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CUE RECOGNITION DEVELOPMENT AMONG UNDERGRADUATE NURSING STUDENTS

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ABSTRACT

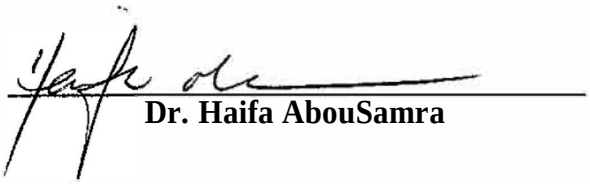
Clinical judgment among nurses is imperative to assure quality, safe healthcare to all. The licensure exam for registered nurses has been criticized for not adequately measuring the clinical judgment needed by entry-level nurses. The National Board of State Boards of Nursing (NCSBN) responded to this criticism by developing a new Clinical Judgment Measurement Model (CJMM) with measurable cognitive processes, including cue recognition, to be used as a framework for item development on the new licensure exam. Nursing programs must evaluate current teaching and evaluation modalities for alignment with the new CJMM measurable cognitive processes to prepare entry-level nurses forsuccessful completion ofthe licensure exam and practice.

A concept analysis of cue recognition determined the defining attributes, antecedents, and consequences most commonly depicted medical, nursing, occupational therapy, and physical therapy literature. Cue recognition was more clearly defined resulting in an operational definition of cue recognition. The operational definition of cue recognition informs nurse educator of specific measurable criteria to include on student evaluations in areas such as clinical and simulation. In addition, question items on exams can be created on cue recognition using cue recognition defining attributes, antecedents, and consequences.

The second paper investigated the effect of using classroom quizzing on the short and long-term cue recognition retrieval of previously learned client cues. Classroom quizzing, a retrieval-based learning strategy, was given to baccalaureate nursing students prior to watching a simulated patient scenario. The posttest scores of the group receiving the classroom quizzing scored lower than the group whom did not receive the classroom quizzing. There was no significant difference in long-term cue recognition ability as measure by retention questions one week after the intervention.

The final study examined nurse educators' knowledge of cue recognition and factors that affect the knowledge ofcue recognition. The results revealed a knowledge deficit among nurse educators. Factors that affected the cue recognition knowledge level included years in the educator role, age, and confidence in using cue recognition as a teaching strategy.

Dissertation Advisor



Dr. Haifa AbouSamra

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Chapter One

Introduction

This chapter provides background information on patient cue recognition, the first cognitive process of a newly proposed clinical judgment model in nursing. The driving forces behind the development of this new clinical judgment model will be discussed. Each of the papers in this dissertation explores cue recognition in specific ways to advance undergraduate nursing programs to implement changes in teaching-learning modalities and evaluation methods related to cue recognition development of nursing students.

Background

Current State of Clinical Judgment Skills Among Entry-Level Registered Nurses

Clinical judgment skills remain predominant skills a nurse must possess to care for the complex patient population in today's healthcare world (Betts et al., 2019). Profound changes in healthcare, including increased aged client populations, increased client acuity, and shortened hospital stays, demand sound clinical judgment by entry-level nurses (Kavanagh & Szweda, 2017). An association between poor patient outcomes and poor clinical judgment by nurses continues to exist (Nibbelink & Brewer, 2018). New graduates are entering the healthcare practice arena with basic knowledge of concepts but lacking the confidence and clinical judgment skills to apply the knowledge in clinical patient situations (Benner et al. 2010). The concern for patient safety when in the care of entry-level nurses is not a new phenomenon. In 1985, Dr. del Bueno developed a competency-based assessment tool known as the Performance-Based Development System (PBDS) for hospitals to create individual orientation plans for entry-level nurses based on the critical thinking, urgency identification, and problem

management (Kavanagh & Szweda, 2017). The most recent PBDS assessment study between 2012 through 2015 involving data from 5,000 new graduate nurses revealed that only 23% scored in the safe or acceptable range (Kavanagh & Szweda). A study investigating medication errors in newly licensed nurses found that approximately 75% of novice nurses were connected to a medication error in some manner (Smith & Crawford, 2003). Kavanagh and Szweda report that 65% of nursing errors are attributed to novice nurses' lack of clinical decision-making skills (2017). Saintsing, Gibson, and Pennington's (2011) integrative review focused on the type and causes of errors among novice nurses revealed that most errors were related to medication administration, patient falls, and treatment delays. Last, a mere 20% of employers report being satisfied with the clinical decision-making ability of novice nurses (Saintsing, Gibson, & Pennington).

Investigations of Nursing Clinical Judgment by the National Council State Board of Nursing

Early investigation of nursing clinical judgment began in 2009 by The National Council State Boards of Nursing (NCSBN), the organization responsible for working with nursing regulatory bodies and developing all nursing licensure examination. Discussions with experts in the nursing profession and reviewing research reports on the importance of clinical judgment among nurses prompted the NCSBN to investigate the current state of clinical judgment among entry-level nurses (NCSBN, 2020b). A literature review of nursing clinical decision-making followed to explore further individual and environmental factors related to novice nurses' clinical judgment and decision-making skills (Muntean, 2012). Current nursing theories and clinical decision-making frameworks were explored in the literature review to provide background

information on the factors that affect a nurse's clinical judgment and decision-making skills (Muntean).

Other investigations by the NCSBN include a practice analysis study conducted every three years to assess the current knowledge needed by entry-level nurses to provide safe patient care (NCSBN, 2018a). These practice analyses results are also used to ensure that items on the National Council Licensure Examination for Registered Nurses (NCLEX-RN) are comprehensive enough to accurately measure the most current knowledge, skills, and abilities needed by entry-level nurses in practice. The practice analysis of registered nurses conducted between the years of 2012-2014 found that clinical judgment, problem-solving, and critical thinking were among the top five skills reported as necessary by entry-level registered nurses, and 46% of the tasks performed by entry-level registered nurses require clinical judgment (NCSBN, 2018a).

The New Clinical Judgment Measurement Model by the NCSBN

The NSCBN researchers developed an operational definition and a new clinical judgment framework, The Clinical Judgment Measurement Model (CJMM), after conducting research on over 200,000 NCLEX-RN candidate's data and analyzing literature from the areas of nursing, nurse pedagogy, cognitive psychology, psychological assessment, and decision assessment (NCSBN, 2020). Clinical judgment by the NCSBN is operationally defined as the "observed outcome of critical thinking and decision-making. It is an iterative process that uses nursing knowledge to observe and access presenting situations, identify a prioritized client concern, and generate the best possible evidence-based solution in order to deliver safe client care" (Betts et al., 2019, p. 23). Although current nursing clinical judgment models exist, the NCSBN suggests that a combination of clinical judgment models and cognitive theoretical

frameworks are necessary to teach pre-licensure nursing students as well as develop assessments and evaluations for both performances in the academic setting and licensure examinations with high stakes examination items (Dickison, Haerling, & Lasater, 2019). The CJMM is an integrative decision-making framework with four distinct layers, each inclusive of cognitive attributes or operations that can be measured (Hensel & Billings, 2020). Layer 0 is the observation layer in which the client needs begin the clinical judgment process, and clinical decisions end the process (Dickison et al., 2016). The cognitive layers are layers two and three, the iterative process of specific cognitive operations (Dickison, Haerling, & Lasater, 2019). Layer two includes the cognitive operations of forming hypotheses, refining hypotheses, and evaluating hypotheses, all of which are dependent on the related cognitive operations in layer three. Recognizing cues, analyzing cues, prioritizing hypotheses, generating solutions, taking action, and evaluating outcomes are the six cognitive operations in layer three. Layer four is the contextual factor layer of the individual or environmental factors that may influence the cognitive operations' performance in the other layers of the model (Dickison, Haerling, & Lasater). Figure 1.1 is the new Clinical Judgment Measurement Model (NCSBN, 2020)

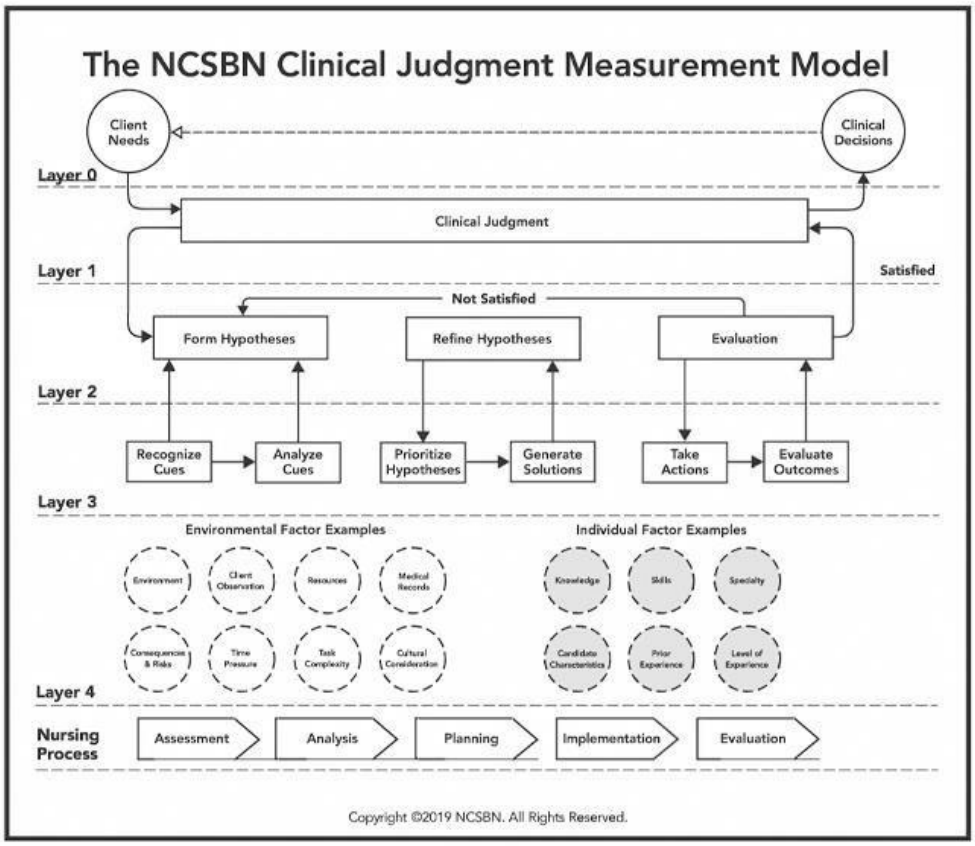

Figure 1.1. The NCSBN Clinical Judgment Measurement Model

The New Registered Nurse Licensure Exam: The Next Generation NCLEX-RN

The years of research by the NCSBN concluded that current item types on the NCLEX-RN do not measure the cognitive operations of clinical judgment required by entry-level nurses (Dickison, et al., 2019). The multiple-choice questions fail to capture the complexity of the practice setting and only measure the candidate's content knowledge. Although content knowledge is an essential component in clinical judgment, entry-level nurses cannot rely solely on content knowledge to make sound clinical judgments (Dickison, et al.). The newly developed CJMM by the NCSBN has laid the groundwork for innovative item types on the NCLEX-RN to authentically measure clinical judgment and decision-making competency in a high-stakes

testing setting. New item types that more accurately measure clinical judgment and decision-making skills of the candidate will be added to the current NCLEX and evaluated for validity and reliability of the clinical judgment and decision-making skills of entry-level nurses discovered in the 2012-2014 practice analysis study (NCSBN, 2020). The new item types include formats such as extended drag and drop, extended multiple-choice, and matrix and have been through usability testing. The cognitive operations of recognizing cues, analyzing, prioritizing hypotheses, generating solutions, taking action, and evaluating outcomes of layer three of the CJMM are the measurement focus and guiding content for item development (NCSBN). New items will also include layer four contextual factors such as time pressure and cultural considerations (NCSBN). The Special Research Section with these different item types is currently offered to selected candidates taking the NCLEX-RN. Participation in this research is voluntary, and the scores on the questions do not count toward the candidate's overall score (NCSBN, 2019). Psychometric testing on these new item types is being conducted. The projected implementation for the Next Generation NCLEX, including item types used on the current NCLEX and the new item types, will be in the year 2023 (NCSBN, 2020).

Cue Recognition Development Among Undergraduate Nursing Students

Cue recognition is the first cognitive operation of the CJMM. As described by the NCSBN, recognizing cue involves filtering information from different sources such as signs, symptoms, and medical history (2018). Burbach and Thompson define cue recognition as acknowledging the presence of objective or subjective patient data by nurses (2014). An item writing model template for the Next Generation NCLEX-RN developed by members of the NCSBN includes the expected behaviors of cue recognition as recognizing abnormal and normal cues, recognizing signs and symptoms, and identifying the history of a depicted disease (Betts,

et al., 2019). Conditioning factors or cue recognition constructs on the item writing template include environmental cues, patient observation cues, medical record cues, and time pressure cues. Failure to recognize patient cues may lead to a further incorrect action, mistakes, and poor patient outcomes (Alfaro-LeFevre, 2009). Novice nurses and nursing students lack the knowledge and clinical experience to consistently recognize patient cues necessary to make complex patient decisions (Muntean, 2012). Nursing curricula are designed to provide students with the knowledge acquisition and clinical experiences necessary to engage in clinical decision making. Cue recognition needs to be specifically taught and practiced in nursing programs to advance clinical decision-making skills (Muntean). Some suggest that cue recognition can be learned and incorporated into nursing courses early in the program through specific instructional formats, deliberate presentation of patient cues, and didactic interactions (Thiele et al.,1986; Welk, 1994; Welk, 2002). Benner suggests that nursing students need instruction on how to pay attention to relevant cues, how cues lead to clinical decisions, and the critical association between accurate cue recognition and patient outcomes (2001).

Existing nursing clinical judgment models that have guided the development of nursing student clinical judgment in many nursing education programs do not include the cognitive operation of cue recognition. Tanner's Model of Clinical Judgment, a commonly used nursing clinical judgment model, includes the processes of noticing, interpreting, responding, and reflecting (Tanner, 2006). Noticing is the first step of clinical judgment in the model and is the "perceptual grasp of the situation at hand" (Tanner, p. 208). The context of the situation, background, and expectations of the nurse and the patient's relationship contribute to the nurse's ability to engage in patient noticing (Tanner). Lasater expanded on Tanner's Model of Clinical Judgment by creating a clinical judgment rubric for simulation student evaluations (2007). This

rubric includes the developmental categories of beginning, developing, accomplished, and exemplary with descriptive statements under each clinical judgment process phase. The noticing phase includes focused observation components, recognizing deviations from expected patterns, and information seeking (Tanner). There are some similarities among the noticing phase in Lasater's model and the recognizing cue phase in the CJMM. The main difference is that cue recognition in the CJMM includes specific inclusion of gaining information from various sources rather than the broad behavior of information seeking identified in Lasater's model.

Research Stance and Statement of Research Agenda

Clinical judgment is a higher-order cognitive construct that cannot be achieved by nursing knowledge acquisition alone (Dickison, et al., 2016; Muntean, 2012). The new definition by the NCSBN suggests that clinical judgment involves both critical thinking and decision-making skills to deliver safe patient care while using nursing knowledge to assess the situation, prioritize patient concerns, and develop possible evidenced-based solutions (NCSBN, 2019). The cognitive operation of patient cue recognition is the first cognitive operation of clinical judgment in the newly proposed CJMM by the NCSBN. Existing nursing clinical judgment models that have guided the development of nursing student clinical judgment in many nursing education programs do not include the cognitive operation of cue recognition.

The NCSBN has consistently supported nursing education programs to keep current clinical judgment frameworks used in the existing curriculum stating that the CJMM does not need to be incorporated in teaching (NCSBN, 2020). The NCSBN does, however, suggest using the CJMM to evaluate student development of clinical judgment and decision-making ability. Others in the field of nursing education suggest integrating the new CJMM into the curriculum to expose students to assessments activities and test items similar to the format of item types in

the future Next Generation NCLEX (Betts et al., 2019; Dickison, Haerling, & Lasater, 2019; & Dickison et al., 2016). Teaching strategies can be developed for each specific construct of the clinical judgment model allowing teachers to evaluate what step of the model the student may not be understanding (Dickison, Haerling, & Lasater, 2019). Research related to educational interventions and evaluation processes needs to be carried out to add to the empirical evidence of nursing students' clinical judgment development, particularly cue recognition as focused in this three paper dissertation.

Summary of the Three Related Research Studies.

Research Study One: Concept analysis of cue recognition.

A concept analysis of cue recognition was conducted to develop an operational definition. Current literature in nursing education lacks an operational definition for cue recognition among nurses. An operational definition for cue recognition is imperative to develop effective teaching-learning strategies and evaluation tools of cue recognition among undergraduate nursing students. Performance criteria on the cognitive process of cue recognition need to be clear and concise for both nurse educators and nursing student understanding. Exam questions focused on cue recognition can be developed using the cognitive operation of cue recognition identified in the concept analysis. Measurement of cue recognition competency through exam questions assures undergraduate nursing students are prepared to successfully answer similar questions on the National Council Licensure Examination (NCLEX-RN Exam). This study aimed to address the following question: What is the operational definition of cue recognition?

Research Study Two: The effects of classroom quizzing on undergraduate baccalaureate nursing students' patient cue recognition ability and long-term retrieval.

A study investigating the effect of a retrieval-based teaching-learning strategy on nursing students' cue recognition ability and long-term retrieval was conducted to address the gap in the literature related to cue recognition development among nursing students. Teaching strategies can be developed for each specific construct of the clinical judgment model allowing teachers to evaluate what step of the model the student may not be understanding (Dickison, Haerling, & Lasater, 2018). Cue recognition development among nursing students has limited evidence to move forward with promoting one teaching strategy over another in undergraduate nursing curricula. This paper aimed to address the following questions:1) Does cue recognition ability differ between baccalaureate nursing students taught by lecture alone and those taught by lecture with classroom quizzing? 2) Does long-term retrieval ability differ between baccalaureate nursing students taught by lecture alone and those taught by lecture with classroom quizzing?

Research Study Three: Exploring nurse educators' knowledge of cue recognition.

Identifying nurse educators' current knowledge of cue recognition among undergraduate nursing students was the focus of paper three. Determining nurse educators' knowledge of the concept of cue recognition provided insight into nurse educator development needs. Nurse educators who do not feel knowledgeable about cue recognition may lack the skills teaching cue recognition to nursing students and evaluating cue recognition among the nursing students. Furthermore, nurse educators' lack of knowledge may make the development of instructional materials and evaluation methods for cue recognition a challenging endeavor. This paper aimed to answer the following question: 1) What are nurse educators' knowledge of cue recognition? 2) What factors affect nurse educators' knowledge level of nursing student cue recognition?

Summary

The purpose of this three paper dissertation was to develop an operational definition of cue recognition, investigate a specific teaching-learning strategy to advance the skill of cue recognition among undergraduate nursing students, and explore nurse educators' knowledge of cue recognition to identify faculty development needs.

Chapter 2

Abstract

Concept analysis of cue recognition among nurses

Analyses of concepts are conducted to gain an understanding of the structure and function of a selected concept (Walker & Avant, 2019). Concept analyses are useful to nurses conducting research to identify both theoretical and operational definitions, identify measurement tools with accurate measurement of the concept's defining characteristics, and determine the need to choose or develop a new measurement tool. Practicing nurses use concept analyses to communicate to the healthcare consumers and policymakers what nursing entails and a precise description of nursing practice to promote further development of nursing science (Encyclopedia of Nursing Research, 2014). Cue recognition or cue acquisition is a concept commonly used in the decision-making process of various healthcare professionals. A new clinical judgment model in nursing education has emerged and includes six cognitive processes. Cue recognition is the first construct of this model and needs an operational definition refinement to ensure nursing education accurately integrates cue recognition teaching and assessment in all educational modalities. Cue recognition requires the nurse to recognize presenting initial cues in the patient situation, gather essential information, and distinguish between relevant and irrelevant cues. It is imperative for nursing education programs to provide opportunities for nursing students to learn the skill of cue recognition and engage in learning activities focused on evaluating cue recognition ability. Informal or formal knowledge of the cues, patient disease process, and medications are necessary for the nursing student to engage in cue recognition.

Keywords: Cues, cue recognition, and cue acquisition

Paper 1

Concept analysis of cue recognition among nurses

The clinical judgment ability of entry-level registered nurses is not meeting the needs of healthcare practice today. Kavanagh and Szweda (2017) concluded that only 23% of new graduate nurses could recognize changes in patient status and respond to them with a sense of urgency. Consistent and safe quality of care by entry-level nurses is necessary for positive patient outcomes (Kavanagh & Szweda, 2017). New graduates are entering the healthcare practice arena with basic knowledge of concepts but lacking the confidence and clinical judgment skills to apply the knowledge in clinical patient situations (Benner, 2012). Increased patient acuity and decreased length of hospital stays have created the need for entry-level nurses to have sound clinical judgment skills with readiness for practice (Benner).

The National Council of State Board of Nursing (NCSBN) responded to reports of the lack of clinical judgment among entry-level nurses by conducting a literature review investigating clinical judgment in the areas of practice, education, and testing (NCSBN, 2018b). Findings confirmed the alarming existence of the lack of clinical judgment among novice nurses. Studies revealed that 50% of novice nurses were involved in nursing-related errors, and only 20% of employers were satisfied with the clinical decision-making skills of the new graduate nurses (Saintsing, Gibson, & Pennington, 2011). Further steps by the NCSBN to address the inadequate clinical judgment performance among novice nurses included completing a unique Strategic Practice Analysis and evaluating the current National Council Licensure Examination for Registered Nurses (NCLEX-RN) test items (NCSBN, 2018a). The Strategic Practice Analysis included a unique approach different from previously conducted practice analyses. The approach included observations of the tasks, skills, and attitudes completed by novice nurses in

practice settings and focus group discussions with both novice and experienced nurses. The strength of the association of entry-level nurse tasks and nursing skills was analyzed to determine if problem-solving, critical thinking, and clinical judgment skills were required to complete the task and skill (NCSBN, 2018a). The practice analysis findings concluded that clinical judgment skills were used in 46% of the tasks completed by entry-level nurses, and problem-solving and critical thinking skills were used in 30% of the tasks performed by entry-level nurses (NCSBN, 2019). The evaluation of current NCLEX-RN test items concluded that inconsistencies exist in the measurement of critical thinking, problem-solving, and clinical judgment on all test items. Only approximately 50% of the test items are written to moderately measure critical thinking, problem-solving, and clinical judgment skills (NCSBN, 2019).

Nursing education has relied on three established clinical judgment frameworks to guide curriculum, including the intuitive-humanistic model by both Benner (1984) and Tanner (2006), dual process reasoning theory (Pelaccia et al., 2011), and the information processing model (Oppenheimer & Kelso, 2015). However, clinical judgment performance research of novice nurses concluded that a combination of clinical judgment models and other theoretical frameworks is necessary to teach, assess, and evaluate pre-licensure nursing students' clinical judgment (Dickison, Haerling, & Lasater, 2019). The NSCBN has responded to this dilemma by developing a new clinical judgment measurement model, which includes components of leading clinical judgment frameworks to advance consistency between educational and licensure evaluations. The fidelity and validity of the assessments and evaluations of nursing students' experiences in the classroom, clinical, and regulatory experience will be increased with the new clinical judgment framework (Dickison, Haerling, & Lasater). Following a review of the literature for the cognitive constructs of clinical judgment, expediting an understanding of

clinical judgment, and determining a definition and assessment criteria for clinical judgment, a new clinical judgment model was developed. This clinical judgment model, called the Clinical Judgment Measurement Model (CJMM) by the NCSBN, includes the layers of observation, cognitive operations, and contextual factors. The cognitive operations layer include the following six steps 1) recognizing cues; 2) analyzing cues; 3) prioritizing hypotheses; 4) generating solutions; 5) taking action and; 6) evaluating outcomes (Dickison, Haerling, & Lasater).

The first step, the cognitive operation of recognizing cues (cue recognition), was the focus of this concept analysis identifying a more precise understanding and operational definition of cue recognition. Development of an operational definition assist nurse educators in developing nursing educational materials focused on this step of clinical judgment and determine assessment and evaluation strategies to identify nursing students' actions and behaviors in the specific step of cue recognition. Identifying a student's weak performance in a specific step of clinical judgment may lead to an individualized remediation plan to assist the student in improving the actions and behaviors of this specific cognitive step in the clinical judgment model (Dickison, Haerling, & Lasater, 2019).

Cue recognition was the selected concept for this concept analysis, as this is the term used in the newly constructed clinical judgment measurement model. Walker and Avant (2019) suggest that selecting a concept should include determining relevancy to a research topic of interest or necessary before moving on to a next step. Since most commonly used clinical judgment models in nursing education do not include the step of cue recognition, it is crucial to investigate the concept of cue recognition before development of evaluations in nursing student cue recognition performance.

Methods

This concept analysis of cue recognition followed the method developed by Walker and Avant (2019). This concept analysis used the following eight steps as guidelines: 1) selection of a concept; 2) determine the aims/purposes of the analysis; 3) identify all uses of the concept; 4) determine all defining attributes; 5) identify a model case; 6) identify other cases; 7) identify antecedents and consequences; and 8) define empirical referents (Walker & Avant, 2019).

A literature review was conducted in medicine, nursing, occupational therapy, physical therapy, and education using the databases of CINAHL, PsychInfo, Medline, and ERIC. Educational literature was not included in this concept analysis of cue recognition as the definition in the literature was more related to individual and group learning, which is not the focus of this analysis. Walker and Avant (2019) suggest examining various uses of the term to avoid the bias of understanding the concept from only limited perspectives. Other search strategies included ancestry searching of the reference lists of relevant articles, and dictionaries for the English definitions and synonyms of the concept. The relevant search terms of "*cue recognition*" and "*cue acquisition*" were used in this inquiry of the concept. Inclusion criteria included peer-reviewed journal articles and books that included discussions about the attributes, antecedents, consequences, and empirical referents of cue recognition. Publications in the English language from all countries were included in this analysis. The time frame was not limited to determine if the concept of cue recognition has changed over time.

The search resulted in a total of 274 articles from the four databases. An ancestry search resulted in an additional 18 articles and three books to review. Initial screening of the articles and books included reviewing the titles and abstracts, if available, for the relevance of cue acquisition or cue recognition. This initial screening excluded 208 articles. The remaining articles and books

were read thoroughly for cue recognition or cue acquisition definitions, defining attributes, antecedents, consequences, and empirical referents. A total of seven articles from the included databases searched, and 15 articles and two books from the ancestry search were used for this analysis. Figure 2.1 depicts a flow diagram of the literature search process.

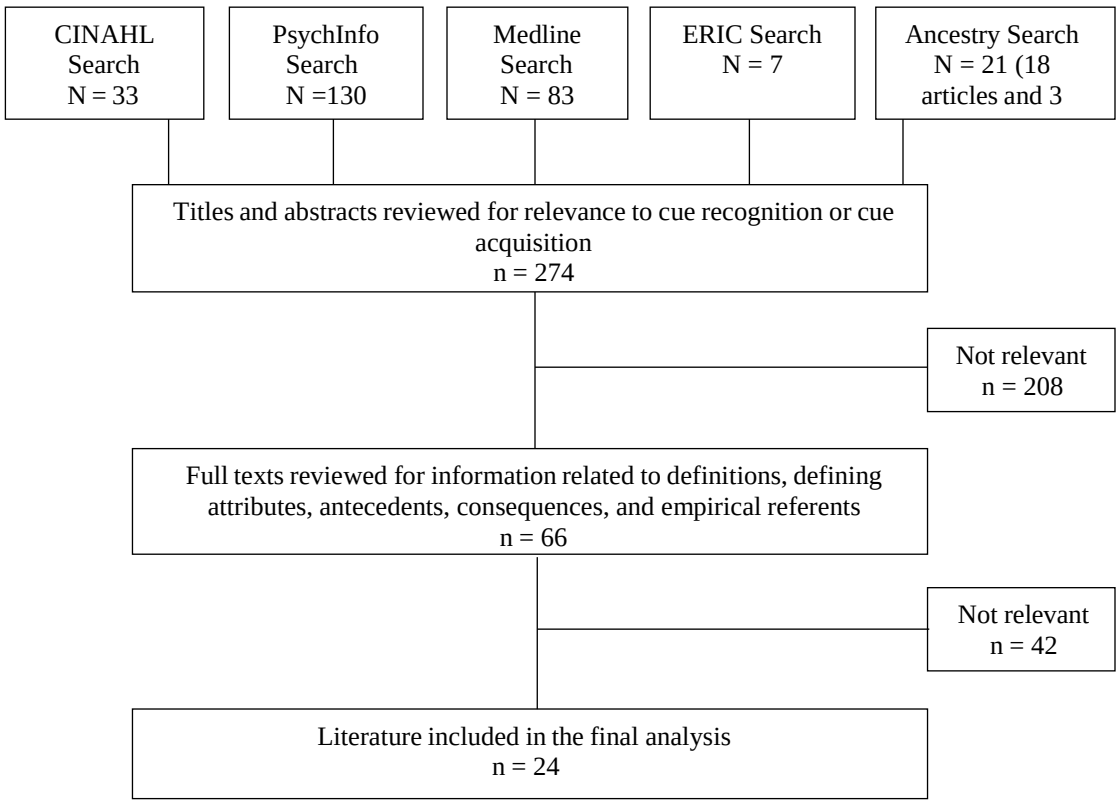

Figure 2.1. Flow diagram of the literature search process

Aims of the Analysis

The aim of a concept analysis describes how the results of the analysis will be used (Walker & Avant, 2019). The primary aim of this concept analysis was to clarify and refine the meaning of cue recognition in the context of the first cognitive step in a clinical judgment measurement model used in nursing education. An operational definition was developed after the

meaning of cue recognition was investigated to be used in further research related to cue recognition skill development and measurement among nursing students.

Definitions and Uses of the Concept

The term cue is defined as "something serving a comparable purpose (hint) or a feature indicating the nature of something perceived" (Merriam-Webster Dictionary Online*). The Mosby Dictionary of Medicine, Nursing, and Allied Health* defines a cue as a "stimulus that determines or may prompt the nature of a person's response" (2013). Recognition is the "action of recognizing, acknowledge or take notice of in some definite way" (Merriam-Webster Dictionary Online). *The Merriam Webster Dictionary Online* defines acquisition as the act of acquiring something, including the acquisition of knowledge. There are no dictionary definitions for "cue acquisition" or "cue recognition."

Elstein, Shulman, and Sprafka (1978) are the pioneers of the diagnostic problem-solving model used in the medical practice, derived from the hypothetico-deductive method and the information processing theory. Cue acquisition, hypothesis generation, cue interpretation, and hypothesis evaluation, are the four cognitive processes of this model (Elstein, Shulman, & Sprafka, 1978). In this model, cue acquisition is referred to as "…obtaining information that may come from a variety of sources." One of the significant findings of the study related to the development of the diagnostic problem-solving model was that the most effective diagnosticians among the physicians collected more cues and demonstrated more accuracy in the cue interpretations (Elstein, Shulman, & Sprafka, 1978). Joseph and Patel (1990) further categorize the cues acquired during the cue acquisition step as critical cues or relevant cues necessary for accurate diagnosis in a patient case. On the contrary, irrelevant cues are not necessary for an accurate diagnosis (Joseph & Patel, 1990).

Early nursing research on decision making and information processing include numerous citations of Elstein and his colleagues (Elstein, Shulman, & Sprafka, 1978). The definition of cue acquisition or cue recognition used in the context of nursing reflects the same processes used in the medical field. Cue recognition is defined as "…the mental process involved in extracting and identifying relevant and important information from the presenting situation. This occurs through various forms of observation, whether through the environment, or medical records, symptoms, or vital signs" (Betts, et al., 2019, p. 24). The main difference between cue recognition among physicians and nurses is the intended use of recognizing relevant cues in a patient situation. Physicians and nurses use cues to develop hypotheses, but physicians use the cues to make medical diagnoses, whereas nurses identify patient problems. It is not within a registered nurse's scope of practice to assign a medical diagnosis to a patient. Cue recognition among practicing nurses and student nurses has been investigated with findings related to the development of cue recognition, factors affecting when a nurse uses cue recognition in a clinical judgment situation, and different type of cue identification.

Research on clinical reasoning skills of occupational therapists and occupational therapy students also has a predominant focus on Elstein, Shulman, and Sprafka's diagnostic reasoning framework, including the steps of cue acquisition, hypothesis generation, cue interpretation, and hypothesis evaluation (1978). Cue acquisition among occupational therapists involves the same process of gathering subjective and objective patient data and sorting cues as relevant or irrelevant (Roger & Holms 1991). Roger and Holms (1991)suggest that cue acquisition among occupational therapists and occupational therapy students is more specific to identifying deficits in a patient's occupational performances. Another difference among occupational therapist's cue acquisition process as compared to a physician's process is the use of a non-linear approach when

engaging in clinical decision making with patients (Fleming, 1991). Physicians most commonly follow the sequential steps of gathering data of medical history, current signs and symptoms, and diagnostic tests, followed by hypothesizing possible medical diagnoses resulting in a final diagnosis before treatments can begin. During the patient encounter with an occupational therapist, a medical diagnosis has been determined by the physician. The occupational therapist can rely on previous knowledge and experience of the medical diagnoses and progress to obtaining data about the patient's occupational health. The occupational therapist can focus the cue acquisition step on asking more social questions such as physical limitations and limitations of activities of daily life to assist the patient in developing goals and possible treatment modalities (Fleming, 1991). A lack of research exists among the physical therapy domain related to the specific step of cue acquisition in clinical decision-making frameworks. Payton (1985) conducted a study comparing the clinical problem-solving methods among physical therapists with the clinical problem-solving methods of physicians and found that physical therapists follow the same decision-making process, which includes the step of information gathering (cue acquisition) as do physicians when determining patient diagnoses and treatments.

Defining Attributes

The fourth step in Walker and Avant's concept analysis framework is determining the defining attributes of the concept to provide a broad perspective of the concept (2019). The defining attributes of a concept are the most common characteristics used in various instances of the concept (Walker & Avant, 2019). All relevant articles were reviewed thoroughly for repeated defining attributes of cue recognition. The final defining attributes include the following three processes of 1) recognizing presenting initial cues in the patient situation; 2) gathering important patient information or data; and 3) distinguishing between relevant and irrelevant cues.

Recognizing initial cues in the patient situation. Recognizing the initial cues presented in a patient situation is essential to begin to make meaning of the cues, formulate potential hypotheses, evaluate the hypotheses, gather more cues if necessary, and evaluate the hypotheses (Elstein, Shulman, & Sprafka, 1978). Failure to give attention to initial cues may lead to judgment errors (Elstein, Shulman, & Sprafka, 1978). Initial recognition of patient cues may be gathered before the actual patient encounter (Carnevali et al., 1984; O'Neil, Dluhy, & Chin, 2005; Radwin,1990; & Thompson, 1999). Handoff report at shift change, reviewing the patient's electronic health record, and scanning the patient's environment are examples of gathering patient data before the actual patient encounter (Levitt-Jones et al., 2010). O'Neil, Dluhy, & Chin (2005) include conversations with health personnel and family members before the patient encounters additional sources of patient cues that may draw attention to the clinician.

Gathering further patient information. Gathering further patient information during cue recognition must be completed before cue interpretation can occur (Elstein, Shulman, & Sprafka, 1978). This phase of clinical reasoning includes the gathering of patient information from multiple sources. Patient information is gathered through observation, interviews, patient medical history, social history, physical exams, and diagnostics (Betts et al., 2019; Elstein, Shulman, & Sprafka, 1978; Thompson, Moorley, & Barrett, 2016). Subjective and objective data is obtained during the cue recognition phase (Elstein, Shulman, & Sprafka, 1978; Hammond et al., 1967; Rogers & Holm, 1991). History taking is the primary approach to gathering subjective data from the patient (McKenna et al., 2011). The nurse may use all their senses including vision for observing the patient, hearing for listening to the patient, and tactile sensations to collect patient data (Elstein, Shulman, & Sprafka, 1978; & Standing, 2007) The detection of risk factors related to a potential problem is also considered part of cue recognition (Elstein, Shulman, &

Sprafka, 1978). Rogers, Swee, and Vallario suggest that charts, colleagues, and families are other sources used for cue recognition (1984).

Distinguishing between relevant and irrelevant cues. Cue recognition competency involves determining relevant from irrelevant cues (Betts et al., 2019; Carnevali, 1984; Joseph & Patel, 1990; Reischman & Yarandi, 2002; Thiele et al., 1986). Relevant cues warrant further gathering of information to make an accurate diagnosis (Joseph & Patel, 1990; Reischman & Yarandi, 2002; Thiele et al., 1986). Irrelevant cues are patient data that are noncontributory to the current patient situation or considered trivial in the present time, not requiring immediate attention (Thiele et al., 1986). Welk (1994) categorizes cues as essential or nonessential rather than relevant and irrelevant, suggesting that essential cues lead to further investigation and must be detected to form patterns of cues and prevent errors in decision-making.

Types of Cases

Varying types of cases are necessary to identify and further understand the defining attributes of a concept (Walker & Avant, 2019). Determining all possible defining attributes of the concept is necessary to develop a pure exemplar or model case. Model cases are derived from real-life scenarios, situations depicted in the literature or authored by the analyst. Borderline cases included some but not all the defining attributes of the concept. Contrary cases aim to depict a case with none of the defining attributes of the concept (Walker & Avant, 2019). The analyst developed all the cases in this analysis.

A Model Case

BA, a night nurse on the orthopedic unit for three years, receives bedside report regarding an 82-year-old male who underwent a left total hip replacement one day ago. During the bedside report, BA notices that the patient is restless and attempting to get out of bed. The

patient is pale and is using accessory muscles to breathe. BA asks the handoff nurse if the patient has a history of any lung diseases or has had any problems with breathing since the hospitalization. The handoff nurse reports that the only history the patient has is hypertension, osteoarthritis, glaucoma, and GERD. The handoff nurse reports that the patient's oxygen saturation on room air has been 93-95%, respiratory rate 16-18 per minute, and clear lung sounds bilaterally. The handoff nurse also reports the following before leaving the shift:

"*Patient X has been alert and oriented times four. His heart sounds are normal to auscultation. Vital signs have all been within normal limits. His blood pressure was a little high at the beginning of my shift early this morning at 146/92 but he was having pain so I gave him his hydrocodone. I also gave him his home medication of metoprolol. His last blood pressure was 102/78. His heart rate was a little high at 102. I already told you that his respiratory status was fine during my shift. I'm not sure what is going on now. He might need some pain medicine. He has hypoactive bowel sounds times 4 quads. Abdomen is soft and non-distended. I increased his diet to soft for supper tonight and he tolerated it well. He is voiding per the urinal at the bedside without difficulty. Urine is clear and a little dark. His output is a little low but nothing to be alarmed about. I told him to drink lots of water. The surgical dressing to his hip is clean dry and intact. Neurovascular checks to his bilateral lower extremities are all within normal limits. The hydrocodone is working well to control his pain. He tolerated PT well today. He uses a walker to stand at the bedside and transfer to the chair with the assist of 1. His am labs, CBC and CMP, were all good today. He needs encouragement and assistance to reposition in bed. His skin is looking good overall. He also needs encouragement to perform his incentive spirometer exercises. His wife and daughter have been with him most of the day. They just left for home for the day. I think that is all. Do you have any questions?"*

BA states "no" and that she will go and assess him first because of his breathing. BA immediately goes into patient X's room and notices that his breathing rate is fast and shallow. BA asks patient X, "How are you doing?" Patient X replies, "I don't know but get me out of here." BA asks the patient, "Can you tell me where you are?" Patient X replies, "I'm at church. I need to get out of here?" BA asks the patient, "Can you tell me what the year is?" Patient X responds, "2008." BA asks the patient, "Can you tell me who the president is?" Patient X responds, "Regan." BA places the O2 saturation monitor on patient X's finger. It reads 82%. BA places the monitor on another finger, and it reads 81%. BA places her hand on the patient's chest and counts the respiratory rate. The rate is 32 breaths per minute. Patient X is using accessory muscles to breathe and is pale in color. BA listens to the heart sounds and notes normal S1 and S2 with a systolic murmur. BA auscultates the bowel sounds and notes they are hypoactive x4 quads. BA assesses the left hip dressing and notes the dressing is intact with a quarter size shadow drainage. BA performs a neurovascular assessment and notes no abnormalities in the bilateral lower extremities. BA looks at the provider orders and notes that oxygen per nasal cannula can be placed at 1-4L/min to keep oxygen saturation levels at or above 95%. BA places oxygen per nasal cannula on Patient X's at 2L/min. BA auscultates patient X's lung fields anteriorly and posteriorly and hears fine crackles throughout and wheezes in the right lower lobe. BA obtains a set of vital signs. The vital signs are as follows: Temperature (temporal)-99.9, pulse 108 beats per minute, respiratory rate 32 breaths per minute, blood pressure 104/68, and oxygen saturation 92% with oxygen at 2L/min. Before calling the health care provider to report the patient's status, BA looks patient X's chart. BA notices that other patient history not given in the handoff report includes the previous surgical history of appendectomy, bilateral cataract removal, laminectomy L4-L5, and a right total hip arthroplasty. Other medical history includes

gastrointestinal bleed, pneumonia, and deep venous thrombosis. Home medications listed in the chart include metoprolol, latanoprost, furosemide, calcium carbonate, and ibuprofen. Medications prescribed during this hospitalization include ondansetron, cefazolin, hydrocodone/acetaminophen, tramadol, and warfarin. BA also decided to look at the current lab results. The CBC components had normal values except the Hgb is 11.6, Hct 40%, WBC, and 12,000. The CMP had all normal values except for a sodium level of 133. The INR was 1.6.

The following is a report, known as SBAR, given to the health care provider by BA per telephone call . The SBAR is a communication tool containing the components of situation, background, assessment, and recommendation. The "R" (recommendation) will be omitted as this step is beyond the cognitive operations of cue recognition.

S: This is BA, and I am caring for patient X. I am concerned about a change in his respiratory status.

B: The patient is an 82-year-old who had a left total hip arthroplasty yesterday morning. His medical history includes hypertension, glaucoma, osteoarthritis, and GERD.

A: The assessments I am concerned about include dyspnea as he is using accessory muscles to breathe. His respiratory rate is 32, O2 sat was 82% on room air. I did put him on oxygen at 2L/minutes per nasal cannula, and his sat is at 92-93%. He has fine crackles throughout his lungs and wheezes noted in the right lower lobe. He is pale and looks to be in distress. He is disoriented to place and time. He is restless. His temp is 99.9. Heart rate is a little tachy at 108. The only lab I am concerned about is his INR of 1.6. He took warfarin 7.5 mg today.

This model case reflects all the defining attributes of cue recognition. BA recognizes initial cues of a change in the patient status during bedside report with the handoff nurse. She recognizes that the patient is having potential breathing difficulties and is restless. She gathers

more information from the handoff nurse by asking if the patient has any medical history related to the respiratory system or any respiratory problems during the hospital. After receiving a complete report from the handoff nurse, BA gathers more information by performing various patient assessments and looking at the patient's chart, particularly for previous medical and surgical history, medications, and recent lab results. The assessment component of the SBAR demonstrates BA determining relevant from irrelevant cues. Although abnormalities are present in the patient's abdominal assessment, heart auscultation assessment, hip dressing, lab values (H&H, Sodium, WBC), only the cues that are most relevant to the patient's change in respiratory status are reported to the health care provider.

Borderline Case

SJ, a nurse on a medical floor for one year, received bedside report from the handoff nurse regarding a 64-year-old female patient admitted for a deep venous thrombosis (DVT) of the right lower leg two days ago. The following is the report received from the handoff nurse: *"Patient X is a 64 year-year old female admitted two days ago by Dr. Z for a DVT of the right lower leg. She has a history of DVTs and had a hysterectomy about a month ago. Her medical history includes hypertension, coronary artery disease, diabetes type 2, osteoporosis, peptic ulcer disease and diverticulitis. Her surgical history includes the recent hysterectomy, tonsillectomy, carpal tunnel of the right hand, and bowel resection. Her vital signs have all been within normal limits during the shift. Her last set was temp of 98.7, pulse 88, respiratory rate 18, blood pressure 118/76, and oxygen saturation 99% on room air. She is oriented times four. Lung sounds are clear bilaterally. Heart sounds normal to auscultation. Abdomen is soft, nontender, and nondistended. Bowel sounds are active x4. She reported she had several bowel movements this morning. She is on a regular diet. She is voiding without difficulty. Urine is clear. Her right*

lower leg is slightly swollen, red, and warm to touch. Pedal pulses on bilateral lower extremities are palpable at +2. She has a thigh high ted hose on the left leg. She is on bedrest with bathroom privileges. She gets up independently but needs assistance with the IV pump. She got a little dizzy the last time I helped her up probably because she got up too quickly. The pain in her right leg is controlled with acetaminophen. She is on a heparin drip with the usual protocol. Her last aPTT was pretty low so I had to increase the drip rate quite a bit according to the protocol. Dr. Z was here a bit ago and ordered a hematocrit and platelet, so you need to look for that result. I think the next draw for the aPTT is around 10 tonight. I put the order in but can't remember the exact time. Her husband and two sons have come for visits today. She is very ready to go home and was wondering about just taking a pill to prevent clots. We talked about the reasons for the heparin drip in the hospital and taking warfarin in the hospital and at home to prevent a clot in the future. I believe that is all. Do you have any questions?"

SJ responded by stating, "No." SJ received a report on the other four patient assignments. During the last handoff report, the UAP approached SJ and reported that patient X put her call light on and stated that her stomach was hurting and felt very bloated. The UAP stated she took the vital signs, and they were as follows: temp 98.4, pulse 106, respirations 20, blood pressure 100/58, and oxygen saturation 94% on room air. SJ told the UAP that she would follow up after she was done getting the last patient handoff report. SJ headed into patient X's room after receiving the last patient report. Patient X was lying in bed and resting with her eyes closed. SJ decided to go to another assigned patient's room and allow patient X to rest. During SJ's assessment of another patient, another nurse on the unit call for SJ's assistance in patient's X's room. SJ entered patient X's room and noticed patient X sitting up vomiting up material that looked like coffee grounds. Patient X also stated, "I feel like I am going to pass out." SJ assisted

patient X to lie on her side and asked the UAP to assist the patient with the emesis basin. SJ assessed patient X's abdomen and noticed it was distended, soft, and tender. SJ obtained a set of vital signs. The vital signs were as follows: Temp 99.2, pulse 116, respiratory rate 22, blood pressure 92/50, and oxygen saturation 90% on room air. SJ obtained a fingerstick blood sugar, and the result was 104. SJ asked patient X what her bowel movements looked like this morning, and patient X responded, "They looked weird. really black and sticky." SJ told patient X that he would be calling Dr. Z regarding all the vomiting. SJ asked the patient if there was anything else she felt that was out of the ordinary. Patient X said that her right leg was also hurting and seemed to be more swollen. SJ looked in the patient chart for the current platelet and hematocrit results. The platelet level was 145,000, and the hematocrit level was 34%.

The following is the SBAR report, without the recommendation part as in the model case, given to the health care provider by SJ per telephone call:

S: This is SJ, and I am caring for patient X. I am concerned about a change in this patient's status.

B: The patient is a 64-year-old who was admitted for a DVT in the right leg. Her medical history includes hypertension, coronary artery disease, diabetes type 2, osteoporosis, peptic ulcer disease, and diverticulitis. She is on a heparin drip and warfarin. The drip was increased per protocol about 2 hours ago. The next aPTT draw will be at 10 pm tonight.

A: The assessments I am concerned about include coffee ground looking emesis, abdomen distended and tender, blood pressure of 92/50, heart rate of 116, and oxygen saturation of 90% on room air. She states that she had several bowel movements this morning that were black and sticky. She also stated that she felt like she was going to pass out when getting out of bed.

This borderline case reflects all the defining attributes of cue recognition except recognizing the presenting initial cues in the patient situation. SJ should have performed further assessments after the UAP reported that the patient complained of abdominal pain and feeling bloated as well as the blood pressure of 100/58 and heart rate 106 as both were significantly different from the values reported by the handoff nurse. The handoff nurse also reported that the patient got a little dizzy the last time she got out of bed. Other cues in the report that SJ should have initially recognized were the running heparin drip and the recent increase in the rate and the patient taking oral warfarin, another anticoagulant. If SJ would have recognized these initial presenting cues before seeing the patient, he or she may have further assessed the patient earlier when the UAP reported the abnormal symptoms and vital signs. The other defining attributes of cue recognition were evident in this case, as demonstrated by SJ gathering patient information when she went into the room after another nurse reported the patient vomiting material looking like coffee grounds. SJ obtained vital signs, performed a fingerstick blood sugar, performed an abdominal assessment, and inquired about bowel movements' frequency and characteristics. SJ did not include the irrelevant cues of the patient's report of increased pain and swelling, demonstrating the ability to distinguish between relevant and irrelevant cues, another defining attribute of cue recognition.

Contrary Case

CH, a nurse on a medical floor for two years, received a bedside report from the handoff nurse regarding a 70-year-old male patient admitted for pneumonia three days ago. The following is the report received from the handoff nurse.

"Patient Y is a 70-year-old male admitted for pneumonia three days ago. His medical history includes COPD, heart failure, and coronary artery disease. His surgical history includes

cholecystectomy, CABG X2, mitral valve replacement, and left rotator cuff repair. Patient Y is disoriented to place. He needs frequent reorientation and reminders to use the call light for help. He has both bed and chair alarms in place. Lung sounds are diminished throughout with rhonchi and wheezes noted in the left lower lobs. Patient Y has a productive cough that produces a moderate amount of green sputum. A sputum sample was sent to lab for a C&S. He is on 4 liters of oxygen per nasal cannula and oxygen saturations have remained at 95% and above. He gets short of breath with any activity. RT sees patient Y and he is on scheduled and PRN nebulizer treatments. He needs to be encouraged to complete the incentive spirometer exercises. He has normal heart sounds with an S3. His abdomen soft, flat, and nontender. He had a bowel movement today. Bowel sounds are active times four quadrants. He is on a heart healthy diet and tolerates it well. He has a Foley catheter in place draining clear yellow urine. His output is adequate. Upper peripheral pulses palpable at +2. Lower extremity pulses palpable and weak at +1. His Braden score is 12. He has a stage II pressure injury on his coccyx. The wound care team sees him daily and cares for the wound. He denies pain. He does have generalized weakness and needs assistance with ADLs. He gets into the chair with assist of 1. He gets very short of breath with activity. He has an IV in his left hand. He is on cefazolin. He had a CBC, BMP, and ABGs drawn this morning. His WBCs are still elevated at 13,000 and his BMP levels were all within normal limits. His PaO2 was a little low at 75%. His vital signs have all been pretty good all day. His last set was the following: Temp 100.8, pulse 100, respiratory rate 22, blood pressure 98/56, and oxygen saturation 95% with O2 at 4l/min per nasal cannula. The final results of his sputum C&S should be coming back soon so you will want to watch for that. Do you have any questions?"

CH responded, stating "no" and went to see patient Y. Upon entering the room, patient Y was receiving a nebulizer treatment from the RT. The RT stated that when she listened to patient Y's lungs, there was a large number of rhonchi and wheezes noted than earlier. She also stated that his oxygen saturation was down to 89% with the oxygen at 4L/minutes, so she decided to administer a nebulizer treatment. CH told patient Y that the RT she would be back after the nebulizer treatment was done. While walking out of the room, the RT told CH that she thought patient Y was getting confused as he was making some inappropriate comments when she came in to start the treatment. The RT asked CH what his most current vital signs were, and CH replied, “the last set the last nurse told me where just fine.” CH assessed two other assigned patients before returning to patient Y’s room. Patient Y was lying on his back with his eyes closed. CH stated she was in the here to do her assessment, and he did not respond. She stated his name loudly, and he still did not open his eyes or respond. She performed a sternal rub, and he moaned. CH called the Rapid Response team and gave them the following report when they arrived at the room:

“When I got report, the nurse said he was fine. Most of his assessments were normal for the previous nurse. His vitals were okay. His WBCs are still elevated which is normal for someone with pneumonia. His ABGs were okay. He did have some rhonchi and wheezes in the right lower lobe. The RT was in giving him a nebulizer treatment when I came on the shift. I guess she did say his oxygen saturation dropped to 89% with oxygen on per nasal cannula at 4L/min. She also thought he was maybe confusion. When I came in to assess him after the RT was done with the nebulizer treatment, he was lethargic and not responding until I performed a sternal rub. I didn’t assess anything else. I then called you guys.”

This contrary case does not reflect any of the defining attributes of cue recognition. CH does not recognize any of the initial presenting cues given in the handoff report. These unrecognized initial cues include disorientation, elevated WBCs, temp 100.8, pulse 100, and respiratory rate 22. It also can be assumed that CH does not recognize the risk factors of advanced age, stage II pressure injury, and pneumonia for sepsis. The RT's encounter did not produce any further initial cue recognition by CH even though the RT reported increased adventitious lung sounds, a decrease in the patient's oxygen saturation, and increased confusion. CH replied that the vital signs were "just fine" when the RT inquired about the last measurements. The only further information gathering that occurred when the nurse entered the room the second time was a level of consciousness assessment before calling for the Rapid Response team. During the patient report to the Rapid Response team, CH could not distinguish all the relevant and irrelevant patient cues. She did not include the most current vital sign measurements, which were very indicative of a patient in early sepsis. She included that the WBCs were elevated related to pneumonia and that RT had been in to assess the patient recently and perform a nebulizer treatment due to increased rhonchi and wheezes heard in the lungs. This case demonstrates that none of the defining attributes of cue recognition were evident.

Antecedents and Consequences

Walker and Avant describe antecedents as essential events or occurrences that must be present before the concept may occur (2019). The most common antecedent evident in the literature related to cue recognition is knowledge (Levett-Jones, 2010; Manias, Aitken, & Dunning, 2004; Muntean, 2012; O'Neil, Dluhy & Chin, 2005; Reimer & Moore, 2010; Thiele et al., 1986). Levett-Jones suggests that nurses need strong foundational knowledge in physiology, pathophysiology, pharmacology, epidemiology, culture, ethics, law, and evidence-based practice

to adequately and accurately perform cue recognition (2010). There is repeated evidence in the literature of contextual factors that affect a nurse or student nurse's cue recognition ability. Dickison and colleagues describe a contextual factor as a "factor that is not a constituent of the construct but could influence the outcome of the cognitive operation" (2016, p. 4). Maturity, stress, experience, intuition, confidence, and knowing the patient are all consider contextual factors that may affect nurse's cue recognition ability (Levett-Jones et al., 2010; O'Neil, Dluhy, & Chin, 2005). The newly proposed NCSBN Clinical Judgment Measurement Model categorizes the contextual factors into individual and environmental contextual factors. (Dickison, Haerling, & Lasater, 2019). Knowledge is considered an individual contextual factor in this model but for this concept analysis, knowledge is the primary antecedent of cue recognition as other literature supports that knowledge is necessary for patient cue recognition.

Consequences of a concept are simply the outcomes of the concept occurrence (Walker & Avant, 2019). The literature describes both the consequences of accurate cue recognition and the consequences of inaccurate or incomplete cue recognition. Inaccurate or incomplete cue recognition leads to poor patient clinical decisions (Alfaro-LeFevre, 2009; del Bueno, 1983; Elstein, Shulman, & Sprafka, 1978; Levitt-Jones, 2010). Efficient, accurate patient clinical decisions result from complete and accurate cue recognition (Muntean, 2012).

Empirical Referents

Defining the empirical referents is the last step of Walker and Avant's concept analysis framework and includes recognizing or measuring the defining attributes of the concept (2019). Instrument development relies on the defined empirical referents of the concept for both content and construct validity. Clinicians rely on the clear, observable empirical referents of the concept when caring for clients (Walker & Avant, 2019).

The defining attributes of cue recognition could be the performance indicators for the assessment of cue recognition performance among nursing students in simulation and clinical. A new clinical judgment measurement tool with each step of the model could be developed. Each defining attribute would include specific designated criteria that must be met to meet a satisfactory score. For example, the defining attribute of recognizing the initial cues would include all the cues that a student nurse should recognize from a shift report before going into the patient room during a simulation. *The Lasater Clinical Judgment Rubric* is commonly used to evaluate students in the simulation and clinical settings (Adamson et al., 2012). This measurement tool's validity and reliability have been confirmed using various approaches (Adamson et al., 2012). This measurement tool could be used as a guide in the development of a similar tool to measure the cognitive construct of cue recognition among nursing students.

Nursing student performance regarding cue recognition in the clinical learning area could be evaluated through patient or clinical instructor interviews. The students could use journal entries of their cue recognition strengths and weaknesses after each clinical. Meaningful feedback could be given by the clinical instructor related to their journal reflections about their cue recognition performance.

Conclusion

This concept analysis unveiled the defining attributes, antecedents, and consequences of cue recognition in the context of undergraduate nursing students. The following definition of cue recognition has been developed after the completion of this analysis:

A nurse's cognitive process during all patient encounters in which initial cues are recognized, further patient information is gathered, and cues are distinguished as relevant or irrelevant before the interpretation of the cues can occur.

This concept analysis of cue recognition lays the foundations for nurse educators to integrate cue recognition teaching-learning strategies into nursing curriculum, identify cue recognition competence among nursing students through measurement tools, and ultimately prepare entry-level nurses with the necessary cue recognition ability to make accurate and thorough patient care decisions and actions. Further research on the concept of cue recognition in the context of the operational definition to identify valid and reliable measurement tools is necessary. Nursing students who fail to meet identified cue recognition competencies will not be able to progress to the next steps of the clinical judgment model. Much of the existing literature of cue recognition in nursing focuses on the differences among novice and expert nurses; and the influences on cue recognition ability (Burbach & Thompson, 2014). Existing evidence on the cue recognition ability of nursing students and entry-level nurses, along with prospective research related to the defining attributes, antecedents, and consequences of cue recognition, will continue to improve the education to practice gap for entry-level nurses. Closing this gap is imperative for overall patient outcome improvement.

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Chapter 3

Abstract

The effects of classroom quizzing on undergraduate baccalaureate nursing students' patient cue recognition ability and long-term retrieval

Background: A significant transformation in evaluating clinical judgment among entry-level nurses has charged undergraduate nursing education programs to assess current teaching and evaluation methods of student clinical judgment. This study aimed to assess the effect of classroom quizzing as a test-enhanced learning (TEL) strategy on nursing students' short-and long-term ability to retrieve previously learned client cues.

Method: This study used a quasi-experimental design comparing two groups of first-semester junior-level nursing students' ability to retrieve learned client cues on a posttest and retention questions on a unit exam, one with and one without the TEL intervention of classroom quizzing.

Results: No significant differences in short- and long-term cue recognition retrieval ability to retrieve previously learned client cues were found between the group who received classroom quizzing and the group who did not receive classroom quizzing.

Conclusion: Further research in TEL strategies' effects on retrieval ability among nursing students needs to be conducted.

Paper 2

The effects of classroom quizzing on undergraduate baccalaureate nursing students' patient cue recognition ability and long-term retrieval

Introduction

Nursing programs are graduating students who successfully pass the NCLEX but are not prepared to practice in complex healthcare systems (Benner, 2015). Years of research and practice analyses by the National Council State Board of Nursing (NCSBN) concluded that current item types on the NCLEX-RN do not measure the cognitive operations of clinical judgment required by entry-level nurses (Dickison, et al., 2019). The multiple-choice questions fail to capture the complexity of the practice setting only measuring the candidate's content knowledge. Although content knowledge is an essential component in clinical judgment, entry-level nurses cannot rely solely on content knowledge to make sound clinical judgments (Dickison, et al.). Responding to these alarming findings, the NCSBN developed a new clinical judgment model, the Clinical Judgment Measurement Model (CJMM), and a new nursing licensure exam, the Next Generation NCLEX-RN, with item types that more accurately measure clinical judgme. The multilayered model includes a measurable layer three, inclusive of cognitive operations nurses must include when making clinical decisions (Dickison et al.). The cognitive operations include recognizing cues, analyzing cues, generating solutions, prioritizing hypotheses, taking action, and evaluating outcomes (Dickison et al.)

Current nursing clinical judgment models, most commonly used in nursing programs, do not include the cognitive operations included in the CJMM. Cue recognition is the first cognitive operation in the measurable layer three of the CJMM. Recognizing client cues aims to prevent poor patient outcomes due to incorrect actions and mistakes (Alfaro-LeFevre, 2009). The

exclusion of the cognitive operation of cue recognition in current clinical judgment models and the lack of empirical evidence on the most effective teaching-learning strategies for nursing student cue recognition development calls for an investigation into the topic of nursing student cue recognition development.

Purpose

The emergence of the new CJMM and NGN challenges nursing education to re-envision current teaching and evaluation methods of student clinical judgment. The purpose of this study was to evaluate the effect of classroom quizzing as testing enhanced learning (TEL) strategy on nursing students' short-and long-term ability to retrieve previously learned client cues. The research questions and hypotheses guiding this study were:

Question 1: Does cue recognition ability differ between baccalaureate nursing students taught by lecture alone and those taught by lecture with classroom quizzing?

Hypothesis 1: Baccalaureate nursing students taught by lecture with classroom quizzing will demonstrate significant differences in scores on a post-intervention test compared to students taught by lecture alone.

Question 2: Does long-term retrieval ability differ between baccalaureate nursing students taught by lecture alone and those taught by lecture with classroom quizzing?

Hypothesis 2: Baccalaureate nursing students taught by lecture with classroom quizzing will demonstrate significant differences in scores on unit exam retention questions compared to students taught by lecture alone.

Literature Review

Cue recognition. Cues are defined in healthcare as "identifiable, physiological or psychosocial changes experienced by a patient, perceived through history or assessment and understood in relation to a specific body of knowledge and philosophical belief "(Levett-Jones et al., 2010). Client cues are disclosed in handover shift reports, patient history, patient charts, results of investigations, and nursing or medical assessments. Nurses are also triggered to recognize a client cue through the recall of knowledge, which requires an understanding of a plethora of knowledge such as physiology, pathophysiology, pharmacology, epidemiology, therapeutics, culture, and evidenced-based care (Levitt-Jones et al., 2010).

Early research on cue recognition ability among nursing students suggests that cue recognition can be learned and introduced early in nursing courses through specific instructional formats, deliberate presentation of patient cues, and didactic interactions (Thiele et al.,1986; Welk, 1994; Welk, 2002). Benner (2001) suggests that nursing students need instruction on how to pay attention to relevant cues, how cues lead to clinical decisions, and the strong association between accurate cue recognition and patient outcomes. Welk (1994) studied the effects of two different instructional formats on nursing students' abilities to recognize cues in patients with pulmonary edema. A typical example of pulmonary edema that included both vital signs and symptoms and the two nonessential signs and symptoms of age and gender was given to one group of participants to review. The other group received a textbook example of pulmonary edema developed from four different textbooks. After studying the various examples and taking notes, each group completed the same test. There was a statistically significant difference in the number of correct responses related to essential cues among the group who read the typical example (Welk, 1994). Welk expanded her research on using typical and non-typical examples

of patient scenarios to enhance cue recognition skills among nursing students in a study that aimed to determine if the type of example design offered to the students resulted in different abilities to recognize essential and nonessential cues of a patient experiencing a heart attack (2002). Some of the results were statistically significant among the groups who read the typical examples, including a higher performance in identifying the five essential cues of a heart attack and the fourteen nonessential cues. There was also a significant difference in recognizing the cues that were not specific to a heart attack situation (Welk, 2002). Thiele et al. (1986) developed five different clinical simulations focused on recognizing relevant cues, linking and sorting the cues, and making a decision based on clinical situations. The post-tests performance indicated a significant difference in student selection of relevant cues compared to the pretest results (Thiele et al., 1986).

Novice and expert nurses differ in client cue recognition ability. Some studies on cue recognition suggest that expert nurses collect more cues than novice nurses (Itano, 1989; Hoffman, Aitken, Duffield, 2009). The types of cues collected, cue clustering, and the use of cues to make clinical decisions vary among novice and expert nurses. Expert nurses are more proficient in selecting the most relevant cues (Hoffman, Aitken, Duffield, 2009; Lamond & Farell, 1998; Reischman & Yarandi, 2002; Taylor, 2002; Thiele et al., 1986) and gathering a more comprehensive set of client cues during clinical decision-making situations (Hoffman, Aitken, Duffield, 2009). Expert nurses who cluster cues more frequently take a proactive approach to the patient situation to prevent a potential patient problem (Hoffman, Aitken, & Duffield).

Limited or impaired knowledge of the novice nurse may affect their ability to recognize cues leading to a decision based on limited information (Muntean, 2012). Novice nurses notice

fewer cues and focus more on single cues to develop a hypothesis (Tanner et al., 1987; Taylor, 1997). Benner (2006) adds that a novice nurse's noticing ability may not be developed at a level to recognize relevant cues because of a lack of exposure to similar patient situations. Last, novice nurses cluster cues less frequently and efficiently, leading to a reactive client decision plan rather than a proactive plan after a patient problem presents (Hoffman, Aitken, & Duffman, 2009).

Retrieval-Based Learning

From elementary-aged students to adult learners in secondary and graduate educational programs, retrieval-based learning has been studied extensively across all students' levels. Retrieval-based learning involves an individual engaging in a retrieval activity in which the learning material is placed aside, and the individual attempts to actively retrieve encoded information in memory (Nunes & Karpicke, 2015). Retrieval processes are enforced during learning activities, including answering a factual question, explaining a concept, making an inference, applying knowledge to a new problem, and producing a creative idea (Karpicke and Grimaldi, 2012). Retrieval-based learning practices enhance long-term retention and retrieval abilities (Karpicke & Roediger, 2008; Karpicke & Blunt, 2011) and lead to more meaningful learning (Karpicke & Roediger, 2007; Karpicke & Zaromb, 2010; Karpicke, 2012).

Test-enhanced learning (TEL). TEL occurs when the "retrieval practice occurs in the context of a test" (Green, Moeller, & Spak, 2018, p. 337). TEL challenges educators to use tests as a learning tool rather than assessing student knowledge (Green, Moeller, & Spak, 2018). The frequency of testing, the timing of tests, test formats, the inclusion of feedback, and test settings are components of TEL to consider when incorporating TEL in the learning environment.

The frequency of testing has been studied in a variety of settings with conflicting findings. Some study results have found no significant differences in the rate of classroom

testing and the effect on final student performance or course grade (Anderson, 1984; Burns & Vinchur, 1992; Connor &Greene, 2000; and Olsen, Weber, and Dorner, 1968). Other studies suggest frequent testing improved student performance. A study conducted on high school algebra students determined that frequent testing led to course grade improvement compared to those students who completed less testing on the same material (Kika, McLaughlin, & Dixon, 1992). Another study involving multi-sites and thirty-five different subject classrooms found that students in the classes with frequent testing outscored fifty-nine percent of the students in the classroom in which traditional testing was used (Bangert-Drowns, 1991).

Another topic that has been studied related to TEL is the timing of the tests. Delaying final tests after the retrieval practice times produces improved test performance (Roediger & Karpicke, 2006; Wheeler, Ewers, & Buonanno, 2003; Wheeler & Roediger, 1992). Wheeler, Ewers, and Buonanno (2003) conducted a study with psychology students to determine recall among groups who used repeated study and another group who used repeated testing. The group engaged in repeated testing recalled more information after seven days from the last test session than the other group who participated in the repeated study (Wheeler, Ewers, & Buonanno). Studies have also found that the longer time between practice test sessions leads to increased retention (Bahrick et al., 1993; Carpenter, Pashler, & Cepeda, 2009).

Different test formats have revealed mixed results related to retention and test performance. The most common formats for recall tests that have been studied are short answer and multiple choice. The individual's active production of information is required in a short answer test format (Halamish & Bjork, 2011). McDaniel, Anderson, Derbish, & Morrisette (2007) describe short answer format tests as recalling crucial information and multiple-choice tests as quizzing on required recognition. In the study by McDaniel et al., recall quizzes using

short answers had more of an effect on the unit exams' performance scores than recognition quizzes using multiple-choice questions (2007). In a similar study by Kang, McDermott, and Roediger (2007), the differences in performance between short answer questions and multiple-choice questions were explored with the addition of feedback after each type of question. The results concluded that there was no statistical finding among the students who performed better on the short answer questions on the quiz in relation to their performance on the short answer questions on the final assessment (Kang, McDermott, & Roediger). Literature suggests there is no difference in retention ability of retrieval practice when tests are in the short answer format or the multiple-choice question format (Clariana & Lee, 2001; Nungester & Duchastel, 1982).

The study results related to the effect of feedback after testing varies. Several studies suggest that feedback after immediate testing produces a re-exposure condition among the individual, leading to improved immediate performance compared to individuals who used study and test practice strategies without feedback (Carpenter et al., 2008; Thompson, Wegner, & Bartling, 1978). However, it is essential to note that the study by Carpenter et al. (2008) resulted in a performance decrease at the fourteenth and forty-two-day delayed testing times. In a study by Wiklund-Hornqvist, Jonsson, & Nyberg (2014), participants in the repeated testing with feedback demonstrated significantly improved learning compared to the rereading group. Other research related to feedback after testing concludes that providing feedback in the correct form is essential to prevent erroneous learning of the material (Fazio et al., 2010; Pashler et al., 2005). The timing of feedback that has the most effect on student learning and improved performance is immediately after the testing occurrence, as discovered in multiple studies (Brosvic et al., 2005; Carpenter et al., 2008; Kulik & Kulik, 1988; McDaniel & Fisher, 1991; Thompson et al., 1978).

The TEL setting has been found to have some influences on student outcomes. A typical environment to deliver practice tests is in the classroom. Classroom quizzing is an effective strategy to promote retrieval practice (Mayer et al., 2009; Campbell & Mayer, 2009; McDaniel et al., 2007; Roediger et al., 2011). McDaniel et al. performed a study in middle school classrooms in which three low-stakes quizzes were administered before the classroom lecture, immediately following the lecture, and one day before the unit exam on the same topics (2011). The scores on summative tests, including the end of the semester and end of the year, showed a thirteen to twenty-five percent improvement in performance and long-term retention (McDanieal et al., 2011). Another study compared two groups of students in a classroom lecture in which one group answered questions with a handheld remote during the PowerPoint presentations, and the other group read a slide with an explanation (Campbell & Mayer, 2009). Both groups received further clarification from the teacher. During the lecture, the group who answered questions outscored the other group on retention and transfer of knowledge tests (Campbell & Mayer, 2009).

Theoretical framework

The framework for this study was the Information Processing theory, a cognitive theory explaining how individuals learn and remember information (Brown, 2015). . Information learned in context has more meaning and is more likely to be stored in long-term memory through encoding to be retrieved more quickly than memorized information. The Information Processing Theory includes sensory memory, working or short-term memory, and long-term memory (Brown).

Participants in both the control and treatment group viewed the lecture video, which according to the theory, activates the participants' sensory memory through the audiovisual

format. The lecture focused on the care management of a client with COPD including teaching about the cues exhibited in a client with COPD. The control group was not given the opportunity to engage in further processing, elaboration, and encoding of the information through classroom quizzing before viewing the patient scenario video. The treatment groups viewed the lecture but continued to process and give attention to the lecture's information through the active learning strategy of classroom quizzing. This processing, rehearsal, and repetition of the information were aimed at making the information more meaningful. Roediger and Butler (2011) suggest that individuals who engage in reprocessing the information during the retrieval effort will lead to the elaboration of memory and a higher likelihood of retrieving the information later. Each participant's long-term retrieval ability was measured by their performance on five cue recognition questions on the unit exam one week following the learning session (Figure 3.1)

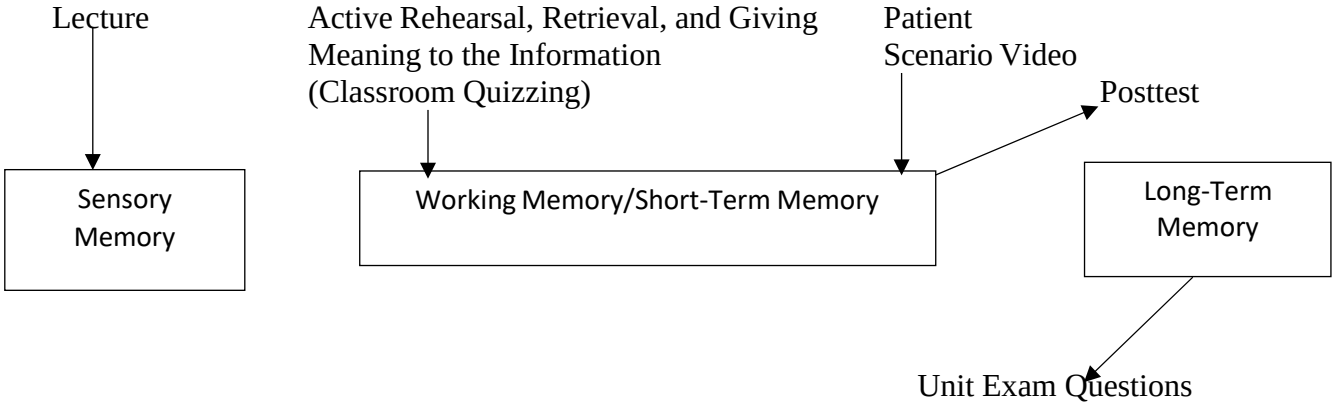

Figure 3.1. Information Processing Theoretical Framework

Methods

Design. This was a quasi-experimental design comparing two groups of first-semester junior-level nursing students' ability to retrieve learned client cues on a post-test and unit exam, one with and one without the TEL intervention of classroom quizzing. The aims of this study

were to assess the effect of classroom quizzing as a TEL strategy on students' short-and long-term ability to retrieve previously learned client cues.

Setting. The study was conducted at a baccalaureate undergraduate nursing program of a Midwestern university in the United States. This nursing program is comprised of three sites in various locations within the same state. The two largest sites were used to recruit the participants. The nursing program is four semesters in length.

Sample. A convenience sample of 33 first-semester junior level baccalaureate nursing students enrolled in a required medical-surgical nursing course was recruited to participate in this study. The inclusion criteria were all junior-level first-semester nursing students enrolled in the course. Students who were repeating the course due to previously failing or withdrawing from the course were excluded from the study. We are not aware of any literature addressing cue recognition in nursing students that could inform sample size calculations. The studies on cue recognition that do exist do not, however, have statistically significant findings. The sample sizes in these studies have been relatively small, at less than sixty participants. Cohen suggests a power of 80% with a large effect size and a significance level of 0.05 for the ANCOVA statistical test using for data analysis in this proposed study (Cohen, 1992). A priori power analysis was conducted using G-power to avoid committing a Type II error. Using an effect size of .40, an alpha level of .05, and a power of .80, the suggested sample size of 52 was determined to obtain a power of .80.

Randomization. The participants were randomly assigned to either a treatment or control group by simple randomization. The researcher delivered the classroom session via Zoom due to class delivery and space constraints related to COVID 19. During the viewing of the recorded lecture, the researcher randomly assigned the students to the control or treatment group by

selecting every other student on the Zoom screen as a control or treatment subject. Each participant was sent a separate Zoom link according to their randomly assigned group. See Figure 3.2 for the study flow diagram.

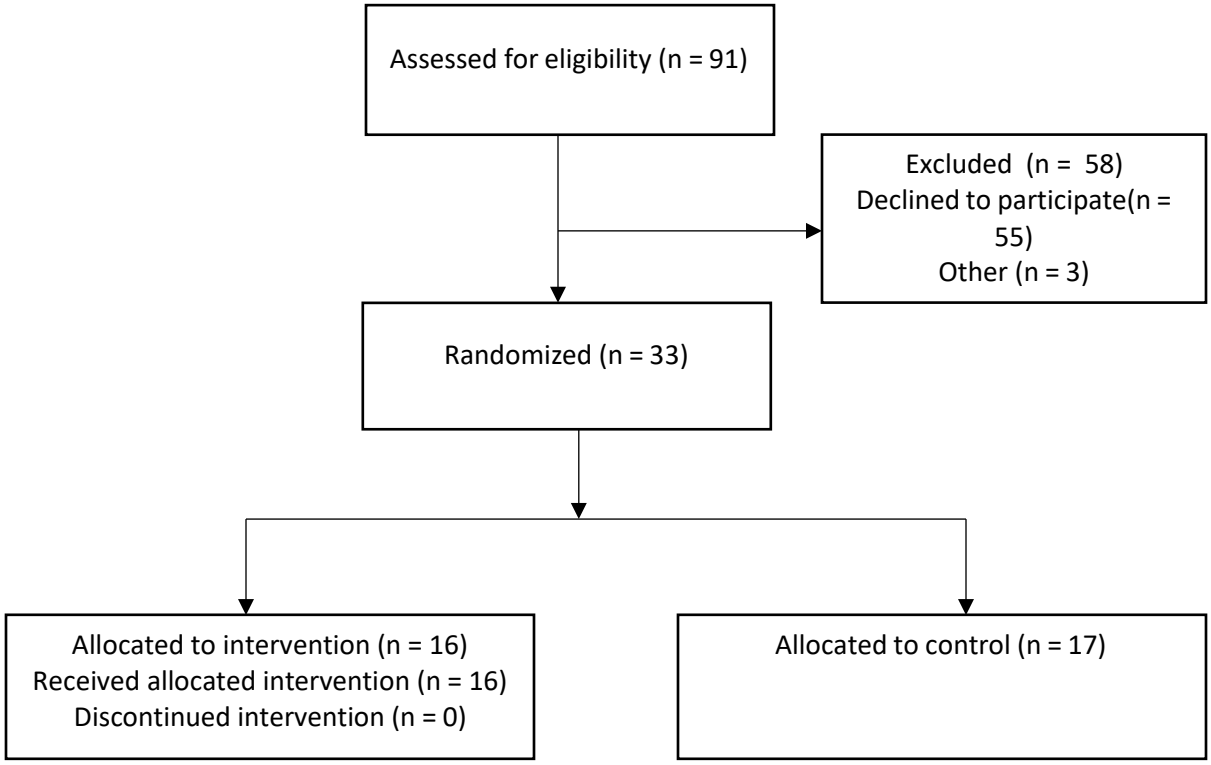

Figure 3.2. Study flow diagram

Intervention: Classroom Quizzing

The study intervention in this study was the active learning strategy of classroom quizzing that occurred with the treatment group. Classroom quizzing, a test-enhanced learning (TEL) strategy, effectively promotes retrieval practice and increases long-term retention (Campbell & Mayer, 2009; Maye et al., 2009; McDaniel et al., 2011; Roediger et al., 2011). Five questions were included in the classroom quizzing session for the intervention group. Previous research on classroom quizzing used two to five questions for each fifty-minute class period (Elliot, 2003; Bojinova & Oigara, 2013; Burnstein & Lederman, 2001). After all the students

answered each question, the researcher provided feedback and allowed the participants to ask questions and further discuss if needed. Providing feedback in the correct form is essential to prevent erroneous learning of the material (Fazio et al., 2010; Pashler et al., 2005).

Measurements

Pretest. A pretest was administered to determine the participant's baseline knowledge of the cues related to a client with COPD. All participants completed the pretest upon entering the classroom for the educational intervention session. The pretest questions included a short scenario of a patient experiencing an exacerbation of COPD followed by two open-ended questions related to the clinical cues of the client with COPD. The expected answers on the open-ended pretest questions were taken from two nursing textbooks; both required to purchase by all the students. A simple frequency count for signs and symptoms of COPD, including abnormal diagnostic results in the two textbooks, established content validity. Walsh used this method to develop content validity for signs and symptoms of myocardial infarction in her dissertation (2010). The two questions were formatted as short-answer on the pretest. Short answer formats are more effective at imposing individuals to recall information than merely recognizing the correct answer from a choice of answers in a multiple-choice format (Smith & Karpicke, 2014). The total possible correct answers were 23.

Post-test. All participants completed the post-test immediately following the viewing of the client scenario video. The post-test included two open-ended questions related to the client scenario video titled "Mrs. Smith," A hand-off report was included in the video with some client cues reported. The questions were the same as the pretest questions but were stated in the context of "the patient you observed in the client video…" The expected responses included a portion of the same responses as identified on the pretest. The total possible correct answers were 11.

Retention exam questions. The normally scheduled unit exam included five questions related to COPD's relevant client cues. This exam was administered one week following the learning session to measure long-term retrieval ability. Readability and content validity were evaluated by nursing faculty with at least five years of teaching experience. The panel of reviewers agreed substantially on each of the items. The content validity index at the item level for relevance was 1.0 for 3/5 items and 0.8 for 2/5 items.

Procedure

Approval from the University's Institutional Review Board was obtained before introducing the study to potential participants. The researcher introduced the study and invited participants during a regular class session two weeks before the study began. All students were informed that this learning session was part of the regular course, participation in the study was voluntary, and all the data collected will be anonymous.

All participants either attended the face-to-face classroom session or joined class remotely if on quarantine status due to COVID 19 restrictions. Two participants in the treatment group attended the classroom session via Zoom. This classroom session focused on the nursing care of a client with COPD**.** All students completed the pre-intervention test at the beginning of the learning session using the Respondus Lockdown Browser to protect the test's security and decrease the data's contamination. The participants attending remotely were required to have webcam monitoring for further protection of the test's security. A video recorded lecture on assessing and managing the care for a client with COPD was played for all students. All participants had access to the same assigned readings from the required textbooks for the course, the opportunity to engage in any online learning resources provided in the course syllabus, and attended prior learning sessions about the concept of gas exchange. After viewing the recorded

lecture, participants in the treatment group exited the online session and joined another online session with a provided Zoom link. The control group participants remaining on the beginning remote session viewed the client scenario video, followed by completing the post-test using the Respondus Lockdown Browser.

Each participant in the treatment group joined the Zoom online session with the researcher. They were asked to answer the five classroom questions using their smartphones or computers through Poll Everywhere, an online polling platform. The researcher provided feedback after each question and allowed time for questions as well as further discussion. The questions' scores were not recorded as the classroom quizzing was a learning activity, not an evaluation method. After completing the classroom quizzing session, the participants viewed the client scenario video, followed by completing the post-test using the Respondus Lockdown Browser. The two participants who attended via Zoom also used a webcam during the post-test completion.

The five retention questions were included in the regularly scheduled unit exam. This exam was administered to all participants one week following the classroom session. All participants completed the unit exam remotely with the required Respondus Lockdown Browser and a webcam to ensure exam security and decrease data contamination.

Data Analysis

All analyses were conducted in SPSS for Windows (version 27.0.0.0). Data were analyzed for missing data and outliers. Shapiro-Wilk tests assessed normality with corresponding histograms, including evaluation for skewness and kurtosis. Descriptive statistics, including means, standard deviations, frequency counts, and correlations, were computed using standard procedures. The success of randomization to group was evaluated by comparing demographic

variables between groups using standard chi-square (nominal variables), Linear-by-Linear Association (ordinal variables; Agresti, 1996), and independent-sample t-test statistics. Two independent one-way analysis of covariance (ANCOVA) tests were used to evaluate hypotheses (or questions) 1 and 2. When evaluating hypothesis 1, post-test responses entered the analysis as the dependent variable. When evaluating hypothesis 2, unit exam question responses entered the analysis as the dependent variable. GPA and pretest scores were entered as covariates in both models. A significance level of 0.05 was used for all analyses in this study. Item difficulties, point biserial, and item discrimination indexes were also calculated on the five retention questions to evaluate quality of the questions (Mehta & Mokhasi, 2014).

Results

Description of the sample. The response rate for recruitment was 39.6% (36/91) before data collection began. From signing the consent to the beginning of the study, three participants dropped the course in which the study occurred, resulting in an overall response rate of 36.3%. In total, 33 students participated in this study. As displayed in Table 1, most participants were 18-21 years of age (78.8%), female (90.9%), and white (93.9%; 75.8% in the 18-21 age range, 79.8 % female, and 87.9% white. All 2 by 2 chi-square analyses failed to meet minimum cell sample size requirements (i.e., 5 per cell). Fisher's Exact Test was used to evaluate the significance level in each case. The only significantly different demographic between the participants of the two groups was the grade point average (GPA), $t(31) = -3.335$, $p = .002$ (Table 3.1)

Table 3.1 Demographic Characteristics by Assigned Group and Total Sample

Characteristic	Treatment Group (n = 16)		Control Group (n = 17)				Full Sample (*N* = 33)	
	n	%	*n*	%	$\chi^2(1)$	*p*	*N*	%

Sex					.437	.601		
Female	14	87.5	16	94.1			30	90.9
Male	2	12.5	1	5.9			3	9.1
Age					1.729	.189		
18-21	14	87.5	12	70.6			26	78.8
22-25	2	12.5	4	23.5			6	18.2
30-33	0	0	1	5.9			1	3.0
Race					2.004	.367		
White	15	93.8	16	94.1			31	93.9
Asian	0	0.0	1	5.9			1	3.0
Other	1	6.3	0	0.0			1	3.0
Post-Secondary Education					.002	1.000		
Yes	1	6.3	1	5.9			2	6.1
No	15	93.8	16	94.1			31	93.9
Knowledge Level					.585	.444		
None	1	3.0	0	0.0			1	3.0
Little	7	43.8	7	41.2			14	42.4
Moderate	8	50.0	10	58.8			18	54.5
Experience Level					.000	1.000		
None	5	31.3	6	35.3			11	33.3

Little	7	43.8	6	35.3			13	39.4
Moderate	3	18.8	4	23.5			7	21.2
High	1	6.3	1	5.9			2	6.1
	M	*SD*	*M*	*SD*	*t*(31)	*p*	*M*	*SD*
GPA	3.566	0.269	3.251	0.274	-3.335	.002	3.404	0.312
Midterm Grade	2.250	1.065	1.941	0.556	-1.054	.312	2.091	0.843

Note: GPA = Grade Point Average. Categories with no response omitted. All 2 by 2 chi-square analyses failed to meet minimum cell sample size (i.e., $n = 5$) requirements; in all cases, reported probabilities are based upon Fisher's Exact Test. All group comparisons involving ordinal-level variables were evaluated using the Linear-by-Linear Association method, which accounts for ordering of the data and is evaluated as chi-square with df = 1 (Agresti, 1996).

Within-group (control vs. treatment) inspection of continuous variables indicated no univariate outliers with some skew identified through visual inspection of histograms and Shapiro-Wilk tests. However, the small group sample sizes limited interpretability of Shapiro-Wilk, and analysis of skew and kurtosis statistics suggested all variables demonstrated acceptable violation of normality assumptions when analyzed in the full sample and by randomly assigned group membership Furthermore, evaluation of multivariate residuals generated through regression indicated normality based upon visual inspection of histograms and P-P plots. Finally, an inspection of Mahalanobis distance statistics indicated no within-group multivariate outliers. As such, transformations were not deemed necessary for any study variable.

Pretest Scores

The pretest scores for the control group ranged from 13% to 26%, with a mean of 17%. The treatment group pretest scores ranged from 9% to 43%, with a mean of 23%. There were statistically significant mean differences in the pretest scores of the groups ($p < .05$) (Table 3.2).

Posttest Scores

The post-test scores for the control group ranged from 37% to 82%, with a mean of 59%. The treatment group post-test scores ranged from 22% to 72%, with a mean of 49%. Both groups showed an increase in the percentage scores from pretest to post-test, with the control group experiencing approximately a 42% increase and the treatment group experiencing approximately a 26% increase. No statistically mean differences were found in the post-test scores among the groups ($p > .05$) (Table 3.2).

Retention Question Scores

Participants completed five retention questions on cues of a client with COPD, included in the regular unit test. The question scores for both the control and treatment groups ranged from 60% to 100%. The treatment group showed a slightly higher mean of 90% compared to a mean of 85% for the control group. No statistically mean differences were found in the retention question scores among the groups ($p > .05$) (Table 3.2). Item analysis was conducted on the five retention questions. Item difficulty for questions two and four were 1.00, over the acceptable range of .30 to .70. Questions one and three were also over the upper end of the acceptable range for item difficulty. The item difficulty for question five was in the acceptable range of .30-.70. All the question point biserial results were within ranges considered fair to good. Item discriminations for questions one and five were in or above the acceptable range of 0.20 to 0.35. (Table 3.3)

Table 3.2 Descriptives for Primary Study Variables by Assigned Group and Total Sample

Characteristic	Treatment Group (n = 16)		Comparison Group (n = 17)				Full Sample (*N* = 33)	
	M	*SD*	*M*	*SD*	*t*(31)	*p*	*M*	*SD*
Pretest	.2283	.0932	.1688	0.0373	-2.433	.003	.1976	1.734
Posttest	.4851	.1503	.5879	.1202	2.331	.333	5.88	1.763
Retention Questions	.9000	0.1265	.8471	.1125	-1.589	.108	4.33	0.595

Note: All values converted to percentages. Retention question scores represent the mean of 5 items embedded in the unit exam for the course.

Table 3.3 Retention Questions Item Difficulty, Point Biserial, and Discrimination Index

Question	Item Difficulty	Point Biserial	Discrimination Index
1	.93	.36	0.22
2	1.00		
3	.97	.40	0.11
4	1.00		
5	.36	.75	0.67

Table 3.4 presents bivariate correlations of primary study variables organized by group membership. Pretest total quiz scores were significantly positively correlated with post-test total quiz scores within the control group members only, r = .65, p = .005, suggesting 42.3% of the variance in posttest scores can be explained by pretest scores for these participants, r2 = .423. Though no other bivariate relations were significant, several correlations were at the higher end of a small effect size (i.e., 0.2- 0.49, Cohen, 1988), suggesting small sample sizes may have limited study power to identify essential relations. For example, GPA and midterm grades, pretest and post-test quiz scores, and posttest scores and midterm grades each demonstrated small (0.45) positive correlations in treatment group members.

Table 3.4 Correlations of Continuous Variables by Group

Variable	1	2	3	4	5
1. GPA	-	-.39	-.28	.15	-.03
2. Pretest Total	-.25	-	.65**	.05	-.15
3. Posttest Total	.08	.45	-	-.05	-.27
4. Retention Question Total	-.31	-.10	-.20	-	.04
5. Midterm Grade	.45	-.06	.45	.10	-

Note: GPA = Grade Point Average. The results for the control group (n = 17) are shown above the diagonal. The results for the treatment group (n = 16) are shown below the diagonal. Posttest quiz items administered during the school semester. Final exam scores represent the mean of X items embedded in the final exam for the course. **$p < .01$

Research question one. The first research question was: Does cue recognition ability differ between baccalaureate nursing students taught by lecture alone and those taught by lecture with classroom quizzing as measured by a post-intervention test? They hypothesis was : Baccalaureate nursing students taught by lecture with classroom quizzing will demonstrate significant differences in scores on a post-intervention test compared to students taught by lecture alone. This question was answered using an ANCOVA. Results of the ANCOVA used to evaluate hypothesis 1 are displayed in Table 3.5. As noted above, GPA was included as a covariate due to significant group differences in the variable. Yet, ANCOVA results indicated GPA did not account for significant differences in post-intervention quiz scores, p = .795. Pre-intervention quiz scores, however, did account for approximately 22.2% (Ηp2 = .222) of unique variance in in post-intervention quiz scores, which was significant, p = .007. Likewise, group membership was a significant predictor of post-intervention quiz scores, p = .005, Ηp2 = .243.

However, examination of estimated means based upon the ANCOVA indicated results were contrary to the research hypothesis. After adjusting for GPA and pre-intervention quiz scores, participants in the comparison condition reported higher post-intervention quiz performance, M = 6.902, SE = 0.425, 95% CI [6.033; 7.770], relative to participants randomly assigned to receive the intervention, M = 4.792, SE = 0.442, 95% CI [3.889; 5.695].

Table 3.5 ANCOVA Statistics Used to Evaluate Study Hypothesis 1

Variable	Mean Square	*df*	*F* ratio	*p*	η_p^2
Intercept	1.097	1	0.487	.491	.017
GPA	0.155	1	0.069	.795	.002
Pretest	18.654	1	8.273	.007	.222
Group Membership	21.034	1	9.329	.005	.243
Error	2.255	29			

Note: GPA = Grade Point Average. Posttest quiz scores were entered as the dependent variable.

Research question two. The second research question was: Does long-term retrieval ability differ between baccalaureate nursing students taught by lecture alone and those taught by lecture with classroom quizzing as measured by unit exam questions? The hypothesis was: Baccalaureate nursing students taught by lecture with classroom quizzing will demonstrate significant differences in scores on unit exam retention questions compared to students taught by lecture alone. Research question two was also evaluated using ANCOVA. Results are presented in Table 3.6. When predicting performance on relevant items administered during the course final, neither GPA nor pre-intervention quiz performance were significant, ps = .565 and .654, respectively. Though estimated marginal means were ordered according to the

research hypothesis such that participants assigned to receive the intervention performed better, M = 4.561, SE = 0.175, 95% CI [4.202; 4.919], relative to participants assigned to the comparison condition, M = 4.119, SE = 0.169, 95% CI [3.774; 4.464], group membership did not appear to exert a significant effect on final test scores, p = .118, and accounted for just 8.2 percent of variance test scores after accounting for other effects in the analysis, $\eta_p^2 = .243$. Thus, hypothesis 2 was not supported.

Table 3.6 ANCOVA Statistics to Evaluate Study Hypothesis 2

Variable	Mean Square	*df*	*F* ratio	*p*	η_p^2
Intercept	4.350	1	12.227	.002	.297
GPA	0.121	1	0.339	.565	.012
Pretest	0.073	1	0.205	.654	.007
Group Membership	0.921	1	2.589	.118	.082
Error	0.356	29			

Note: GPA = Grade Point Average

Discussion

Sample characteristics. Sample characteristics were very similar to the nursing program's population characteristics. The sample did include a higher percentage of females (90.9%) than the percentage in the nursing program overall (79.8%). Participants' ages in the sample were similar to the population's makeup, except the sample did not contain any participants in the age range of 26-29 years of age; the nursing class had 5.1% of students in this age range. The mean midterm grade was somewhat higher at 2.78 than the nursing class's mean midterm grade of 2.09. The midterm grade, however, did not differ among the two groups.

Research question one. The first research question was: Does cue recognition ability differ between baccalaureate nursing students taught by lecture alone and those taught by lecture with

classroom quizzing as measured by a post-intervention test? The hypothesis was : Baccalaureate nursing students taught by lecture with classroom quizzing will demonstrate significant differences in scores on a post-intervention test compared to students taught by lecture alone. The results indicated that the integration of classroom quizzing did not significantly affect nursing students' short-term retrieval ability of learned client cues. The control group who did not receive the classroom quizzing session and immediately watched the simulated client scenario after the lecture video before completing the post-test scored significantly higher on the post-test. One of the reasons for this result may be due to factors related to the transfer of learning theory components, particularly near transfer. Perkins and Salomon (1992) suggest that "transfer of learning occurs when learning in one context or with one set of materials impacts on performance in another context or with other related materials" (p. 3). As opposed to far transfer, near transfer occurs when the transfer is related to a very similar context (Perkins & Salomon). The control group viewed the lecture video focused on caring for a client with COPD immediately, followed by a viewing a simulated client scenario of a nurse caring for a client with COPD. These two learning modalities had very similar contexts promoting the student to transfer the learning as evidenced by higher performances on the post-test. The lecture with classroom quizzing group (treatment group) watched the same lecture video and immediately engaged in the classroom quizzing session before watching the simulated client scenario of a nurse caring for a client with COPD. The classroom quizzing session may have been too different in context from the video lecture that the participant's near transferability was impaired.

It is important to note that both groups did improve in mean score performance on the post-test related to COPD from the pretest to the post-test. This finding may validate that didactic learning with active learning strategies, in this case, both the simulated client scenario video and

classroom quizzing, affects students' retrieval ability and the ability to apply previously learned knowledge**.**

Research question two. The second research question was: Does long-term retrieval ability differ between baccalaureate nursing students taught by lecture alone and those taught by lecture with classroom quizzing as measured by unit exam questions? The hypothesis was: Baccalaureate nursing students taught by lecture with classroom quizzing will demonstrate significant differences in scores on unit exam retention questions compared to students taught by lecture alone. This study did not show significant differences between the two groups' performance on the unit exam questions. Studies measuring long-term retrieval after TEL have produced significant findings however, it is important to note that various factors in the interventions may have produced different outcomes. Karpicke and Roediger (2008) determined that long-term retention is enhanced when individuals engage in long-term retrieval repeated practices, such as quizzing or testing, as compared to individuals who in engage in repeated studying. Repeated quizzing of the content before the unit exam in this study may have produced higher unit exam question performance. Repeated testing and quizzing increases student motivation to study (McDaniel, et al., 2007; Roediger et al., 2011). An indirect testing effect may result from frequent testing leading to increased and improved study time (Larsen et al., 2008; Roediger & Karpicke, 2006). One last factor of TEL that affects long term retention is the spacing of testing. Longer intervals between testing produced higher retention abilities in one study (Karpicke and Bauernschmidt, 2011). Only one quizzing session was included in this study which did not have a significant effect on the participants' retention ability as measured by question performance on the unit exam one week later. Another explanation for the lack of significant findings related to long-term retrieval ability is the phenomenon of maturation.

Participants may have gained more knowledge of cue recognition and COPD between the classroom session and unit exam, affecting their performance on the five retention questions on the unit exam.

Implications for Nursing Education

Nursing educational programs are obligated to the students and public to prepare graduates who are ready to practice in a complex healthcare arena. Conforming to changes mandated by accrediting bodies, boards of nursing, and other organizations overseeing nursing educational programs challenges nursing programs to constantly evaluate teaching-learning strategies and evaluation processes. The NCSBN's development of the new CJMM is a significant catalyst for a nursing education transformation and new research to advance the science of student nurse clinical judgment development. This study's findings contribute to nursing education evidence by providing new findings related to the effective use of retrieval-based strategies to enhance cue recognition abilities among undergraduate nursing students. Although the study results did not indicate that classroom quizzing improved cue recognition ability in undergraduate nursing students, the results did offer insight into the relationship of the timing of teaching/learning strategies during learning sessions and short- and long-term retrieval ability. Nursing is a complex science requiring nurses to constantly engage in critical thinking and recall information stored in the long-term memory (Karpicke & Blunt, 2011). Active learning strategies are prevalent in nursing education classrooms. This study may inform nurse educators to organize the timing and repetition of the activities based on student performance and feedback.

Limitations and Recommendations for Further Research

This study had several limitations. The sample obtained was by convenience and included participants from a nursing program in which the student population was composed primarily of Whites leading to decreased generalizability of the findings. Future research should include a larger, more diverse sample of nursing students to increase the generalizability of all significant findings. A larger sample would also increase the power and effect size of any significant findings.

The small amount of retention questions to evaluate knowledge may have contributed to low reliability. The quality of the five questions was low as evidenced by four of the five questions having item difficulties of greater than .90. The point biserial of three questions, however were close or within the acceptable range of 0.40 to 0.70.

The constraints caused by the pandemic, COVID-19, posed several limitations related to both the design and implementation. The design of this study had to consider that some participants may attend the classroom session via Zoom, and some may attend in the classroom with associated COVID-19 classroom safety measures, including assigned seating with social distancing and wearing face masks. All but two participants attended the classroom session in the physical classroom, but the researcher was in quarantine and led the classroom quizzing session via Zoom. Future research in this area needs to be conducted in a face-to-face classroom environment in which the researcher is physically present to lead the TEL intervention, classroom quizzing. During the Zoom classroom quizzing session, no questions were asked on any of the questions. More participant engagement during the classroom may occur in a live setting which may affect the study results. The low participation rate (33%) may have been affected by stress associated with the pandemic. Participants in this study were in the first of four

semesters of this nursing program. The transition into the nursing program coupled with variances in the learning environments, social isolation, and fear of COVID affecting their own or loved one's health may have led to hesitancy to volunteer for this study.

The results of this study indicated that students in the control group who watched the simulated client scenario immediately after viewing the lecture performed higher on the post-test even though their pretest scores were lower. Changing the sequencing of the intervention, classroom quizzing, is another recommendation for future studies in this area. The classroom quizzing may have more of an effect on retrieval ability if completed after viewing the simulated client scenario. The lecture video and simulated client scenario are very similar in context. The participants might rehearse and store the information more during the classroom quizzing if the simulated client scenario was viewed before the quizzing session.

Conclusion

This study further identifies areas in retrieval-based learning and TEL that may be further explored. Research has shown that TEL is an effective strategy to increase both short-and long-term retrieval ability. Research has also supported that the development of cue recognition abilities among nursing students is not solely based on intuition and experience but can be taught. Aside from conducting the same study under non-pandemic conditions and using a larger, more diverse population for recruitment, future research should focus on assessing the effectiveness of the timing of the TEL strategies during learning sessions and inclusion of assessing individual factors such as metacognition and self-regulatory behaviors on short- and long-term retrieval ability.

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APPENDIX A

Definitions of Relevant Terms

Classroom quizzing- A form of retrieval practice and test enhanced learning in which questions are asked during class in which the content was previously discussed in the class session (Roediger et al., 2011).

Clinical judgment- the observed outcome of critical thinking and decision making. It is an iterative process that uses nursing knowledge to observe and access presenting situations, identify a prioritized client concern, and generate the best possible evidence-based solutions to deliver safe client care" (NCBSN, 2018).

Cues- identifiable, physiological or psychosocial changes experienced by a patient, perceived through history or assessment and understood in relation to a specific body of knowledge and philosophical belief" (Levett-Jones et al., 2010, p.517). These cues are disclosed in handover shift reports, patient history, patient charts, results of investigations, and nursing or medical assessments. (Levett-Jones et al., 2010).

Cue recognition- Identify relevant and important information from different sources such as medical history and vital signs (NCSBN, 2019).

Test-enhanced learning- a type of retrieval-based learning strategy which occurs when the "retrieval practice occurs in the context of a test" (Green, Moeller, & Spak, 2018, p. 337).

APPENDIX B

Demographic Data Survey

1. Age
   - ☐ 18-21 years of age
   - ☐ 22-25 years of age
   - ☐ 26-29 years of age
   - ☐ 30+ years of age

2. Gender:

   - ☐ Male
   - ☐ Female
   - ☐ Male Transgender
   - ☐ Female Transgender
   - ☐ Not Listed. Please specify _____

3. Race or Ethnic Identity:

   - ☐ White/Caucasian
   - ☐ Other. Please specify_____

4. Do you have any other post-secondary educational experience beside the nursing program you are currently enrolled in?

   - ☐ Yes. Please specify _____
   - ☐ No

5. On a scale of 0 through 3, please rate your *knowledge* of caring for a patient with chronic obstructive pulmonary disease or any other respiratory disease. Please use the criteria below.

0=*no knowledge* 1=*little knowledge* 2=*moderate knowledge* 3=*high level of knowledge*

0 1 2 3

6. On a scale of 0 through 3, please rate your *experience* of caring for a patient with chronic obstructive pulmonary disease or any other respiratory disease. Please use the criteria below.

0=*no experience* 1=*little experience* 2=*moderate experience* 3=*high level of experience*

0 1 2 3

APPENDIX C

Pretest

1. An 84 year-old male is admitted to pulmonary unit for an exacerbation of chronic obstructive pulmonary disease (COPD). What cues (signs and symptoms) would you expect to recognize in this patient?

Wheezes
Diminished breath sounds
Tachypnea (respiratory rate >20 bpm)
Dyspnea
Pursed lip breathing
Oxygen saturation <95%
Use of accessory muscles
Cough-nonproductive or productive
Digital clubbing
Barrel-chested
Cool skin
Anorexia
Weight loss
Fatigue
Orthopnea
Tripod positioning
Intercostal retractions
Prolonged expiration

2. Looking at the cues you listed above, which of those cues would indicate there may be a concern.

Intercostal retractions
Use of accessory muscles
Tachypnea
Oxygen saturation <95%
Wheezes

APPENDIX D

Post-Test

1. Please list all the cues (signs and symptoms) that you observed in the video titled "Mrs. Smith" that are related to a patient with COPD. Please make sure to include both subjective and objective data, including all patient cues heard in the hand off report.

Shortness of breath (dyspnea)
Tripod position
Orthopnea
Cough
Increased respiratory rate (tachypnea)
Decreased oxygen saturation
Wheezes auscultated in bilateral lungs
Fatigue

2. Looking at the cues you listed above, which of those cues would indicate there may be a concern.

Tachypnea
Dyspnea
Wheezes

APPENDIX E

Outline of the Patient Scenario Video

Hand Off Report Using SBAR:

S (Situation)-I am caring for Betty Smith, an 84-year-old of Dr. Winters. She was admitted this morning for complaints of increased shortness of breath.

B (Background)- Mrs. Smith has a history of hypertension, myocardial infarction, chronic obstructive pulmonary disease, diabetes, and glaucoma. She lives alone and is widowed. Her last hospitalization was four months ago when she had a myocardial infarction. She underwent a coronary artery bypass graft x2.

A (Assessment)- Mr. Smith is an alert and oriented times four. She complains of shortness of breath. She has expiratory and inspiratory wheezes throughout both lungs. Her pulse sat is between 88 to 92% on room air. All vital signs are within normal limits. She states she uses oxygen at home when she needs it. She has coughed a few times but has not brought any sputum up. All other assessments are normal.

R (Recommendation)- I recommend that you look at the lab results and let Dr. Winters know the results. The chest x-ray was just completed so you may want to let Dr. Winters know that also.

*Nurse enters client room and follows the script.

COPD Patient Cues	Nurse Action	How Exhibited or Stated by Patient
Shortness of breath (dyspnea)	Introduce yourself and ask how the patient is feeling?	The patient states, "I can't catch my breath" Patient using shoulders (accessory muscles) to breathe. "I need to sit up"
Tripod position	Assist patient to set up and get the bedside table if needed.	Patient will sit on edge of bed leaning on bedside table.
Orthopnea		The patient states, "I can't breathe when I'm lying down." "I have to sit up in my recliner at home to catch my breath at night."
Cough	"Have you been coughing a lot?" "When you cough are you bringing anything up..sputum?	Patient coughs with no sputum. "Yes, more and more." "No"
Increased Respiratory Rate (tachypnea)	Look at the monitor and verbalize-"It looks like you are breathing a little fast"	Respiratory Rate 28 on the monitor in the room "Yes, sometimes I just can't catch my breath."
Decreased Oxygen Saturation	"I am going to put a little oxygen on you to help your breathing"	O2 saturation 89% on the monitor
Wheezes Auscultated in Bilateral Lungs	"I am going to listen to your lungs. Can you take some deep breaths?) BOTH anterior and posterior Can replay by saying "They sound a little wheezy. Can you take some deep breaths and cough?"	Wheezes heard during lung auscultation assessment "Do my lungs sounds okay?"
Heart Sounds	Listen to heart sounds and state they sound just fine.	
Fatigue	Ask patient if she is having any pain?	Patient states, "No but I am so tired lately. I just sit around and do nothing."
	"Is there anything else I can do for you right now" "Ok..well use the call light if you need anything. I will be	"No, I would just like to lie down and rest."

	back in an hour with some medications for you.”	

APPENDIX F

Classroom Quizzing Questions

1. The nurse is caring for a client with COPD. Which of the client assessments would require immediate attention?
   A) O2 saturation 92%
   B) Disoriented to time and place
   C) Tripod client positioning
   D) Clubbing of fingernails

2. A client is admitted for an exacerbation of COPD. The nurse administers a nebulizer treatment with albuterol. Which of the following assessment findings is the best indicator that the client is improving?
   A) O2 saturation 92%
   B) Clear lung sounds.
   C) Productive cough.
   D) Respiratory rate 20 bpm

3. The nurse is caring for a client whom is newly diagnosed with COPD. During the education session, the nurse recognizes client understanding when the client states which of the following?
   A) "I need to call the health care provider if I feel a little short of breath when I go up the stairs."
   B) "I need to call the health care provider if I begin to cough up some greenish phlegm off and on."
   C) "I need to call the health care provider if I feel tired when I do too many things at one time."
   D) "I need to call the health care provider if I need to sleep in my recliner at night."

4. The nurse is looking through the morning laboratory results for a client with COPD. Which of the following laboratory results is most concerning to the nurse?
   A) Hemoglobin 20 g/dL
   B) PaO2 75 mm/Hg
   C) PaCO2 56 mm/Hg
   D) Hematocrit 45%

5. The oncoming nurse is listening to hand off report before beginning the shift. Which of the following clients should the nurse see first?
   A) A client with COPD who has a nonproductive cough.
   B) A client with COPD who has a respiratory rate of 34 breaths per minute.
   C) A client with COPD who has expiratory wheezes in the right lower lobe.
   D) A client with COPD who has only been eating 50% of meals.

APPENDIX G

Retention Quiz Questions

1. The nurse is caring for a client admitted for chronic obstructive pulmonary disease (COPD). Which of the following arterial blood gas (ABG) values should the nurse expect to see on the laboratory report?

   A. pH = 7.33, pCO2 = 48 mm Hg, HCO3 = 24 mEq/L, and pO2 = 74 mm Hg.
   B. pH = 7.30, pCO2 = 30 mm Hg, HCO3 = 34 mEq/L, and pO2 = 80 mm Hg.
   C. pH = 7.50, pCO2 = 38 mm Hg, HCO3 = 26 mEq/L, and pO2 = 92 mm Hg.
   D. pH = 7.45, pCO2 = 32 mm Hg, HCO3 = 22 mEq/L, and pO2 = 96 mm Hg.

2. The nurse is caring for a client admitted for pneumonia. The client has a history of chronic obstructive pulmonary disease (COPD). Which of the following breathing patterns would lead to nurse to notify the health care provider?

   A. Pursed lip breathing.
   B. Longer inhalation period.
   C. Intercostal retractions.
   D. Longer exhalation period.

3. The nurse is completing an admission assessment on a client admitted for an exacerbation of chronic obstructive pulmonary disease (COPD). Which of the following client assessment finding indicates an immediate need to call the health care provider?

   A. Respiratory rate of 22 breaths per minute.
   B. Temperature of 101.8 degrees Fahrenheit.
   C. Oxygen saturation of 92% on room air.
   D. Heart rate of 98 beats per minute.

4. The nurse is discussing discharge instructions with a client admitted for chronic obstructive pulmonary disease (COPD). Which of the following client statements indicates understanding?

   A. “If I get short of breath when I go up the stairs I should call the health care provider.”
   B. “If I start to cough up greenish phlegm I should call the health care provider.”
   C. “If I need to sleep with two pillows at night I should call the health care provider.”
   D. “If I start to cough in the morning when I wake up I should call the health care provider.”

5. The nurse is caring for a client admitted for chronic obstructive pulmonary disease. The nurse explains the results of the diagnostic tests to the client and family. Which statement by the nurse regarding diagnostic findings is related to the diagnosis of COPD?

   A. "The chest x-ray shows increased lung field sizes."
   B. "The arterial blood gases show low carbon dioxide levels."
   C. "The arterial blood gases show high oxygen levels."
   D. "The chest x-ray shows a flattened diaphragm."

Chapter 4

Abstract

Exploring nurse educators' knowledge of nursing student cue recognition

Background. Nurse educators are responsible to facilitate and effectively evaluate nursing student cue recognition ability to assure graduates have the level of clinical judgment to provide safe quality care upon entry into practice. There is no prior research of nurse educators' knowledge of nursing student cue recognition. The purpose of this study was to explore nurse educators' knowledge of nursing student cue recognition and factors that affect nurse educators' knowledge level of nursing student cue recognition.

Method. This study was a cross-sectional descriptive design of a convenience sample of undergraduate nursing educators and clinical adjunct instructors from the United States. Data were collected using a demographic questionnaire and a researcher-developed cue recognition knowledge survey.

Results. Only 5.4% of the survey participants (N = 93) answered all four cue recognition knowledge questions correctly, and only 45% answered two of the four questions correctly. Age and years in the educational role were the only two demographic characteristics correlated to cue knowledge question performance. Participants who rated their confidence level as "very confident" in using cue recognition as a teaching strategy had the highest mean score on the cue recognition knowledge questions.

Conclusion. Nurse educators revealed a low level of knowledge of nursing student cue recognition. Further research in this area and the development of targeted faculty development on cue recognition are warranted to improve nurse educator knowledge and competency.

Paper 3

Exploring nurse educators' knowledge of nursing student cue recognition

A change in how clinical judgment is measured on exam items of the registered nurse licensure exam called the Next Generation National Council Licensure Examination-RN (NGN) is imminent, with implementation scheduled for 2023. The reasons for the licensure exam transformation are vast, stemming from alarming concerns related to entry-level nurses, including consistent reports of preventable healthcare errors (Kavanagh & Szweda, 2017; Saintsing, Gibson, & Pennington, 2011), low employer satisfaction (20%) clinical judgment abilities (Saintsing, Gibson, & Pennington, 2015), a small percentage (23%) in the safe and acceptable range to care for patients (Kavanagh & Szweda, 2017), and the lack of the current licensure exam to adequately measure the cognitive operations of clinical judgment (Dickison, et al., 2019).

The National Council State Boards of Nursing (NCSBN) has answered the call to measure clinical judgment and decision-making competency more accurately on the NGN by developing a new clinical judgment model called the Clinical Judgment Measurement Model (CJMM) (2019). The CJMM is an integrative decision-making framework with four distinct layers, each inclusive of cognitive operations that can be measured (Hensel & Billings, 2020). The cognitive operations of the measurable layer three include recognizing cues, analyzing, prioritizing hypotheses, generating solutions, taking action, and evaluating outcomes are the measurement focus and guiding content for item development on the NCLEX-RN (NCSBN, 2019). Cue recognition is the first of six cognitive operation of layer three in the CJMM (Dickison, Haerling, & Lasater, 2019). The CJMM will serve as a framework for item development on the NGN with the end outcome of each item on the exam measuring a specific

cognitive process of the measurable layer three of the model. Clinical judgment models are not new to nurse educators. Tanner's Model of Clinical Judgment, developed in 2006 and further developed by Lasater as a valid and reliable tool to measure nursing student progressive clinical judgment development, are common clinical judgment models used in nursing education today (Lasater, 2007). The difference between the CJMM and Tanner's model is the steps or cognitive operations, as the NCSBN refers to them in the new model. The first step, for example, in Tanner's model is noticing, which has similarities to the first step of cue recognition in the new model but is different enough that nurse educators need to assess their understanding and engage in learning if a lack of understanding exists. This study explored nurse educators' knowledge of nursing student cue recognition and the factors that affect the knowledge level of nursing student cue recognition.

Background

Nurse educators' knowledge of the cognitive operations in the measurable layer three of the new CJMM by the NCSBN is not evident in the existing literature. The sparse existing literature of the first cognitive operation, cue recognition, focuses on the effect of instructional format on nursing student development of cue recognition and the differences among novice and expert nurses. The emergence of the new CJMM by the NCSBN challenges nurse educators to re-envision clinical judgment educational and evaluation strategies. As with any new curriculum implementation, nurse educators must be knowledgeable and competent in effective integration into the curriculum and success in the nursing student cue recognition development.

Little to no literature exists on cue recognition development in nursing student and nurse educator knowledge of cue recognition. Literature from evolving pathways on the development of evidence-based practice integration into nursing education was reviewed. Similar to the

constantly changing definition of clinical judgment in nursing, evidence-based practice (EBP) has undergone multiple transformations in definition and utilization in both nursing practice and education (Mackey & Bassendowski, 2017). Stichler et al. (2011) claim that while most nurse educators are competent and knowledgeable in the research process, the shift to integrating EBP into nursing courses and assignments poses a challenge related to the lack of EBP knowledge and competencies. The emergence of evidence-based practice (EBP) in nursing occurred in the 1990s after an evolutionary path was introduced by early nurse scientist Florence Nightingale in the 1800s, followed by medical field use of EBP, known as evidence-based medicine, in the 1970s (Mackey & Bassendowski). EBP has been the focus of the investigation of nurse educators' knowledge, competency, and attitudes in several studies (Melnyk et al., 2004; Orta et al., 2016; Stichler et al., 2011). These studies suggest that nursing faculty lacked actual or perceived EBP knowledge and skills to integrate EBP in nursing courses adequately. Orta et al. (2016) included an EBP online educational intervention in their study and found statistically significant differences in the pretest and posttest scores. Nursing programs must develop strategies to prepare nurse educators for the new CJMM, including cue recognition, the first cognitive process in the measurable layer of the model. In effort to explore nurse educators' knowledge of cue recognition, a topic lacking in nursing literature, lessons learned from evidenced-based practice in nursing education studies were considered. This study aided in the generation of hypotheses and further related areas of research.

Methods

Study design. A cross-sectional descriptive survey design was used in this study to explore nurse educators' knowledge of nursing student cue recognition ability and the factors that affect the nurse educators' knowledge level of nursing student cue recognition.

Setting. This study recruited nurse educators from six registered nursing programs in the Midwestern United States from May 12th, 2021 to June 9, 2021. Due to a low response rate, a recruitment posting was posted on a nurse educator community website from June 9, 2021 to June 23, 2021.

Participants. Participants in this study were a convenience sample of nurse educators. To be eligible, participants had to be currently teaching in an undergraduate registered nursing program or a graduate nursing program.

Procedures. Approval by the university's institutional review board was obtained before conducting the study. Qualtrics, the electronic survey tool, was used to deliver the survey. The Qualtrics survey link was delivered to potential participants via email per the contact person designated at each of the six nursing programs and later posted on the nurse educator community site. Participants were informed that participation was voluntary, and only aggregate data will be reported to assure anonymity. Three reminder emails were sent two weeks apart after the initial emails were sent to the contact person at each site. The posting on a nurse educator community site was posted only once. Due to a low response rate, the survey remained open for a total of six weeks.

Measurement. A survey, developed by the researcher, included nine demographic questions (age, gender, race, degree level of the program in which you teach, title of the current position, years in an educational role, highest academic degree earned, and yes/no questions regarding practice as a licensed nurse role and teach in a setting outside of academia) and three questions related to cue recognition exposure, use, and confidence in using as a teaching strategy. The researcher developed the four cue recognition knowledge questions using the definitions and examples of cue recognition from the CJMM developed by the NCSBN. The four

questions were in multiple-choice question formats to determine the participants' cue recognition knowledge. A review panel of five nursing faculty was chosen to evaluate the survey items for clarity, relevancy, and overall recommendations for revisions in an open comment section. The panel consisted of three doctoral-prepared faculty, one master prepared faculty, and one outside reviewer who has published a book on the new CJMM. The panel was sent the survey items on a document via email and the study purpose, research questions, and description of possible participants. The clarity on all four questions was rated similarly by all the reviewers, with question three requiring minor revisions. There was substantial agreement among the reviewers regarding each item's relevancy. The content validity index at the item level for relevance was 1.0 for 2/4 items and 0.8 for 2/4 items.

Data analysis. All statistical procedures were performed using Statistical Package for the Social Sciences (SPSS) software version 27.0. The completeness of the data was verified before the statistical analysis and interpretation occurred. Descriptive statistics, including means, standard deviations, and frequency counts, were used to describe the sample and responses to the cue recognition exposure, use, confidence questions, and cue recognition knowledge questions. Eta coefficient tests were conducted to examine possible associations between all (nominal/categorical) demographic characteristics and cue recognition knowledge question performances (interval/scale). Spearman's rank-order correlation was conducted to examine the correlation between cue recognition exposure, use as a teaching strategy, and confidence of using as a teaching strategy and cue recognition knowledge question performance. Chi-square tests were conducted to examine the correlation between demographic variables and cue recognition exposure, use, and confidence. Item difficulties, point biserial, and item discrimination indexes

were also calculated on the five retention questions to evaluate quality of the questions (Mehta & Mokhasi, 2014). A significance level of $p \leq 0.05$ was used in this study.

Results

Participants. Ninety-three nurse educators participated in the study. All ninety-three participants who completed the demographic survey met the eligibility criteria of teaching currently in an undergraduate registered nurse program or graduate nursing program.

Descriptive data. The majority of participants were female (94%) and white (95.7%). Ninety (96.8%) of the participants were over the age of 30, and seventy-one percent were in their educational role for more than five years. Participants were in the current positions of instructor (33.3%), assistant professor (31.2%, associate professor (17.2%), lecturer and clinical adjunct (both 6.5%0), and professor (5.4%). The two highest academic degrees earned among participants were master's degrees (58.1%) and doctoral degrees (35.5%). Fifty-six (60.2%) of the participants taught in a baccalaureate program, with only five participants (5.4%) teaching in an RN-BSN program. Only 34.4% of participants reported practicing in licensed nurse roles outside of academia, and 18% reported teaching in a setting other than academia (Table 4.1).

Table 4.1 Demographic Characteristics

	Characteristic	*n*	%
Race	White/Caucasian	89	95.7
	Black or African American	2	2.2
	Other Race	2	2.2
Gender	Female	88	94.6
	Male	5	5.4
Age	< 30	3	3.2
	30-39	21	22.6
	40-49	22	23.7
	50-59	28	30.1
	60 or >	19	20.4

Title of Current Position	Instructor	31	33.3
	Lecturer	6	6.5
	Assistant Professor	29	31.2
	Associate Professor	16	17.2
	Professor	5	5.4
	Clinical Adjunct/Preceptor	6	6.5
Degree Program	Associate or Diploma	8	8.6
	Baccalaureate	56	60.2
	RN-BSN	5	5.4
	Graduate	10	10.8
	Multiple Programs	14	15.1
Years in Educational Role	0-5	27	29.0
	6-10	29	31.2
	11-15	18	19.4
	16-20	7	7.5
	21-25	4	4.3
	26-30	8	8.6
Highest Academic Degree Earned	Baccalaureate	6	6.5
	Master's	54	58.1
	Doctoral	33	35.5
Practice in Licensed Nurse Role Outside Academic Setting	Yes	32	34.4
	No	61	65.6
Teach in Setting Other Than Academia	Yes	18	19.4
	No	75	80.6

Note: Percentages may not equal 100% due to rounding.

Cue recognition exposure, use, and confidence of use as a teaching strategy. Overall, 40.8% of the participants reported that they have heard of cue recognition, and 17.2% reported being

unfamiliar with the concept of cue recognition (Figure 4.1). The use of cue recognition as a teaching strategy was obtained using a four-point Likert scale in which

1 = not at all, 2 = somewhat, 3 = somewhat, and 4 = frequently use. Only 45% of the participants reported occasional or frequent use of cue recognition as a teaching strategy. The confidence level of using cue recognition as a teaching strategy was obtained using a four-point Likert scale in which 1 = not confident, 2 = somewhat confident, 3 =confident, and 4 = very confident. 41% of the participants reported feeling confident or very confident in using cue recognition as a teaching strategy. (See Table 4.2).

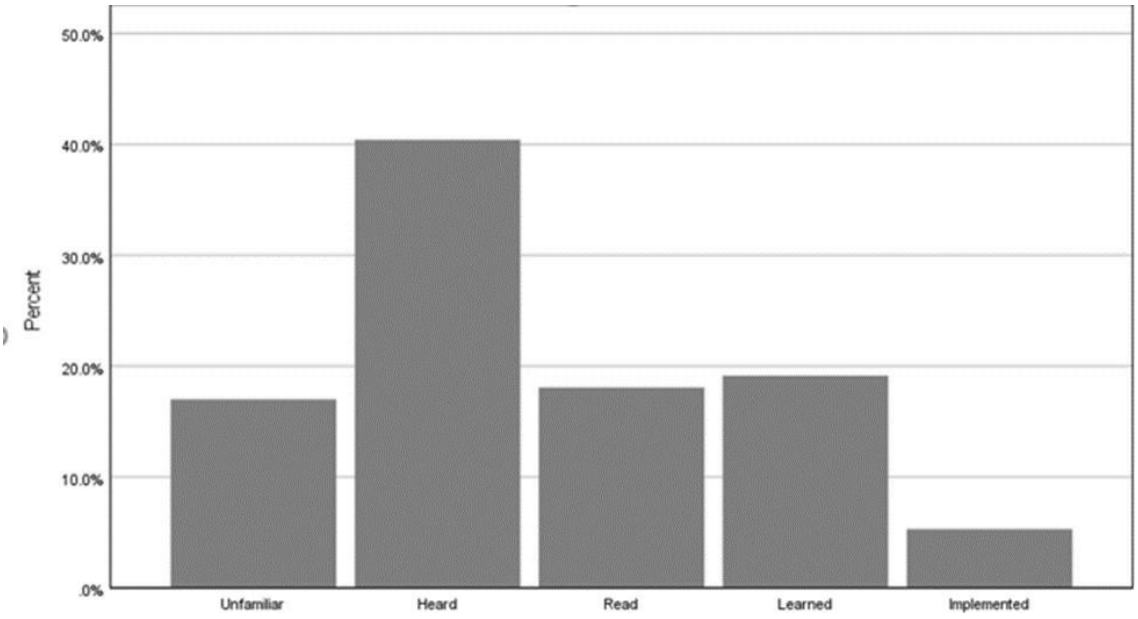

Figure 4.1. Exposure to cue recognition

Table 4.2 Summary of Using Cue Recognition in Teaching and Confidence in Using in Teaching

Characteristic	*n*	%	*Mdn*	*Mo*	*SD*
Use			2.00	1.00	1.088
1=not at all	27	29.0			
2=somewhat	24	25.8			
3=occasionally	25	26.8			

	4=frequently use	17	18.3			
Confidence				2.00	2.00	0.982
	1=not confident	24	25.6			
	2=somewhat confident	30	31.9			
	3=confident	28	29.8			
	4=very confident	11	11.7			

Fisher exact tests on demographic variables and cue recognition exposure, use, and confidence were conducted in place of Chi-square tests for all demographic variables except the identification if participants practice outside the academic setting due to failing to meet the requirement of 80% of cells having greater or equal to 5 sample sizes. The only statistically significant difference was the association between participants that reported teaching outside the academic setting and the frequency of use ($x^2 = 14.403$, $p = .001$). However, the association was overwhelmingly small, Cramer's V = .003.

Knowledge of cue recognition. Participants completed four multiple-choice questions on the survey to determine knowledge of cue recognition. The mean total score was 1.92 (*SD* = .900) with a range of 0 to 4 correct. Only five (5.4%) participants answered all four questions correctly. 45.2% of the participants answered two of the four questions correctly, 29% answered one of the four questions correctly, 17.3% answered three of the four questions correctly, and 3.2% failed to answer any of the questions correctly. Item difficulty for questions 1,2, and 3 were close to the acceptable range of .30 through .70. Question 4's item difficulty was .16 and not within the acceptable range. All the questions were above .20 for item discrimination. All questions' point biserial results were in the range of 0.40-0.70 (Table 4.3)

Table 4.3 Cue Recognition Knowledge Question Item Difficulty, Point Biserial, and Item Discrimination

Question	Item Difficulty	Point Biserial	Item Discrimination
1	.40	.51	0.83
2	.72	.46	0.43
3	.63	.49	0.74
4	.16	.44	0.30

Participants who rated their confidence in using cue recognition as a teaching strategy as "4" or "very confident" category scored the highest on the cue recognition questions (M = 2.09, SD = .944). Participants in the "confident" category had a mean score of 1.82, followed by mean scores of 1.93 and 1.96 for the categories of "somewhat confident" and "not confident," respectively. Participants who had the lowest mean cue recognition question score (M =1.74, SD= .813) reported use of cue recognition as a teaching strategy as a “1” or “not at all” while the highest mean cue recognition question score (M =2.08 , SD = .929) was in the cue recognition use category of a “2” or “somewhat use” cue recognition as a teaching strategy .

Eta coefficient tests were conducted to examine possible associations between all (nominal/categorical) demographic characteristics and cue recognition knowledge question performances (interval/scale). The only correlations found were found between the years in the educational role and age range, 0.228 and 0.246, respectively. However, both correlations were weak. Spearman’s rank-order correlation was conducted to examine the correlation between cue recognition exposure, use as a teaching strategy, and confidence of using as a teaching strategy and cue recognition knowledge question performance. No correlations existed between any of the cue recognition characteristics and cue recognition question performance.

Discussion

The representativeness of the demographics data collected was challenging to determine due to the recruitment of participants from both a specific geographical area, six Midwestern U.S. states, and a national nurse educator community website. The National League for Nursing (NLN) Faculty Census Survey of 2018-2019 revealed that nurse faculty is made up of 9% males and 82% Whites (National League for Nursing, 2021). The sample in this study was composed of 5.4% males and 2.2% African Americans.

Cue recognition exposure, use, and confidence in use as a teaching strategy. The findings related to cue recognition exposure, use of cue recognition as a teaching strategy, and confidence in using cue recognition as a teaching strategy may be attributed to nurse educators' lack of urgency to learn about the new CJMM because the implementation of the Next Generation NCLEX-RN does not begin until 2023 (NCSBN,2019). Forty percent of participants reported hearing about cue recognition, but only 19.4% have learned about cue recognition through some type of structured learning activity. Expert nurse educators suggest that all nurse educators should become familiar with the new CJMM and orient nursing students on how to use each of the six cognitive skills of layer three in the model (Ignatavicius & Silvestri, 2021).

Some participants reported using cue recognition as a teaching strategy. This finding is not unusual as the NCSBN has been performing research on potential NGN item types since 2017 and providing the nurse educator community with research updates on NGN item types, case studies, CJMM, and action plans consistently. The low rate (17.2%) of participants reporting feeling "very confident" in using cue recognition as a teaching strategy is expected as cue recognition is a new cognitive process in the newly developed CJMM.

As mentioned above, one minimal association was found between teaching in a setting other than academia and the frequency of using cue recognition as a teaching strategy. No other associations were detected between the demographic characteristics and cue recognition exposure, use as a teaching strategy, and confidence in the use of cue recognition as a teaching strategy. These findings may indicate that the topic of cue recognition, the new CJMM, and the NGN are too new for nurse educators to effectively self-evaluate their use of cue recognition as a teaching strategy and their perceived confidence in using cue recognition as a teaching strategy.

Cue recognition knowledge. The item analysis performed on each question indicated an overall good quality of questions on questions one through three. Question four's item difficulty was not acceptable at .16 and should be revised before including on future evaluations. The findings suggest a considerable deficit in the knowledge level of cue recognition among nurse educators. Only 42.5% of the participants correctly answered two of the four multiple-choice questions with a mean total score of approximately 48%. Questions one and four revealed a significant knowledge gap (40.9% and 15.1%, respectively). Participants demonstrated increased knowledge on the questions related to facilitation of the student to engage in cue recognition and an evaluation of the student's ability to recognize client cues, questions two and three. A lack of knowledge related to the final step in cue recognition before moving on to the following cognitive process of cue analysis was evident by the low percentage score on the survey's final question. The NCSBN emphasizes that layer three of the CJMM, which includes the first cognitive process step of cue recognition, is vital for both nursing student education and testing of clinical judgment (NCSBN, 2019).

These findings also may indicate that participants do not feel a sense of urgency to learn about the new clinical judgment model and begin to implement teaching and evaluation

strategies in the curriculum. Current clinical judgment models utilized in nursing programs, including Tanner's Model of Clinical Judgment and the nursing process, include steps of clinical decision making. Nurse educators may feel confident in using these models to facilitate clinical judgment development in nursing students, determining that learning about the new model is unnecessary at this time.

Factors related to cue recognition knowledge. Factors that may contribute to nurse educators' knowledge of cue recognition were explored without insightful findings. The results of the eta coefficient tests revealed an association, though weak, between both the age of the participant and years in the nurse educator role and the cue recognition question knowledge score. Participants reporting 11-15 years in the educational role scored the highest on the cue recognition knowledge questions, followed by the participants in the 0-5 years category. This finding may indicate that nurse educators teaching after 15 years may be teaching in graduate programs in which clinical judgment and registered nurse licensure success is not the focus. The findings indicated that the participants in the category ">60 years of age" scored the highest on the cue recognition knowledge questions. The results indicated that those participants who rated their confidence level as "very confident" scored the highest on the four cue recognition questions.

Implications

It is incumbent for nurse educators to prepare competent and practice-ready entry-level nurses. The new CJMM challenges nursing education programs to re-envision the current curriculum and evaluation methods of student clinical judgment. Nursing education programs' potential curriculum changes from the CJMM and NGN will organically require preparing nurse educators about the new model and evaluation methods. The findings of this study revealed the current state of nurse educators' knowledge of cue recognition, the first cognitive process of the

new model, to begin the discussion of nurse educators' educational needs of the new CJMM. It is prudent that an assessment of nurse educator knowledge of the CJMM, including all the cognitive processes in layer three of the model, be performed in all nursing programs to determine targeted faculty development.

Limitations and Recommendations for Future Research

Several limitations were determined in this study. This study used an unvalidated survey that the researcher developed. The small number of cue recognition knowledge questions on the survey may not have accurately represented nurse educators' knowledge of nursing student cue recognition. The item analysis on the questions did, however support a good quality evaluation of knowledge of cue recognition as evidenced by all questions in the acceptable ranges for item discrimination and point biserial and three of the four questions in the acceptable item difficulty range. Further research should include more questions and be comprehensive in nature to gain valuable insight into this topic.

The timing of the data collection may have affected the accuracy of the survey results and contributed to the low response rate. This survey was sent out at the end of the semester, which may have affected the participant's attention to complete the survey due to obligations related to end of the semester responsibilities. Some non-responders may have a higher or previous experience using cue recognition as a teaching strategy. The small sample size may not accurately represent the target population of all nurse educators. The timing of future survey research on this topic should be considered carefully to increase the response rate, thus increasing the sample size.

Another limitation of this study was the low number of clinical adjunct instructor and preceptor participation. Clinical adjunct instructors and preceptors play integral roles in facilitating and evaluating cue recognition development among nursing students in the clinical environment. Attempts should be made to increase the number of clinical adjunct instructors and preceptors in future research to identify unique learning and future development of targeted educational plans on nursing student cue recognition development in the clinical setting.

Conclusion

The findings of this study indicated a low level of knowledge among nurse educators regarding cue recognition. All nurse educators, particularly those who prepare entry-level registered nurses, are at the interface of implementing the new CJMM into the current nursing curricula. Nursing schools are responsible for providing resources such as conferences, webinars, and educational consultants for faculty to become competent and confident in teaching and evaluating cue recognition ability among nursing students. Future studies should include a larger sample from a diverse population and more cue recognition knowledge questions that are comprehensive to assess nurse educator competence accurately.

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Appendix A

Demographic Data Survey

*Required

1. *Age
   - ☐ < 30 years of age
   - ☐ 30-39 years of age
   - ☐ 40-49 years of age
   - ☐ 50-59 years of age
   - ☐ > 60 years of age

2. Gender
   - ☐ Male
   - ☐ Female
   - ☐ Prefer not to say

3. Race or Ethnic Identity
   - ☐ American Indian or Alaska Native
   - ☐ Asian
   - ☐ Black or African-American
   - ☐ Native Hawaiian or Pacific Islander
   - ☐ White/Caucasian
   - ☐ Other. Please specify _____

4. *Degree Level of Program in Which You Teach
   - ☐ Associate or Diploma
   - ☐ Baccalaureate
   - ☐ RN-BSN
   - ☐ Graduate
   - ☐ Multiple Programs

5. *Title of Current Position:
   - ☐ Instructor
   - ☐ Lecturer
   - ☐ Assistant Professor
   - ☐ Associate Professor
   - ☐ Professor
   - ☐ Adjunct Clinical Instructor/Preceptor

6. *Years in Educational Role
   - ☐ 0-5 years
   - ☐ 6-10 years
   - ☐ 11-15 years
   - ☐ 16-20 years
   - ☐ 21-25 years
   - ☐ 26-30 years

7. *Highest Academic Degree Earned
   - ☐ Associate or Diploma Degree
   - ☐ Baccaulearate Degree
   - ☐ Master's Degree
   - ☐ Doctoral Degree
   - ☐ Other

8. *Do you currently practice in a licensed nurse role outside of the academic setting?
   - ☐ Yes
   - ☐ No

9. *Do you teach in a setting(s) other than an academic setting?
   - ☐ Yes
   - ☐ No

Appendix B

Cue Recognition Knowledge Questionnaire

1. Which of the below statements best describes your exposure to the concept of cue recognition? Select all that apply.

   ☐I am unfamiliar with the concept of cue recognition
   ☐I have heard about cue recognition.
   ☐I have read about cue recognition.
   ☐I have learned about cue recognition through a structured learning activity such as a webinar, conference, workshop, podcast, online class, etc.
   ☐I have begun implementing cue recognition in the educational setting.

2. On a scale of 1-4 (1=not at all, 2=somewhat 3= occasionally, and 4= frequently use), how often do you use cue recognition as a teaching strategy during a classroom learning activity (i.e. case study), a simulated client encounter or a live client encounter?
   ☐ 1
   ☐ 2
   ☐ 3
   ☐ 4

3. On a scale of 1-4 (1=not confident, 2=somewhat confident =3 confident, and 4= very confident), how confident are you in your ability to use cue recognition as a teaching strategy during a classroom learning activity (i.e. case study), a simulated client encounter, or a live client encounter?
   ☐1
   ☐2
   ☐3
   ☐4

Cue recognition is a critical step a student must engage in when making a clinical judgment. For questions **4, 5, & 6,** assume the context of each question is "during a classroom learning activity (i. e. case study), a simulated client encounter, or a live client encounter."

4. Which of the following student activities best describes cue recognition?
   A. Identifying probable client needs, concerns, or problems.
   B. Filtering information from a variety of different sources.
   C. Implementing solutions to address the priority problems.
   D. Comparing observed outcomes to the expected outcomes.

5. Which of the following questions is not appropriate to ask a student to promote the student to recognize patient cues?

A. What information is relevant?
B. What information is most important?
C. What information requires immediate concern?
D. What information is connected to each hypothesis?

6. Which of the following indicators is appropriate if the goal is to accurately assess whether a nursing student correctly recognizes client cues?
   A. The student can identify the client findings that require follow-up and immediate attention.
   B. The student can identify the client findings that are related to a specific disease process.
   C. The student can identify if each indicated intervention is essential or contraindicated.
   D. The student can identify if each client finding indicates improvement, no change, or a declining status.

7. A nursing student was assigned a client who was admitted for an exacerbation of chronic obstructive pulmonary disease (COPD).During the initial student-client encounter, the student identifies the following client cues. Which of the following actions by the student indicate that the student was able to correctly recognize student cues?

   Oriented x4
   Client restless
   Respiratory rate 30 breathes per minutes
   Use of accessory muscles to breath
   Labored breathing at rest
   Tripod positioning
   Wheezes auscultated in bilateral lung fields
   Client complaints of shortness of breath
   Oxygen saturation 84% on room air
   Blood pressure 142/90 mmHg
   Heart rate 100 beats per minute
   Temperature 98.4 F (temporal)
   S1 and S1 noted with heart auscultation
   No edema noted
   Skin pale and cool
   Capillary refill > 3 seconds
   Pedal pulses +1
   Bowel sounds active x4 quads
   Abdomen soft and nontender
   Client denies pain

   A. The student will attribute some of the client cues in the initial assessment to the client's condition of COPD.
   B. The student will determine that this client is at risk for pneumonia based on the client cues identified in the initial assessment.
   C. The student will decide that placing oxygen per a nasal cannula at 2l/min is indicated at this time.

D. The student will determine that the interventions of oxygen therapy and an albuterol nebulizer treatment are indicated.

Chapter Five

Summary, Conclusions, and Recommendations

Summary

Nursing education faces increased challenges prompted by a call to improve nurse graduates' clinical judgment skills and practice readiness. The newly developed CJMM includes six specific, measurable cognitive operations, including the first cognitive operation of cue recognition, which nurse educators can utilize to facilitate learning in each cognitive operation and generate data related to performance in cue recognition. Furthermore, nursing programs must adequately prepare students to successfully pass the newly developed nursing licensure exam, the NGN, which includes higher-level questions that accurately measure the clinical judgment skills needed by entry-level nurses.

The purpose of this dissertation was to develop an operational definition for cue recognition, investigate the effects of the test-enhanced learning strategy of classroom quizzing on nursing student client cue recognition ability, and explore nurse educators' knowledge of cue recognition. The methodology, discussion of results, and conclusion in each paper answered each paper's questions.

The first completed study explored the literature in medicine, nursing, occupational therapy, and physical therapy for common uses, definitions, defining attributes, antecedents, and consequences of cue recognition in healthcare. A concept analysis of cue recognition was completed, which answered the question: What is the operational definition of cue recognition? The literature review for the concept analysis uncovered 22 articles and two books meeting the inclusion criteria. Medicine and nursing literature had similarities in definitions, defining

attributes, antecedents, and consequences; however, the uses were different in each discipline. Nurses use cue recognition and determine relevant cues to identify patient problems and physicians use cue recognition to make medical diagnoses. Nurses are prohibited from assigning a medical diagnosis to a patient due to their scope of practice. Model, borderline, and contrary cases were developed to determine the defining attributes of cue recognition further. An operational definition was developed after completing all eight steps of the concept analysis process.

The second completed study investigated the effects of the test-enhanced learning strategy of classroom quizzing on nursing student cue recognition ability of previously learned client cues to answer the questions: 1) Does cue recognition ability differ between baccalaureate nursing students taught by lecture alone and those taught by lecture with classroom quizzing as measured by a posttest? 2) Does long-term retrieval ability differ between baccalaureate nursing students taught by lecture alone and those taught by lecture with classroom quizzing as measured by retention questions? The use of an ANCOVA for question one allowed controlling for the pretest scores and the GPA, which both showed statistically significant differences. The results were negative for the first question. The group who did not receive the intervention scored significantly higher on the posttest. ANCOVA was used to analyze question two, and no significant differences in retention question scores were found. Both groups did, however, show improvement on mean pretest to posttest scores.

The final study explored nurse educators' knowledge of nursing student cue recognition and answered the questions: 1) What is nurse educators' knowledge of student nurse cue recognition? 2) What are the factors that affect nurse educators' knowledge of student nurse cue recognition? Only 5.4% answered all four knowledge questions correctly, and 45.2% answered

two of the four questions correctly. A weak correlation was found between the performance on the knowledge questions and years in the educational role and age range. Participants in the role for 11 to 15 years had the highest mean on the knowledge questions. Those age 60 and above also had the highest mean on the knowledge questions. Participants who rated their confidence in using cue recognition as a teaching strategy scored higher than those who rated their confidence as lower confidence.

Conclusions

The following conclusions can be drawn from these three studies:

1. The concept analysis of cue recognition resulted in a more precise definition used to create an operational definition.

2. The operational definition of cue recognition can be used for measurement tools in simulation and clinical.

3. The operational definition of cue recognition can be used for reflection exercises on strengths and weaknesses of cue recognition in simulation or clinical

4. The use of classroom quizzing does not improve short-term and long-term retrieval of previously learning client cues.

5. Nurse educators' overall knowledge of cue recognition is lacking.

6. Years in a nurse educator role and increased age improves cue recognition knowledge.

7. Increased confidence in using cue recognition as a teaching strategy improves cue recognition knowledge.

8. Working outside of the academic setting increases frequency of using cue recognition as a teaching strategy.

Recommendations for Future Research

Further research is needed to explore further the topic of student nurse cue recognition development in the following areas:

1. Develop a measurement tool for simulation and clinical with specific observable cue recognition performance criteria followed by validity testing.

2. Examine the effects of classroom quizzing on advanced-level students.

3. Examine the effects of classroom quizzing when placed after all other learning activities.

4. Investigate the correlation of student learning characteristics such as metacognition and self-regulation, and retrieval ability.

5. Examine differences in cue recognition knowledge among nursing faculty and clinical adjunct instructors.

These recommendations will provide further information on cue recognition development and evaluation among nursing students. Additionally, a measurement tool with specific performance criteria for cue recognition will provide remediation areas to promote competency in cue recognition. Determining the knowledge level among different nurse educator populations will inform the nursing program of faculty development needs that can be tailored to specific nurse educator populations.

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