid and reliable instrument that measures critical thinking be used to evaluate outcomes related to critical thinking. Overall, Garwood et al. (2018) suggested that concept maps are an effective teaching and learning tool to promote critical thinking by facilitating relationships and bridging the gap between theory and practice.

The systematic review conducted by Garwood et al. (2018) is Level III evidence because it is a combination of randomized controlled trials, quasi-experimental, and non-experimental research. The evidence in Quality A- due to one threat to the rigor of the review. However,

many positive aspects to the systematic review are also important to note. First, a clearly stated objective were presented by the researchers that guided the systematic review. Furthermore, a systematic and comprehensive search strategy was implemented to identify potential research evidence to include in the review, which also addressed the grey literature. Specifically, the researchers stated key terms used, databases searched, inclusion and exclusion criteria that made the review reproducible. Although a figure was not presented to provide a visual representation of how the pieces of evidence were chosen, a thorough description was provided in the narrative text. Furthermore, a comprehensive table containing details regarding each specific study was presented. According to Garwood et al. (2018), the population, intervention, and outcome were the same throughout the 17 articles reviewed. However, there were many different methods used to evaluate nursing students' critical thinking. In addition, a thorough appraisal of each study was conducted using the Melnyk and Fineout-Overholt model and the validity of the studies appeared to have been assessed appropriately. Lastly, the conclusions presented by Garwood et al. (2018) are clearly presented and flowed logically from the systematic review. Furthermore, specific directions for new research including the need for a valid and reliable critical thinking measurement tool were presented by the researchers.

Despite the positive aspects of the systematic review conducted by Garwood et al. (2018), one negative aspect exists, which should not be ignored. The primary threat to the systematic review is that Garwood et al. (2018) failed to mention that two independent researchers reviewed, analyzed, and critiqued the research studies. The process of analyzing and critically appraising the research by two people using an independent process prevents bias and strengthens the findings of the review. Therefore, the systematic review conducted by Garwood et al. (2018) is Level III, Quality A- evidence.

Combining Pedagogies within Nursing Education

Orique and McCarthy (2015) conducted a quasi-experimental pretest-posttest research design where the authors aimed to examine the critical thinking skills of first-semester undergraduate nursing students during nursing care plan development. Orique and McCarthy (2015) used the intervention of problem-based learning plus concept mapping during care plan development sessions in a nursing fundamentals course over one semester. A convenience sample was used for the study, consisting of 56 first-semester undergraduate nursing students enrolled in a western United States university nursing program (Orique & McCarthy, 2015). However, only 49 of the 56 participants finished the study, thus generating the sample size of 49. Orique and McCarthy (2015) did not report a power analysis, therefore the sample size of 49 cannot be confirmed to be of sufficient size.

The data collection methods were discussed after the aims, intervention, and sample were reviewed. The data, care plans and Holistic Critical Thinking Scoring Rubric (HCTSR) scores, were collected and analyzed by the two researchers at four points in time over five weeks (Orique & McCarthy, 2015). First, baseline data were collected after lecture and group discussion as the primary teaching modality. The second point in which data were collected was after the initiation of problem-based learning. Problem-based learning is a student-centered learning approach in which small groups work together to seek solutions (Orique & McCarthy, 2015). The third point in which data were collected was after concept mapping was used as the primary teaching modality, while the fourth and final point of data collections was after problem-based learning and concept mapping were used as the primary teaching modalities (Orique & McCarthy, 2015). The HCTSR was created by Facione and Facione (1994), and is a valid instrument as Facione and Facione (1994) established face validity, content validity, and

construct validity (Orique & McCarthy 2015). Furthermore, the HCTSR is a reliable instrument

as evidence by a Cronbach's alpha of 0.88.

Orique and McCarthy (2015) used SPSS version 22 software to conduct descriptive and

inferential statistics for data analysis. A repeated-measures analysis of variance (ANOVA) and

Greenhouse-Geisser correction was conducted to show significant differences in critical thinking

scores between each phase of the data collection (Wilks' λ= 0.064, F[2.433, 116.783]= 319.279,

p<0.001) (Orique & McCarthy, 2015). Furthermore, a post hoc mean comparison test using the

Bonferroni method with each pairwise comparison tested at the 0.013 level of significance was

completed. The post hoc tests indicated that mean critical thinking at phase 4 (M=3.714,

SD=0.456) was significantly higher, compared with phase 2 (M=2.306, SD=0.466), and phase 1

(M=1.449, SD=0.503; p<0.001) (Orique & McCarthy, 2015). Furthermore, the post hoc tests

indicated that mean critical thinking at phase 3 (M=2.939, SD=0.242) was significantly higher,

compared with phase 2 (M=2.306, SD=0.466) and phase 1 (M=1.449, SD=0.503; p<0.001).

Therefore, the students' critical thinking was higher with problem-based learning plus concept

mapping than problem-based learning alone and the traditional teaching methods. Furthermore,

the students' critical thinking was higher with concept mapping alone in comparison to problem-

based learning alone, and the baseline. However, there was no significant difference between

concept mapping alone and problem-based learning plus concept mapping as the primary

teaching methods. Therefore, Orique and McCarthy (2015) concluded based on the findings of

the study that concept mapping and problem-based learning are effective nontraditional

instructional methodologies in facilitating critical thinking due to self-directed learning and

nonlinear thinking. Furthermore, when concept mapping and problem-based learning teaching

methods were implemented, students displayed an increase in clinical reasoning, decision-

making skills, a better understanding of a clinical situation, and lastly a more holistic approach to care than the traditional teaching methods.

The quantitative research conducted by Orique and McCarthy (2015) is Level II evidence because it is a quasi-experimental study due to the manipulation of an independent variable, but lacked a control group and the randomization to groups. The evidence is quality B due to several threats to internal and external validity. Despite the threats, the research conducted by Orique and McCarthy (2015) had several positive aspects as well. For example, Orique and McCarthy (2015) conducted a current comprehensive literature review, provided a clear purpose to the research, described data collection methods clearly and concisely, used a valid and reliable instrument, provided clear tables that were consistent with the narrative, presented clear results and conclusions, and lastly, identified several limitations to the research.

In addition to the limitations identified by Orique and McCarthy (2015), additional threats to internal validity are present including maturation, testing, and selection bias. First, maturation is a potential threat to internal validity since the research occurred over the course of seven weeks. It is possible that the students had better critical thinking skills after the course of the semester rather than only due to the intervention of problem-based learning and concept mapping. Additionally, the threat of testing is present because the study design is a pretest – posttest design, and the effect of taking a pretest may sensitize the student and improve the posttest score. Lastly, selection bias is a threat to internal validity because the research is composed of a convenience sample. Furthermore, Orique and McCarthy (2015) did not report a power analysis, thus it is unable to determine if the sample size was sufficient for the study.

In addition to the threats to internal validity, threats to external validity are present for the research conducted by Orique and McCarthy (2015). The research was conducted at one

university located in the western United States (Orique & McCarthy, 2015). Although the research sample included both men and women, and students from a wide array of ethnicities, and age brackets, the results of the study may not be generalizable to prelicensure nursing students in all universities in the United States due to selection effects. Additionally, the threat of measurement effects is also present due to maturation of the study subjects as well as the pretest – posttest nature of the research design. Overall, the threats to external validity include selection effects and measurement effects and thus, limit the generalizability of results. To improve the generalizability of the research conducted by Orique and McCarthy (2015), the researchers could have implemented a control group, which would provide more control to the study design. Additionally, the researchers could have provided a power analysis so the reader could assess if the sample size was sufficient for the study. Furthermore, the researchers could have used a random sample from a variety of universities within the United States to increase the generalizability of the findings. Therefore, according to the JHNEBP model and guidelines, the evidence presented by Orique and McCarthy (2015) is Level II, Quality B due to the reasonably consistent results and fairly definitive conclusions, but lack of a known sufficient sample size.

Alfayoumi (2019) conducted a one group pretest-posttest quasi-experimental research design where the study aimed to determine the impact of combining concept-based learning and concept mapping pedagogies on clinical judgment and clinical reasoning abilities of baccalaureate nursing students in an adult health course at a private college in Jordan. Alfayoumi (2019) conducted baseline data containing four questionnaires including a demographic sheet, general clinical reasoning behavior scale, independence in clinical reasoning scale, and independence in clinical judgment scale. After the baseline data were collected, concept-based curriculum and concept mapping pedagogies were implemented in the adult

health nursing course (Alfayoumi, 2019). Then, posttest data were collected using the same four questionnaires used prior to the implementation of the intervention.

According to Alfayoumi (2019), a consecutive sample was used for the study in which three inclusion criteria needed to be met for participation in the research study. Students must be enrolled in Adult Health Nursing courses during the 2015 academic year, could read Arabic and English fluently, and agreed to participate in the study (Alfayoumi, 2019). The total number of students that met the inclusion criteria were used in the study, totaling 40 participants (Alfayoumi, 2019). A power analysis was not reported; therefore, it cannot be determined if the sample size is sufficient to avoid a type II error.

The data were collected at two points during the study. The first before concept-based curriculum and concept mapping were implemented, and the second at the end of the semester after the new pedagogies were executed (Alfayoumi, 2019). According to Alfayoumi (2019), the clinical instructors for the adult health nursing courses administered the four questionnaires to the students. The four questionnaires included a participant demographic sheet, general clinical reasoning behavior scale, independence in clinical reasoning questionnaire, and independence in clinical judgment questionnaire (Alfayoumi, 2019). Furthermore, the demographic sheet included questions regarding the students' age, sex, academic level, grade point average (GPA), and the students' perception of their academic success. The general clinical reasoning behavior scale is a 26-item questionnaire with a 5-point Likert scale that measures students' general clinical reasoning behavior including antecedents, processes, reasoning patterns, and consequences of clinical reasoning (Alfayoumi, 2019). Also, the independence in clinical reasoning questionnaire was also used to determine the level of independence in clinical reasoning and decision-making after the student observed patient cues and problems. Lastly, the

independence in clinical judgment questionnaire was used to evaluate the independence of students after they assessed patients to identify significant cues, interpret patient data, and decide if interventions were necessary. In addition to the self-reported questionnaires, the clinical instructors also observed the students' independence in clinical reasoning and clinical judgment as a method of triangulation to assess the accuracy of students' self-reported scores. According to Alfayoumi (2019) the general clinical reasoning behavior scale, the independence in clinical reasoning questionnaire, and the independence in clinical judgment questionnaire, all were determined to be valid and reliable in previous research. However, no mention of validity or reliability measures, including a Cronbach's alpha were reported in the current study.

Alfayoumi (2019) used SPSS version 20 to analyze the statistical data. The pretest and posttest student reports of academic success were shown to be non-normative, thus the non-parametric test, Wilcoxon signed rank test, was used to evaluate the data. However, the student scores for the general clinical reasoning behavior, independence in clinical reasoning, and independence in clinical judgment were shown to be normative data, and thus the parametric, paired samples *t*-test, was used to analyze the data. According to Alfayoumi (2019), there were significant improvements in the students' perceptions of their clinical academic success from the beginning of the course ($M = 1.9$, SD $= 0.658$) to the end of the clinical course ($M = 2.8$, $SD = 0.616$, Z $= -2.236$, $p = 0.025$). Additionally, the students had significant improvements from the beginning of the course ($M = 72$, $SD = 9.6$) to the end of the course ($M = 76$, $SD = 8$) in general clinical reasoning behavior ($t = -3.11$, $p = 0.005$). Also, the student self-reported independence in clinical reasoning significantly improved from the beginning of the course ($M = 66$, $SD = 14$) to the end of the course ($M = 71.5$, $SD = 13$, $t = -2.24$, $p = 0.032$). Furthermore, the clinical instructors' observation of the students' independence in clinical reasoning ($t = -6.15$, $p < 0.001$)

and independence in clinical judgment ($t = -6.43$, $p < 0.001$) were also significantly improved from baseline ($M = 53.5$, $SD = 18$; $M = 49$, $SD = 19$) to the end of the course ($M = 67$, $SD = 19$; $M = 64$, $SD = 20$) respectively. Therefore, Alfayoumi (2019) concluded based on the evidence, that combining concept-based and concept mapping pedagogies were effective in regards to prelicensure students' general clinical reasoning behavior and independence in clinical reasoning and clinical judgment during an adult health nursing course.

The quantitative research conducted by Alfayoumi (2019) is Level II evidence because it is a quasi-experimental study due to the manipulation of an independent variable but lack of a control group and randomization to groups. The evidence is quality B- due to several threats to internal and external validity, and thus is used with caution. Despite the identified threats, the research conducted by Alfayoumi (2019) had several positive aspects as well. First, Alfayoumi (2019) clearly stated what is known regarding the topic and gaps in the current literature. Additionally, almost half of the literature review contained current evidence or seminal literature. Furthermore, the purpose of the study, data collection methods, results, tables, a few limitations, and the conclusions were clearly described and discussed. Lastly, the detail to which the researcher described the statistical tests, as well as the use of the correct statistical tests due to non-normally distributive data in some aspects of the research was extremely important.

Despite several positive aspects to the research, threats to the internal validity of the study exist, including testing, maturation, instrumentation, and selection bias. First, testing threat is present due to the pretest – posttest nature of the quasi-experimental research study conducted by Alfayoumi (2019). In addition, maturation is a potential threat to the internal validity of this study because the results were conducted over the course of a semester. Therefore, the significant increase in general clinical reasoning behavior and independence in clinical reasoning

may be due to the students overall learning throughout the curriculum, rather than the intervention of concept-based learning and concept mapping. Also, instrumentation bias is also present. Alfayoumi (2019) stated the validity and reliability of the instruments used were validated in previous literature. However, in the present study, the researcher failed to state any aspects of validity and a Cronbach's alpha to suggest reliability. Lastly, selection bias is present for several reasons, which is a threat to the internal validity of the study. Alfayoumi (2019) used a consecutive sample, which is a non-probability sampling technique that does not promote the sample to be representative of the population. Additionally, the researcher failed to report a power analysis, thus the sufficiency of the sample size cannot be determined. Overall, the threats to internal validity include testing, maturation, instrumentation, and selection bias.

In addition to threats to internal validity, threats to external validity exist for the research conducted by Alfayoumi (2019) as well. Selection effects, measurement effects, and reactive effects are all threats to the external validity of the study. The reactive effects of the study may be a response from the participants being studied, and not necessarily from the interventions. Measurement effects are also a threat due to the pretest – posttest design, and the lack of valid and reliable instruments used in the study. Lastly, selection effects are also present due to the small sample size and sampling procedures. Therefore, the results of this study should be generalized with caution.

To improve the internal and external validity of the research conducted by Alfayoumi (2019), some adjustments should be made. First, the use of probability sampling could increase the likelihood that the sample is representative of the population. Additionally, a power analysis should be reported assure the sample size is sufficient to avoid a type II error. Next, validity and reliability measures for the instruments should be reported to ensure that the findings are

accurate and reliable. Furthermore, the use of a control group would have been helpful to improve the study design to limit threats to internal validity. Therefore, according to the JHNEBP model and guidelines, the research conducted by Alfayoumi (2019) is Level II, Quality B- and should be used with caution.

A Holistic Viewpoint

Bilik, Kankaya, and Deveci (2020) conducted a convergent mixed methods study with the purpose to determine the effects of web-based concept mapping education on concept mapping and critical thinking skills of nursing students. Although Bilik et al. (2020) did not specifically present the research as a mixed methods design, the quantitative and qualitative characteristics of the study suggest it should be evaluated as such. Bilik et al. (2020) implemented a web-based educational session on concept mapping to the intervention group in a surgical nursing course during the second-year of a four-year nursing program at a state university in Turkey. The web-based education consisted of a PowerPoint presentation concerning theoretical information regarding concept mapping, the role of concept maps in the nursing process, principles of creating concept maps, and concept map examples (Bilik, Kankaya, & Deveci, 2020). The control group did not receive the web-based educational session on concept mapping and data collection from the control group was competed prior to the implementation of the intervention (Bilik et al., 2020). Students were randomized to the intervention and control group by student identification numbers (Bilik et al., 2020). Furthermore, both the participants and the researchers were blinded as to which participants were in each group. The control group attended clinical practicums in which the students were required to completed concept maps on several patients (Bilik et al., 2020). After the control group finished the practicum, data were collected from the control group (Bilik et al., 2020).

Then, the web-based educational session on concept mapping was introduced to the intervention

group. The intervention group attended clinical practicums and on the final day of practicum,

the intervention group data were collected.

Bilik et al. (2020) used a convenience sample of second-year nursing students enrolled in

a surgical nursing course at a state university in Turkey. Inclusion and exclusion criteria were

presented to guide the sample of the research study. According to Bilik et al. (2020), participants

were excluded from the study if they were a transfer student, repeating the surgical nursing

course, and completing clinical practicums at a state hospital rather than a university hospital.

The sample size was 419, with 210 students in the experimental group and 209 students in the

control group (Bilik et al., 2020). Furthermore, the power analysis of 87% reported in the study

indicates a sufficient sample size for the quantitative portion of the study. However, the authors

did not state that data saturation was obtained to indicate a sufficient sample size for the

qualitative portion of the study.

After the control and intervention groups completed the clinical practicums, data were

collected for the research study (Bilik et al., 2020). The data collected included a student

information form, concept map evaluation keys, the Critical Thinking Motivational Scale

(CTMS) and a structured interview form (Bilik et al., 2020). The concept map evaluation keys

were created by the researchers to evaluate concept maps (Bilik et al., 2020). Although, the

authors identified the lack of evidence to confirm validity and reliability of the concept map

evaluation keys, the researchers believed the keys were created in light of current relevant

literature. On the contrary, the CTMS, which contains five subscales including, expectancy,

attainment, utility, value, and cost, is a valid instrument and is also reliable as demonstrated by a

Cronbach's alpha of 0.9. The structured interview form contained two questions for students to

answer in an open-ended written format (Bilik et al., 2020). The questions were, "what do you think of concept maps (both positive and negative sides of concept maps)?" and "what are the contributions of concept maps to learning?" (Bilik et al., 2020, p. 3).

After the data were collected, the data were analyzed using both statistical measures for the quantitative aspect, and content analysis for the qualitative aspect of the research. To begin with the quantitative aspect, Bilik et al. (2020) conducted descriptive and inferential statistics for the data. There was no significant differences between the experimental and control groups in terms of demographic data (Bilik et al., 2020). Independent samples t-test were conducted to show statistically significant differences between groups. According to Bilik et al. (2020), there was a statistically significant difference between the experimental group ($M = 16.45$, $SE = 10.91$) and the control group ($M = 12.70$, $SE = 9.31$), ($t = -3.7513$, $p=0.00$) for the concept map evaluations. Additionally, the experimental group (M = 4.49, SE = 0.79) had significantly higher scores for the CTMS expectancy subscale than the control group (M = 4.65, SE = 0.74, t = 2.092, p = 0.037). Furthermore, there were significantly different scores for the experimental group (M = 5.34, SE = 0.68) and the control group (M = 5.50, SE = 0.62) for the CTMS attainment subscale (t = 2.454, p = 0.015). Lastly, there were significant differences in scores between the experimental group (M = 4.98, SE = 0.78) and the control group (M = 5.17, SE = 0.75) for the CTMS utility subscale (t = 2.453, p = 0.015).

In addition to the quantitative data, Bilik et al. (2020) analyzed the qualitative data by using two researchers to independently analyze the student responses via the content analysis method. Three main themes emerged from the student responses indicating that concept mapping contributed to the nursing process, concept mapping facilitated learning, and concept mapping was difficult and took a considerable amount of time to complete (Bilik et al., 2020).

Bilik et al. (2020) presented a discussion to explain the quantitative and qualitative results. Bilik et al. (2020) emphasized the significantly higher concept map evaluation scores in the group that received the web-based concept map education. In addition, the significantly higher CTMS subscale scores for expectancy, attainment, and utility in the intervention group may be attributed to an increased information and awareness regarding the concept mapping process. Bilik et al. (2020), also suggested that the findings of the research is comparable with other findings in current literature. Regarding the qualitative portion of the study, concept mapping allowed the prelicensure nursing students to use a holistic view to make associations within the nursing process (Bilik et al., 2020). Although the students believed the concept maps were helpful in facilitating learning, the process was time consuming and difficult. Overall, Bilik et al. (2020) concluded based on the findings of the study, that the web-based concept mapping education enhanced the prelicensure nursing students' concept mapping abilities and critical thinking skills.

The mixed methods research conducted by Bilik et al. (2020) is Level III evidence due to the convergent parallel quantitative and qualitative design. The evidence is quality B- due to threats to internal and external validity as well as threats to the quality of the qualitative aspect of the evidence. Thus, the evidence is used with caution. First, the quantitative aspect of the research will be critiqued. Although the research conducted by Bilik et al. (2020) contains threats to internal and external validity, positive aspects of the research have also been noted. Bilik et al. (2020) presented a clear purpose, used a sufficient sample size as evidenced by a power analysis of 87%. Furthermore, there were no reported significant differences between the experimental and control group, the CTMS is valid and reliable instrument, and the tables presented correlated with the narrative. Additionally, the researchers described the data

collection methods, results, and conclusions clearly. Despite the few limitations discussed by Bilik et al. (2020) additional limitations, including the outdated literature review, are present.

The threats to internal validity include maturation, instrumentation, and selection bias. Maturation threat is possible since the control group completed clinical practicum first, therefore, allowing more time for the experimental group to have increased CTMS scores and concept map evaluations. Although the CTMS is a valid and reliable instrument, the concept map evaluation key is a researcher-designed instrument and is not a valid and reliable instrument. Therefore, it is possible that the significantly higher concept map scores for the intervention group may be confounded by the invalid and unreliable instrument. Although Bilik et al. (2020) used a sufficient sample size for the study design, the sample was a convenience sample and poses a threat to the internal validity of the study.

In addition to the threats to internal validity for the research conducted by Bilik et al. (2020), threats to external validity exist as well, including selection effects and measurement effects. The research was conducted using a convenience sample from second-year nursing students enrolled at one university in Turkey and therefore, may not be generalizable to prelicensure nursing students in the United States. Furthermore, the concept map evaluation key is not a valid and reliable instrument and therefore, the conclusion that a web-based education module on concept mapping results in better concept mapping skills may not be valid. Overall, the threats to external validity include selection effects and measurement effects, and therefore, limit the generalizability of results. To improve the generalizability of results, the researchers could have used a random sample from other university nursing programs. Furthermore, the researchers could have used an instrument with evidence to suggest validity and reliability to evaluate the concept maps to ensure valid results.

In addition to the quantitative aspect of the mixed methods research, the qualitative aspect must be critiqued as well. Bilik et al. (2020) clearly articulated the purpose, research questions, and findings. Additionally, quotations provided in the evidence supported the narrative data. Despite the positive aspects of the qualitative research, negative characteristics are also present. For example, Bilik et al. (2020) did not provide justification for qualitative research, only presented limited information regarding participant characteristics, and did not state that data saturation was achieved. Furthermore, a verification process was not used to confirm data and the description on data analysis was limited. In addition, the credibility of the research is limited when Bilik et al. (2020) failed to confirm the precision of the interpretation of the students' answers as well as the lack of data saturation. However, two researchers analyzed the data independently and came to the same interpretation of the data, therefore credibility is less threatened. In addition, dependability was not established since an inquiry audit and member checking were not completed. Although two researchers analyzed the data independently, the researchers could have increased the confirmability by bracketing or completing a reflexive journal to minimize researcher biases. In addition, Bilik et al. (2020) failed to report a detailed description of the participants, therefore limiting transferability to other nursing students. Lastly, auditability is limited due to the lack of clear data collection process for the qualitative portion of the study. Despite the identified threats, Bilik et al. (2020) provided thoughtful excerpts of student answers to support authenticity and fittingness. Overall, there are several threats to the quality of the qualitative portion of the research conducted by Bilik et al. (2020). Therefore, the mixed methods research conducted by Bilik et al. (2020) is a Level III, Quality B- due to the lower-quality qualitative study component and good quantitative study component, and will be used with caution.

Yue, Zhang, Zhang, and Jin (2017) conducted a systematic review and meta-analysis aimed to evaluate the effects of concept mapping on development of critical thinking in nursing education. Yue et al. (2017) conducted a systematic search of the literature, critically appraised the evidence that met inclusion criteria, synthesized the conclusions of the evidence, and reported a pooled effect size to show an overall effect of the concept map intervention. A systematic literature search was completed using several electronic databases including PubMed, Web of science, Embase, Cochrane Central Register of Controlled Trials (CENTRAL), CINAHL, and China National Knowledge Infrastructure (CNKI) (Yue et al., 2017). Furthermore, the search was conducted between 1998 and August 2016 and used specific search terms including pupil nurse, nursing student, nurse, nursing personnel, registered nurse, nursing education, critical thinking, think critically, critical reasoning, educational model, and concept map. In addition to the evidence obtained through the online database search, a manual search of the literature was conducted to include grey literature. The inclusion criteria for the search included evidence written in the English or Chinese language, randomized controlled trials or other research evidence that included comparative trials, and subjects in the studies were nursing students or clinical nurses enrolled in continuing education (Yue et al., 2017). Additional inclusion criteria included concept mapping as the intervention, critical thinking as the outcome assessed, a reported sample size, and a 95% confidence interval of critical thinking scores. The exclusion criteria included studies that did not include complete data and duplicate articles (Yue et al., 2017). According to Yue et al. (2017), a total of 593 pieces of evidence were identified through the systematic search, however only 11 studies were included in the meta-analysis.

After the 11 studies were identified and selected, the data from each study was extracted and put in tables which allowed for synthesis and analysis by the first researcher (Yue et al.,

2017). Furthermore, the tables included authors' names, publication years, countries, study designs, subjects, sample size, teaching methods for intervention and control groups, length of intervention, outcome, and outcome measures. All 11 pieces of evidence were critically appraised using the Cochrane Handbook for Systematic Reviews of Intervention, which critiques the evidence based on seven items including random sequence, a concealed allocation, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, and the presence of selective reporting and other bias (Yue et al., 2017). Two researchers independently assessed each piece of evidence and disagreements in quality were resolved with a discussion of a third researcher (Yue et al., 2017).

Through an analysis of the 11 research studies, a total of 1204 participants were included in the sample size (Yue et al., 2017). In addition, several countries were represented throughout the 11 articles, including Turkey, Iran, Taiwan, the United States of America, and China. Furthermore, all 11 research studies selected for inclusion for the systematic review and meta-analysis were randomized controlled trials. Although all of the studies measured critical thinking as the outcome, several different critical thinking scales were used including the California Critical Thinking Disposition Inventory (CCTDI), Critical Thinking Scale (CTS), and the California Critical Thinking Skill Test (CCTST). Therefore, the researchers separated each of the critical thinking scales and reported an effect size for each. According to Yue et al. (2017), all 11 studies included in the systematic review and meta-analysis were grade B. In addition to the overall quality, there were no statistically significant differences between the intervention and control groups at baseline for any of the included articles. However, none of the 11 randomized controlled trials described allocation concealment or blinding of the participants or

personnel, which increases risk of bias. Overall, the quality rating of the included studies were

quality B (Yue et al., 2017).

The first critical thinking scale used to measure students' critical thinking abilities was

the CCTDI. Seven studies included in the systematic review used the CCTDI to measure critical

thinking. According to Yue et al., (2017), there was significant heterogeneity ($I^2 = 69\%$)

between the studies, therefore a random-effects model was used to pool data. Furthermore,

concept mapping had a significant effect (MD = 16.50, 95% CI [11.60, 21.40], $p <0.001$) on

critical thinking affective dispositions. Additionally, three studies used the CCTST to measure

critical thinking and a significantly higher critical thinking score was noted in the concept

mapping groups in comparison to the control group (MD = 1.78, 95% CI [0.17, 3.39], $p=0.03$).

A random-effects model was also used to complete the meta-analysis due to significant

heterogeneity between studies ($I^2=67\%$) (Yue et al., 2017). Lastly, critical thinking was also

measured by the CTS in two studies in which no heterogeneity was present, therefore, the fixed-

effects model was used to suggest a significant effect of concept mapping on critical thinking

scores (MD = 1.41, 95% CI [0.11, 2.71], $p=0.03$). Overall, the three meta-analyses suggested a

significant effect of concept mapping on critical thinking in nursing education.

Yue et al. (2017) concluded that the systematic review and meta-analysis supported the

effectiveness of concept mapping in nursing education. The increase in critical thinking abilities

may be related to the fact that concept maps help students to link new information to existing

knowledge by presenting clear relationships between concepts in a manner that promotes active

learning. Furthermore, the use of concept maps can be used not only as a learning tool but as an

evaluation tool as well. Yue et al. (2017) suggested future research to include the creation of a

comprehensive and holistic critical thinking assessment system since several measuring tools for

critical thinking are being used. Furthermore, additional research should be conducted using blinding of data collectors and participants if possible. Overall, Yue et al. (2017) suggested concept maps are an effective tool in improving critical thinking ability in nursing education.

The systematic review and meta-analysis conducted by Yue et al. (2017) is Level I evidence because all studies include were randomized controlled trials. The evidence is Quality B- due to several threats to the rigor of the review. Despite several threats, a few positive aspects of the systematic review and meta-analysis were identified as well. First, a specific and clearly stated objective and research question were presented by Yue et al. (2017). Furthermore, it is apparent that there was a comprehensive and thorough search strategy used to identify all potential pieces of evidence and the researchers clearly stated key search terms, the multiple databases searched, and inclusion and exclusion criteria. In addition, there was a clear and descriptive explanation of how the studies were selected for inclusion. Yue et al. (2017) included a detailed figure to help explain the selection of included studies. Furthermore, the researchers reported a comprehensive table of the characteristics of each study. In addition, the intervention of concept mapping was evaluated by all 11 studies included in the review. Yue et al. (2017) provided a thorough summary of the findings and specific recommendations for future research that were supported by the data collected.

Although several positive aspects exist for the systematic review and meta-analysis conducted by Yue et al. (2017), several threats are present as well. First, and the main threat to the review is the lack of evidence to suggest that each study was assessed and critically appraised appropriately. Yue et al. (2017) suggested that all 11 studies included in the review were quality B. Although two researchers independently analyzed and critiqued the studies, there was a limited description of the methods used to appraise the evidence. Furthermore, the populations

of the studies were not similar, which creates uncertainty in the results. Additionally, there were

several different methods to measure critical thinking, thus one effect size could not be

described, but rather three effect sizes were necessary. Yue et al. (2017) failed to thoroughly

describe the reasons for the differences in the studies. Overall, the apparent lack of appropriate

critical appraisal techniques is concerning and threatens the overall rigor of the systematic

review and meta-analysis. Therefore, the evidence by Yue et al. (2017) is Level I, Quality B-,

and thus is used with caution.

Chapter Summary

In this chapter, the review of literature was presented regarding concept mapping and the

influence on prelicensure nursing students' critical thinking abilities. Three themes were

identified throughout the comprehensive literature review, which consisted of seven pieces of

evidence. Each piece of evidence was reviewed and critically appraised using the JHNEBP

model and guidelines, and therefore a level and quality rating was assigned to each piece of

evidence.

CHAPTER IV

RESULTS AND SYNTHESIS

The critical thinking skills and abilities of prelicensure nursing students are of grave importance to ensure high-quality and safe patient care. Therefore, methods for nurse educators to facilitate the development of critical thinking is a particularly significant topic within nursing education literature. Concept mapping may be an effective teaching and learning method used to improve critical thinking skills and abilities among prelicensure nursing students in comparison to traditional teaching methods. In addition to improving critical thinking skills of prelicensure nursing students, concept mapping promotes meaningful connections between concepts that bridge the gap between nursing theory and nursing practice. Although concept mapping provides a method for students to engage in active and deep learning, the combination of multiple pedagogies may facilitate more nursing students to have improved critical thinking rather than only the students that are visual learners. Lastly, as patient care is improved with a holistic mindset, concept mapping and critical thinking must be viewed in a holistic manner as well to promote the most benefits to nursing education.

Results

Throughout this evidence-synthesizing project, seven pieces of research evidence were reviewed and critically appraised using the JHNEBP model and guidelines. According to the JHNEBP model and guidelines, the seven pieces of evidence resulted in two Level I studies, three Level II studies, and two Level III studies. The Level I studies included a randomized controlled trial, and a systematic review. The Level I pieces of evidence had quality ratings of B+ and B-. Therefore, the overall quality for the Level I evidence is B. The Level II studies included three quasi-experimental studies with one B and two B- quality ratings. Therefore, the

overall quality for the Level II evidence is B-. Lastly, the Level III studies included a systematic

review, and a mixed-methods study. The Level III evidence had quality ratings of A- and B-.

Therefore, the overall quality of the Level III evidence is B. See Appendix B for the Synthesis

and Recommendations Tool, which concisely synthesizes the evidence included in this Capstone

project.

Synthesis of Results

Throughout the analysis and critical appraisal of the seven pieces of evidence in this

evidence-synthesizing project, three themes were identified. The first theme is making

meaningful connections between theory and practice. The second theme is titled combining

pedagogies within nursing education. The third and final theme is labeled a holistic viewpoint.

The evidence included in the first theme, making meaningful connections between theory and

practice, emphasized how concept mapping helped prelicensure nursing students to connect new

information to previous knowledge to produce deep meaningful learning. Additionally, the

evidence within the first theme supported the idea that concept mapping connects theoretical

knowledge to the clinical practice setting. Making meaningful connections between theory and

practice promotes deep meaningful learning and may be helpful in developing critical thinking

skills and abilities amongst prelicensure nursing students. The evidence synthesized in the first

theme consisted of three studies including a Level I, quality B+ randomized controlled trial, a

Level II, quality B- longitudinal quasi-experimental study, and a Level III, quality A- systematic

review. The three pieces of evidence in the first theme suggested a positive impact of concept

mapping on critical thinking skills in prelicensure nursing students due to promoting deep

learning and meaningful connections between theory and practice. However, the studies

included in the first theme had various limitations including the lack of power analyses to avoid a

type II error, limited reports of validity and reliability for the instruments, and poor sampling procedures which limit the generalizability of the findings. Furthermore, there was only one reviewer for the systematic review which increases the potential for bias in the results. Therefore, the theme of making meaningful connections between theory and practice was assigned an overall B quality rating.

Combining pedagogies within nursing education is the second theme in this evidence synthesizing project. The evidence included in this theme emphasized how concept mapping may be used in conjunction with other pedagogies within nursing education to improve critical thinking skills of prelicensure nursing students. Two pieces of evidence were included in the combining pedagogies within nursing education theme. First, a Level II, quality B quasi-experimental pretest-posttest study, and second, a Level II, quality B- quasi-experimental pretest-posttest study. Both studies in this theme highlighted that concept mapping may be a teaching and learning strategy that works best for the visual learner, however, with combining concept mapping with other pedagogies, such as concept-based curriculum and problem-based learning, students with other learning styles, may benefit as well. The evidence within the second theme had several limitations including testing threat and selection bias due to the pretest-posttest design, convenience sample, and lack of power analyses. Therefore, an overall B quality rating was given to the second theme.

The third theme, a holistic viewpoint, refers to a benefit of concept mapping, the need for holistic education regarding concept mapping, as well as the need for a holistic measure of critical thinking. Concept mapping provides a holistic and comprehensive view of patients in the clinical setting, which allows for students to provide more inclusive care. Furthermore, concept mapping cannot be implemented without holistic education regarding the importance and process

of the teaching and learning strategy. Lastly, a holistic critical thinking assessment is necessary since there are several instruments that measure various aspects of critical thinking. Two pieces of evidence were included in the third theme including a Level III, quality B- convergent mixed methods study and a Level I, quality B- systematic review and meta-analysis. Although both pieces of evidence supported the use of concept mapping due to the positive impact on prelicensure nursing students' critical thinking abilities, several threats to the evidence are important to consider. The qualitative aspect of the mixed methods study was poorly developed and therefore posed several threats to the transferability of the research. Furthermore, there was little evidence to suggest that each study in the systematic review and meta-analysis was reviewed and critically appraise appropriately. Therefore, the overall quality rating for the third theme, a holistic viewpoint, is a B-.

Chapter Summary

The results and synthesis of results of this evidence-synthesizing project were discussed throughout this chapter. The level and quality rating of the seven pieces of evidence according to the JHNEBP model were described. Furthermore, the three themes, meaningful connections between theory and practice, combining pedagogies within nursing education, and a holistic viewpoint were clarified and discussed in additional detail. Finally, an overall quality rating was assigned to each theme as a result of a synthesis from the evidence included.

CHAPTER V

DISCUSSION AND CONCLUSION

Developing critical thinking skills and abilities of prelicensure nursing students is a primary concern of nurse educators to promote safety and high-quality care to patients. Concept mapping is a teaching and learning strategy that is used by nurse educators in hopes of facilitating critical thinking skills among prelicensure nursing students in comparison to traditional teaching methods. To promote the critical thinking skills of prelicensure nursing students, concept mapping encourages meaningful connections between theory and practice, may be used in combination with other pedagogies, and requires a holistic viewpoint.

Discussion of Findings

Through the analysis and synthesis of seven pieces of evidence in nursing education literature, there is overwhelming support for the use of concept mapping to promote critical thinking skills and abilities in prelicensure nursing students. Statistical data from several quantitative studies suggest prelicensure nursing students critical thinking skills were improved when using concept mapping in comparison to traditional teaching methods. One explanation for the improvement in critical thinking skills in prelicensure nursing students is the method in which concept mapping promotes meaningful connections between previous knowledge to new information. The process of physically linking classroom content to specific patient data promotes the deep connections that are necessary to move beyond memorization, and toward critical thinking. Therefore, in novel situations requiring additional thinking beyond memorization of facts, students are able to critically think and apply previous knowledge to new situations that promote safe and high-quality nursing care.

Although a positive impact of concept mapping on prelicensure nursing students' critical thinking is apparent, the teaching and learning strategy cannot be implemented in an imprudent manner. Education regarding the process and importance of concept mapping is necessary for students to understand and reap the benefits of the active learning strategy. Furthermore, combining multiple pedagogies increases the likelihood that students with an audio, read/write, or kinesthetic learning style will also develop critical thinking skills and abilities. Therefore, the good and consistent results of this evidence-synthesizing Capstone project suggest a need for a pilot study or further investigation of the impact of concept mapping on the critical thinking skills of prelicensure nursing students.

Implications of Findings

Concept mapping appears to be a best practice teaching and learning method to develop critical thinking skills in prelicensure nursing students. Thus, there are several implications for nursing education and nursing practice. Nurse educators may implement concept mapping as a teaching and learning strategy within the classroom or clinical environment. However, the educator should be knowledgeable regarding the concept mapping process. Furthermore, educators should provide information to students concerning the importance and process of concept mapping to develop critical thinking skills and abilities. In addition, nurse educators should implement concept mapping in addition to other evidence-based nursing pedagogies to promote active learning for multiple different learning styles. Overall, nurse educators should consider using concept mapping in nursing education environments.

There are also implications for nursing practice as a result of the findings of this evidence-synthesizing project. Although the population of interest in this project was prelicensure nursing students, concept mapping may also be beneficial for students at all levels,

including post-licensure. Specifically, concept maps may be used as an active learning strategy in hospital orientation or specialty courses, such as a critical care course. However, additional research regarding this population is warranted. Overall, this evidence-synthesizing project has several implications for the nursing profession in both education and practice.

Gaps in Findings and Recommendations for Research

Despite the support to use concept mapping to develop prelicensure nursing students' critical thinking skills and abilities, gaps in the findings were also discovered in this evidence-synthesizing project. Although there was consistent evidence to support the use of concept mapping to cultivate critical thinking skills in prelicensure nursing students, higher quality evidence that minimizes the risk for bias is needed since over half of the pieces of evidence in this evidence-synthesizing project received a quality rating of B-. In addition, one identified gap in the findings is the specific area of nursing education in which concept mapping is best used to develop critical thinking skills in prelicensure nursing students. For example, the seven pieces of evidence reviewed and synthesized included concept mapping in both the classroom and clinical environments, but additional evidence is needed to determine which environment is better suited to employ concept mapping. Furthermore, additional research is needed to assess the value of concept mapping in other populations, including post-licensure nurses. Recommendations for future research also include one holistic measure of critical thinking since there are multiple observable measures to assess such a valuable concept within nursing education. Future high-quality research is necessary to continue to provide evidence-based practice regarding concept mapping and the development of critical thinking skills in nursing education.

Limitations for Consideration

Several limitations were identified during this evidence-synthesizing project. First, there were multiple instruments used to measure critical thinking. Therefore, each tool may measure different aspects of critical thinking. Thus, there is a need to develop one instrument to measure critical thinking with a holistic view. In addition, several pieces of evidence were excluded from this evidence-synthesizing project due to the lack of quality in both research and non-research pieces of evidence. In an effort to increase the quantity of high-quality evidence, evidence published between the years of 2013 to 2020 were reviewed and appraised. Since the standard for current literature is five years, expanding the publication date to 2013 is a limitation to this evidence-synthesizing project. Despite the positive findings that suggest concept mapping may be a best practice teaching and learning method to foster critical thinking in prelicensure nursing students, the limitations of this evidence-synthesizing project should be considered.

Chapter Summary

In this final chapter, a discussion and the conclusions of this evidence-synthesizing project were presented. Additionally, implications for nursing education and nursing practice were discussed. Furthermore, gaps in the findings of this evidence-synthesizing project as well as recommendations for future research were examined. Lastly, several limitations of this evidence-synthesizing project were identified despite the positive findings that suggest concept mapping may be a best practice teaching and learning method to develop critical thinking skills in prelicensure nursing students.

Project Summary

Fostering critical thinking skill development among prelicensure nursing students is a primary concern of nurse educators to promote safe and high-quality care to patients and their

families. Concept mapping is an active learning strategy that uses a visual representation for organizing and making connections between relationships in patient care. Therefore, this evidence-synthesizing project was used to review and synthesize current evidence to determine the best practices in nursing education to promote critical thinking abilities in prelicensure nursing students. Three themes were identified in the synthesis of evidence including meaningful connections between theory and practice, combining pedagogies within nursing education, and a holistic viewpoint. There is overwhelming evidence to support the use of concept mapping in nursing education, however, education regarding concept mapping and its use with other pedagogies should be considered. Therefore, a pilot study or further investigation of the impact of concept mapping on critical thinking abilities of prelicensure nursing students should be conducted. Areas for future research were identified and include the specific environment within nursing education in which concept mapping may be best suited, additional populations in which concept mapping may impact critical thinking skills, such as post-licensure nurses, and lastly, the development of one holistic measure of critical thinking. Overall, this evidence-synthesizing project supports the use of concept mapping in nursing education to foster the development of critical thinking skills in prelicensure nursing students.

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Appendix A

Evidence Summary Matrix

PICO(T) Question: In prelicensure nursing students, what is the impact of concept mapping, in comparison to traditional teaching methods on students' critical thinking abilities?

Article #	Authors and Date	Evidence Type	Sample, Sample Size, Setting	Findings that Help Answer the EBP Question	Observable Measures	Limitations	Evidence Level, Quality

1	**Authors**: Lee, Chiang, Liao, Lee, Chen, and Liang
	
	Date: 2013
		Type: Quantitative; quasi-experimental, longitudinal research design	**Sample:** Nursing students in a registered nurse baccalaureate program
			
			Sample size: n=95
			
			Setting: University in Central Taiwan
				Prelicensure nursing students who were taught using concept maps had statistically significantly higher scores of inference and deduction related to critical thinking, in comparison to the control group after 2 years.
				
				Deep, meaningful learning may help nursing students to make meaningful connections that improve critical thinking.
				
				Concept mapping should be used in teaching prelicensure nursing students due to the positive effects of critical thinking over time.
					Critical Thinking Scale
					
					The Approaches to Learning and Studying Scale
						- Selection Bias:
						  o Significant difference in age between groups
						  o No Power analysis to confirm adequacy of sample size
						
						- Maturation:
						  o Critical thinking scores were measured over 2 years
						
						- Instrumentation Bias:
						  o Limited reported validity and reliability measures for the two scales used
						
						- Selection Effects
						  o Research was conducted at one university and included all female students
						  o Limited generalizability to male students in America
							II, B -

Article #	Authors and Date	Evidence Type	Sample, Sample Size, Setting	Findings that Help Answer the EBP Question	Observable Measures	Limitations	Evidence Level, Quality
						- Measurement Effects	

2	**Author:** Odreman and Clyens
	
	Date: 2020
		Type: Quantitative; Randomized Controlled Trial	**Sample:** Convenience sample of prelicensure nursing students in the final year of one institution's nursing program
			
			Sample Size: n= 34
			
			Setting: Not reported
				A statistically significant difference in the Analyzing Thought and Feelings subscale, and the Learning and Making Connections of the Debriefing Experience Scale between the traditional group discussion debriefing and the concept mapping debriefing.
				
				Concept mapping assists prelicensure nursing students in critical thinking and making meaningful connections between theory and clinical concepts due to the active learning nature of concept mapping.
					Debriefing Experience Scale	- Selection Bias:
						  o Limited information regarding participants – unable to assess for difference between the intervention and control groups
						  o Convenience sample
						  o Lack of a power analysis to ensure a sufficient sample size for the study
						
						- Selection Effects:
						  o Sampling procedures limit the generalizability of results
							I, B+

3	**Author:** Garwood, Ahmed, and McComb **Date:** 2018	**Type:** Systematic Review	**Sample:** Quantitative and Qualitative research studies completed between January 2005	Concept maps are an effective teaching and learning tool to promote critical thinking by facilitating relationships and bridging the gap	n/a	- Quality Appraisal: o Did not specify if two researchers independently reviewed, analyzed, and critiqued the evidence	III, A-

Article #	Authors and Date	Evidence Type	Sample, Sample Size, Setting	Findings that Help Answer the EBP Question	Observable Measures	Limitations	Evidence Level, Quality
			to May 2016 written in the English language that used concept mapping as the intervention and critical thinking as the outcome. The population of interest was nursing students. **Sample Size:** n= 17 **Setting:** Evidence was obtained from CINAHL, PubMed, EBSCO, MEDLINE, Health Source: Nursing, and Web of Science, Wiley Online Library, Cochrane Library, and ACADEMIC	between theory and practice. Students find concept maps to be a useful teaching and learning strategy. Future research should include a single, valid and reliable instrument that measures critical thinking to be used to evaluate outcomes related to critical thinking.			

Article #	Authors and Date	Evidence Type	Sample, Sample Size, Setting	Findings that Help Answer the EBP Question	Observable Measures	Limitations	Evidence Level, Quality
			SEARCH databases.				

4	**Author:** Orique and McCarthy
	
	 Date: 2015
		Type: Quantitative; quasi-experimental pretest-posttest design.	**Sample:** Convenience sample of first-semester undergraduate nursing students enrolled at a university nursing program
			
			 Sample Size: n=49
			
			 Setting: University in the western United States
				Statistically significant improvement in critical thinking for the intervention group which received education via concept mapping and problem-based learning in comparison to problem-based learning alone as well as traditional lecture.
				
				 Critical thinking scores were higher with concept mapping alone in comparison to problem-based learning alone, and the baseline.
				
				 No significant difference between concept mapping alone and problem-based learning plus concept mapping as the primary teaching methods.
				
				 Concept mapping and problem-based learning are effective
					Holistic Critical Thinking Scoring Rubric	- Selection bias
						    o Convenience sample
						    o No reported power analysis to confirm adequacy of sample size
						
						 - Maturation
						    o Research occurred over seven weeks, and increase in critical thinking may be due to students finishing the semester rather than the independent variable
						
						 - Testing
						    o Pretest – Posttest design may sensitize students and influence posttest results
						
						 - Selection Effects
						    o Setting of study was only at one university and results may not be generalizable to all universities in the United States
							II, B

Article #	Authors and Date	Evidence Type	Sample, Sample Size, Setting	Findings that Help Answer the EBP Question	Observable Measures	Limitations	Evidence Level, Quality
				nontraditional instruction methodologies in facilitating critical thinking due to self-directed learning and nonlinear thinking.		- Measurement Effects o Due to maturation of study subjects and pretest – posttest design	

5	**Author:** Alfayoumi
	
	Date: 2019
		Type: Quantitative; one group pretest-posttest quasi-experimental study	**Sample:** A consecutive sample of baccalaureate nursing students enrolled in the adult health nursing course.
			
			Sample Size: n=40
			
			Setting: A private teaching college in Jordan.
				Statistically significant improvement in the students' perceptions of their clinical academic success after the implementation of concept-based learning and concept mapping.
				
				Students had significant improvements in general clinical reasoning behavior and self-reported independence in clinical reasoning after the intervention.
				
				Combining concept-based learning and concept mapping pedagogies were effective in regards to prelicensure students' general clinical
					General Clinical Reasoning Behavior Scale
					
					Independence in Clinical Reasoning Questionnaire
					
					Independence in clinical judgment Questionnaire
						- Testing
						  o Pretest – Posttest design may sensitize students and influence posttest results
						
						- Maturation
						  o Study was conducted over the course of a semester and results may be due to finishing the semester rather than the independent variable
						
						- Instrumentation
						  o Failure to report validity and reliability measures for the instruments used
						
						- Selection Bias
						  o Use of a consecutive sample; a non-probability sampling
							II, B-

Article #	Authors and Date	Evidence Type	Sample, Sample Size, Setting	Findings that Help Answer the EBP Question	Observable Measures	Limitations	Evidence Level, Quality
				reasoning behavior and independence in clinical reasoning and clinical judgment during an adult health nursing course.		technique o No reported power analysis to confirm adequacy of sample size - Reactive Effects o Participants were aware they were being studied - Measurement Effects o Pretest – Posttest design o Lack of stated valid and reliable measures for the instruments used - Selection Effects o Sampling procedures limit the generalizability of the results	
6	**Author:** Bilik, Kankaya, and Deveci **Date:** 2020	**Type:** Convergent Mixed Methods	**Sample:** Convenience sample of second-year nursing students enrolled in a surgical nursing course **Sample Size:** n= 419	The experimental group that received the web-based concept map education had significantly higher CTMS subscale scores of expectancy, attainment, and utility than the control group, which may be attributed to increased information and awareness regarding	Critical Thinking Motivational Scale Concept Map Evaluation Keys	Quantitative Aspect: - Maturation o The separation of data collection between the experimental and control groups create a potential threat - Instrumentation o The Concept Map Evaluation Keys were a	III, B-

Article #	Authors and Date	Evidence Type	Sample, Sample Size, Setting	Findings that Help Answer the EBP Question	Observable Measures	Limitations	Evidence Level, Quality

			Setting: A four-year university nursing program in Izmir, Turkey	the concept mapping process.
				
				Concept mapping allows nursing students to use a holistic view to make associations within the nursing process.
				
				Students perceived concept mapping was helpful in facilitating learning, but was time consuming and difficult.
				
				The web-based concept mapping education enhanced prelicensure nursing students' concept mapping abilities and critical thinking skills.
						researcher-designed instrument that lacks validity and reliability data
						
						- Selection Bias
						  o Convenience Sample
						
						- Measurement Effects
						
						- Selection Effects
						  o The research was composed of a convenience sample and was conducted in Turkey and may not be generalizable to prelicensure nursing students in the United States
						
						Qualitative Aspect:
						
						- Credibility
						  o Lack of reported data saturation
						
						- Dependability
						  o No inquiry audit or member checking
						
						- Confirmability
						  o No report of bracketing	

Article #	Authors and Date	Evidence Type	Sample, Sample Size, Setting	Findings that Help Answer the EBP Question	Observable Measures	Limitations	Evidence Level, Quality

						or reflexive journaling
						
						- Transferability
						  o Lack of a detailed description of the participants
						
						- Auditability
						  o Lack of clearly described data collection process for the qualitative aspect of the research	

7	**Author:** Yue, Zhang, Zhang, and Jin
	
	Date: 2017
		Type: Systematic Review and Meta-analysis	**Sample:** Randomized controlled trials completed between 1998 and August 2016 written in the English or Chinese language that used concept mapping as the intervention and critical thinking as the outcome. Additionally, participants in the research	A significant effect of concept mapping on critical thinking abilities in nursing education, supports the effectiveness of concept mapping in nursing education.
				
				The increase in critical thinking may be related to the process in which concept maps help students to link new information to existing knowledge by presenting clear relationships through active learning.
					n/a	- Critical Appraisal
						  o Lack of evidence to suggest each study was assessed and critically appraised appropriately as all studies were given B quality
						
						  o Limited description of the methods used to appraise the evidence
						
						- Similarity of Studies
						  o Population of the studies were not similar, which creates uncertainty in the results
						  o Several different
							I, B-

Article #	Authors and Date	Evidence Type	Sample, Sample Size, Setting	Findings that Help Answer the EBP Question	Observable Measures	Limitations	Evidence Level, Quality
			were nursing students or clinical nurses enrolled in continuing education. **Sample Size:** n= 11 **Setting:** Evidence was obtained from PubMed, Web of science, Embase, CENTRAL, CINAHL, and CNKI databases.	Future research should include the creation of a comprehensive critical thinking assessment system since several measuring tools are currently being used.		methods to measure critical thinking were used o Failed to thoroughly describe the reasons for the differences in the studies	

* From: Dang, D., & Dearholt, S. L. (2018). *Johns Hopkins evidence-based practice: Model and guidelines* (3rd ed.). Indianapolis, IN: Sigma Theta Tau.

Appendix B
Synthesis of Levels of Evidence and Quality Table
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EBP Question: In prelicensure nursing students, what is the impact of concept mapping in comparison to traditional teaching methods on students' critical thinking abilities?

Category (Level)	Total # Sources	Overall Quality Rating	Synthesis of Findings Evidence That Answers the EBP Question
LEVEL I • Experimental Study • Randomized controlled trial (RCT) Systematic Review of RCTs with or without meta-analysis	2	B	The two Level I studies are consistent and encourage nurse educators to implement concept mapping to facilitate critical thinking development in prelicensure nursing students. The evidence suggests concept mapping promotes a connection between theory and practice and argues that a single holistic measure of critical thinking should be developed.
LEVEL II • Quasi-experimental studies • Systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis	3	B-	The three Level II studies are consistent and suggest that concept mapping may facilitate critical thinking skills in prelicensure nursing students. In addition, the findings of two of the Level II studies suggest improvement in critical thinking when concept mapping was used in addition to another pedagogy including concept-based curriculum or problem-based learning.
LEVEL III • Non-experimental study • Systematic review of a combination of RCTs, quasi-experimental, and non-experimental studies, or non-experimental studies only, with or without meta-analysis • Qualitative study or systematic review of qualitative studies with or without meta-analysis	2	B	The two Level III studies are consistent and support the use of concept mapping within nursing education to develop critical thinking skills in prelicensure nursing students. Furthermore, concept mapping allows students to apply theory to practice, and create a holistic view of patients, but education regarding the concept mapping process is necessary to see an impact on critical thinking.

LEVEL IV • Opinion of respected authorities and/or reports of nationally recognized expert committee based on scientific evidence.	0	n/a	n/a
LEVEL V • Evidence obtained from literature reviews, quality improvement, program evaluation, financial evaluation, or case reports • Opinion of nationally recognized expert(s) based on experiential evidence	0	n/a	n/a

Based on your synthesis, which of the following four pathways to translation represents the overall strength of the evidence?
- ☐ **Strong, compelling evidence, consistent results:** Solid indication for a practice change is indicated.
- **X Good and consistent evidence:** Consider pilot of change or further investigation.
- ☐ **Good but conflicting evidence:** No indication for practice change; consider further investigation for new evidence or develop a research study.
- ☐ **Little or no evidence:** No indication for practice change; consider further investigation for new evidence, develop a research study, or discontinue project.

Recommendations Based on Evidence Synthesis and Selected Translation Pathway:
The evidence is consistent in supporting the use of concept mapping to promote critical thinking skills and abilities in prelicensure nursing students. However, education regarding concept mapping and using the teaching and learning strategy with other pedagogies within nursing education should be considered. Although there is consistent evidence, higher quality evidence may be beneficial prior to translating the evidence to practice. Therefore, a pilot of change or further investigation should be considered.