ORIGINAL ARTICLE

An innovative approach to enhance students' clinical judgment and clinical reasoning abilities

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ABSTRACT

Objective: This study used Fowler's Model for developing nursing judgment to document an innovative approach to enhance students' clinical reasoning and judgment by examining the impact of incorporating concept-based learning and concept mapping in a structured classroom alongside clinical activities.
Methods: The study employed a pretest-posttest design to collect data from a cohort of 40 junior students enrolled in adult care nursing courses at a private university in Jordan. Self-reporting and observing students' clinical reasoning and judgment using a questionnaire and the Students' Performance Aspects of Clinical Judgment Scale were employed.
Results: Enhancement in students' general cclinical reasoning behavior, independence in clinical reasoning and clinical judgment, and clinical judgment abilities were evident.
Conclusions: This study provided a workable approach that will broaden academics' understanding of the contextual factors that may impact students' clinical reasoning and judgment abilities. It can also enhance deep learning and help desaturate the curriculum.

Key Words: Clinical judgment, Clinical reasoning, Nursing students, Nursing education

1. INTRODUCTION

The consequence in clinical reasoning applies to clinical judgment[1] that involves the recognition and response, under conditions of uncertainty, to an unfolding clinical situation.[2] The increasing acuity and complexity of practice environments bring the inexperienced nurse's clinical reasoning and judgment abilities to the test.[3] The preparedness of these nurses takes place during nursing education.[3] In addition to nursing knowledge, flexibility, and self-confidence, clinical reasoning forms the basis for undergraduate education.[4,5] It is unfortunately proven that new graduates entering the workforce lack these abilities[4,6,7] that originate from the type of instructional methods used in nursing education.[5]

Hence, educators are encouraged to adopt different pedagogical approaches, isolated or combined, and to envisage scenarios in which learning can be transformed into meaningful experiences.[8] Unlike teacher-centered approaches that encourage rote learning and lead to unstimulated students, student-centered approaches help students apply theoretical knowledge to specific clinical situations. The conceptual instructional techniques of concept-based learning[9–11] and concept mapping are among the student-centered approaches.[9,10,12] A concept-based approach to learning helps involve nursing students in reasoning and learning that will be transferred from one context to another.[13] It is designed by organizing specific content around identified concepts which adds to the factual content and skills; a third dimen-

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sion that represents the mental images that promote deep learning and understanding.[13] Oxygenation, acid-base balance, mobility, nutrition, and elimination are examples of clinical concepts that form the standards to judge the care assignments of students.[11] After the clinical day, nursing students will debrief each other about their patients concerning the concept at the post-conference. Ignatavicius[13] advocated using common health problems as prototypes for a concept to avoid content saturation that causes students to rely on memorization for superficial learning. Exemplars like chronic kidney disease and chronic obstructive pulmonary disease can be used as prototypes for the concept of acid-base balance.[13] The prototypes can be weaved in the classroom by concept mapping. Concept mapping improved students' critical thinking and clinical judgment by emphasizing critical reasoning.[14, 15] In terms of related ideas, concept maps include a graphic or pictorial arrangement of a given subject matter, shown as shapes such as circles or boxes, and the interrelationships of concepts, shown as link lines.[16, 17] Both concept-based learning and concept or mind mapping methods stress students' active participation in data organization, knowledge compare and contrast, and idea synthesis.[13, 15]

Current nursing faculty practice adopts a traditional approach to classroom and clinical teaching. These pedagogies emphasize a teacher-centered approach to classroom teaching and a case assignment to the practicum component of the course. Not all students will have the same opportunity and experience in the ever-changing, complex clinical placement areas. The faculty is continuously compensating by adding more clinical hours to the practicums. Furthermore, the clinical evaluation forms had a single component for evaluating students' mental processes regarding their critical thinking rather than clinical reasoning or judgment abilities, giving only a cursory understanding of these mental processes. Combining several pedagogies can boost aspects of clinical judgment; favor the development of various skills; enhance the competence and self-confidence of experienced and inexperienced nurses.[8, 18] Therefore, this research aims to investigate the contextual effect of the combination of conceptual pedagogies of concept-based learning and mind mapping in a private teaching facility in Jordan on clinical judgment and reasoning in baccalaureate nursing students attending adult medical-surgical courses.

1.1 Research question
Does combining concept-based learning and concept mapping pedagogies improve contextual clinical reasoning and judgment abilities among baccalaureate nursing students?

1.2 Theoretical framework
The study utilized Fowler's Model[19] for developing nursing judgment, as shown in Figure 1. Fowler[19] indicated that to develop good nursing judgment, simultaneous knowledge-building and realistic practice are required.[19] Tanner[20] defined clinical judgment as "an interpretation or conclusion about a patient's needs, concerns, or health problems, and the decisions to take action (or not) use or modify approaches, or improvise new ones as deemed appropriate by the patient's response." Additionally, clinical reasoning is defined by Tanner[20] as "the processes by which nurses make their judgments."

1.3 The Intervention
The intervention used concept mapping and concept-based learning simultaneously in both the classroom and the clinical setting. During classroom sessions, students were asked to actively construct concept maps for pathology and nursing care for specific disease conditions (see Figure 2). On the clinical side, the concept-based learning method was created to organize the clinical day around a concept such as patient safety, oxygenation, or acid-base balance. Each week's concept became integral to all patient care student assignments, and students jointly debriefed their colleagues about their patients about the provided concept at the clinical day's post-conference. While classroom lecturers oversaw the concept mapping pedagogy, clinical instructors guided the concept-based clinical activities. The clinical day began with a briefing from the clinical instructors on the concept of the week and the expectations of each student throughout the clinical day.
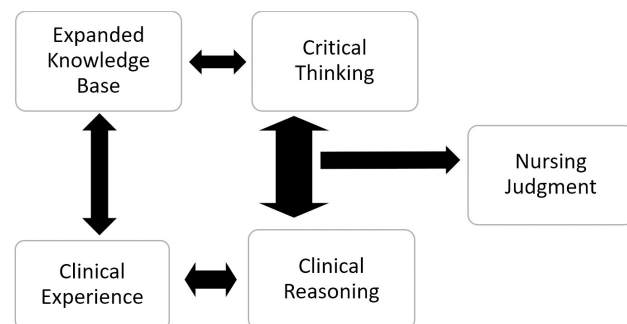
Figure 1. Fowlers Model for Development of Nursing Judgment
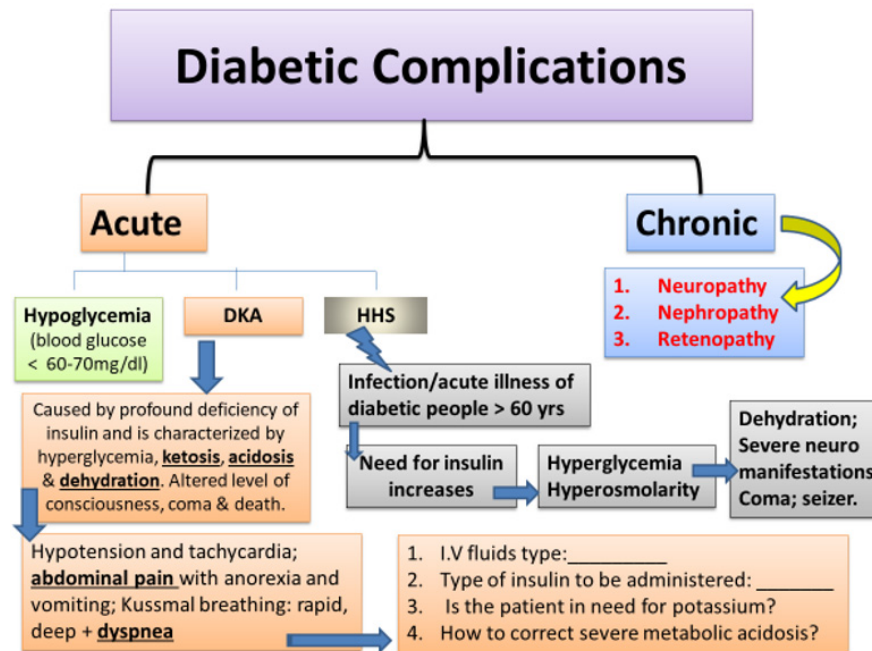
Figure 2. Concept map example: the acute complications of Diabetic Ketoacidosis (DKA) and Hyperglycemic Hyperosmolar State (HHS)

1.4 Research hypothesis

The combination of concept-based learning and concept mapping pedagogies profoundly affects undergraduate nursing students' clinical reasoning and judgment when undertaking courses in adult medical-surgical nursing.

2. MATERIAL AND METHODS

This study used a quasi-experimental design to collect data to validate the research hypothesis. A selection of all students enrolled in adult medical-surgical nursing courses was employed to protect the privileges of beneficence and equity of subjects.[21] It was impartial to conclude that the intervention, with the baseline data collected before implementing the two pedagogies, was the most likely cause for improvements in knowledge and skill.

2.1 Setting and participants

The study was conducted in Jordan at a private university. Qualified for inclusion were junior nursing students enrolled in one of the adult medical-surgical nursing courses with its theoretical and practical components. A consecutive purposive sample of all students who agreed to participate and read Arabic and English fluently (N = 40) was recruited. It is mandated that the theoretical and practicum courses be undertaken consecutively in the same semester.

2.2 Methods and instruments of data collection

Most studies on students' decision-making, problem-solving, or clinical judgment involved presenting them with written scenarios or simulated situations, followed by questions incorporated into written exams or interviews. Because clinical judgment and reasoning are complex, it is necessary to use techniques that improve the study's overall credibility.[22] Triangulation is the strategy generating the most interest,[23] which refers to using two or more theories, methods, data sources, investigators or analysis methods in a study.[23] Therefore, the current study will use two data collection techniques, self-reporting via a questionnaire and observation, and two data sources, students and clinical instructors. The observation will happen inadvertently as students complete their clinical rotations.

A. At the beginning of the semester, the two Ph.D. lecturers of the adult medical-surgical nursing courses administered the questionnaire to the students. The questionnaire encompassed three scales. The General Clinical Reasoning Behavior scale is a 24-item-5-point Likert-type scale[24] designed to uncover antecedents, processes, and consequences of clinical reasoning. The second scale sought to assess the student's degree of independence in making care decisions for patients as he/she assessed patients to recognize subtle signs; analyzed data to recognize nursing diagnosis; and decided to intervene, react or take action or not.[20, 24] Respondents were asked to select one of four options for each of the three elements on this scale. The independence level is operationally defined as the frequency with which the student depended on the preceptor when performing patient care clinical judgments.[22] The options for responses varied

from "constantly relying on preceptor" to "making all clinical judgments and the preceptor assisting them." The four choice options of the third scale were structured to determine students' level of independence in their clinical reasoning. The student's level of independence in clinical reasoning is operationally defined as how frequently he or she depended on his or her preceptor to detect relevant cues and patient problems and take the necessary action in patient care interactions.[22] The selections varied from "always autonomous (alone)" to "always dependent on the preceptor." Tanner's[20] definition of clinical reasoning was also used to develop the patient care elements of this measure. The questionnaire also included items related to students' age, sex, level/year, Grade Point Average (GPA) and their opinion of their academic success. The clinical instructors assigned to teams of eight students were asked to complete the independence scales to substantiate students' self-reporting of these variables. The responsibilities of different parties involved in students' clinical training are outlined in the Collaborative Model developed to regulate the relationship between the hospital and the academic body. The requirement for clinical preceptorship is attendance at the preceptor workshop sponsored and executed by the Nursing Service of the health care facility. Throughout the clinical rotation, feedback from students and instructors regarding clinical preceptors' performance is gathered to enhance the preceptorship experience. A two-hour observation of the student's real performance was used to gather the data needed.

B. Observation of Performance Aspects of Good Clinical Judgment:

A 4-point Students Performance Aspects of Clinical Judgment Scale[25] was adopted[23] to assess the clinical judgment potential of students when providing/participating in nursing care to assigned patients. The skill ranking of the four facets of clinical judgment was focused on aspects of effective problem solving, including engagement, background knowledge," "process," and "representation," both in the Lasater's[26] and Petrina's study.[27] Engagement in clinical judgment respected students' identification and involvement in solving patient care problems based on properly identifying significant cues. According to Petrina's study,[26] this process is usually based on background knowledge that is accessed by the student.[27] Students reasoning was addressed by the process component of clinical judgment that is free of reasoning biases and then represented through proper documentation, communication, and reflection.[27] At the start and conclusion of clinical rotations, the clinical instructors focused on using the scale to observe students' clinical judgment. The observations measured students' independence in clinical judgment and reasoning. The scales' face validity

was determined by three course coordinators and five clinical instructors from the school not participating in the study. The internal consistency of the scales was measured after introducing them to 5 students and varied from 0.729 to 0.807. To ensure consistency and impartiality in data collection, the authors provided the appropriate training and supervision to the five clinical instructors who were appointed to supervise students' clinical experience. In addition, rather than the measures employed in this study for data collection, clinical instructors graded students' clinical performance in clinical courses using a standardized clinical assessment form.

2.3 Research plan
The research plan included the following phases:

1) Preparatory phase:

The tasks within this phase included: obtaining research/ethical approval; orientation of the research team to the research approach and the educational strategies used in the study, namely, concept-based learning and concept mapping; and preparation of specific content using concept mapping and agreeing on clinical concepts to be integrated to clinical training.

2) Data collection phase:

It included two episodes: pretesting and post-testing. These episodes took place in the third and twelfth weeks of the semester.

2.4 Ethical considerations
The Deanship of Scientific Research at Isra University granted ethical approval to conduct the study. Students were assured that information obtained from them would not affect their evaluations and that they could withdraw from the study at any time. Completing the questionnaire implicitly denoted an obtained consent from participants. Moreover, the blinding procedure was used, with a secretary issuing code numbers to the individuals and then writing the numbers on the questionnaires and the completed observation sheets. Data entry by the researcher solely considered students' codes rather than their names.

3. RESULTS
The data collected from 40 student participants were analyzed using the Statistical Package for Social Science Software (SPSS version 20). Table 1 outlines the characteristics of the subjects. The Shapiro-Wilk normality test was run on the entire set of ordinal variable data.

Data analysis was then performed to evaluate the research hypothesis and demonstrate relationships between study variables.

The significant Wilcoxon signed ranks test measure ($Z = -2.136$, $p = .025$) indicated that students reported a greater perception of their clinical academic success at the end of the clinical rotation. However, no improvements in students' theoretical academic success were evident.

Impact on Students' Clinical Reasoning (CR) and Clinical Judgment (CJ):

While testing the research hypothesis, the study team kept in mind that the pretesting measures constitute evidence supporting the existing teaching method at the nursing faculty, which reflects a traditional approach to classroom and clinical teaching. The methodology stresses a teacher-centered approach to classroom instruction and a case assignment for the course's practicum component. It was logical to conclude that the intervention, based on baseline data obtained before deploying the innovative approach that integrated the pedagogies of concept mapping and concept-based learning, was the most likely cause of improvements in knowledge and competence. As indicated by the results of paired samples t-test (see Table 2), improvements in eight out of ten aspects of students' CR and CJ were evident at the end of the clinical rotations. Except for students' perceptions of their independence in CJ (-1.147, $p = .260$) and the engagement element of their CJ (-1.856, $p = .071$), all other components of students' CR and CJ improved considerably after the rotation. These components covered the general CR behavior of students, their independence in CR and CJ, and their CJ with its background, process, and representation aspects.

Table 1. Demographic variables

Variable		Number of students	Percentage
Age (n = 40)	20 years	9	22.5%
	21 years	10	25%
	22 years	5	12.5%
	23 years	6	15%
	> 23 years	4	10%
	missing	6	15%
Gender (n = 40)	Male	30	75%
	Female	10	25%
GPA (n = 40)	60%–69%	22	55%
	70 %–79%	7	17.5%
	> 80%	4	10%
	missing	7	17.5%

Table 2. The impact of combined pedagogy on CR and CJ

Variable	Pre		Post		t	Sig. (2-tailed)*
	Mean (out of 100)	SD	Mean (out of 100)	SD		
General CR behavior	72	9.6	76	8	-3.11	.005*
Independence in CJ (students' perceptions)	62	20.6	66	19.3	-1.147	.260
Independence in CR (students' perceptions)	66	14	71.5	13	-2.24	.032*
Independence in CR (clinical instructor observation)	53.5	18	67	19	-6.15	<.001*
Independence in CJ (clinical instructor observation)	49	19	64	20	-6.43	<.001*
Clinical Judgment (CJ)	59.5	15	70	17	-4.85	<.001*
CJ engagement	2.5	.68	2.8	.84	-1.856	.071
CJ background	2.3	.75	2.7	.82	-4.523	<.001
CJ process	2.6	.71	2.9	.81	-2.481	.018
CJ representation	2.2	.72	2.9	.66	-6.607	<.001

Note. *Significant at .05 α level. CR: Clinical Reasoning; CJ: Clinical Judgment

3.1 Relationships among study variables

The Spearman's Rho correlation coefficient findings demonstrated substantial correlations between research variables.

Two links have been found between students' GPAs and their expectations of academic achievement.

As perceived by nursing students, the theoretical academic success was strongly linked with their GPA as indicated by pretest ($r = 0.643$, $p < .001$) and post-test ($r = 0.540$, $p < .002$) correlation coefficient results.

Students' CJ, as assessed by their clinical instructors, was strongly correlated with their independence in both CJ and CR, as shown, respectively, by both pretesting ($r = 0.759$, $p < .001$; $r = 0.831$, $p < .001$) and post-testing ($r = 0.896$, $p < .001$; $r = 0.892$, $p < .001$) measures. Moreover, students' general CR behavior was strongly linked with their CJ ($r = 0.527$, $p < .003$) and their independence in both CJ ($r = 0.471$, $p = .009$) and CR ($r = 0.468$, $p = .009$) at the end of the semester. Figure 3 shows the links between the major variables at the beginning and end of the clinical rotation.

**Table 3.** Students performance aspects of clinical judgment scale

Aspect of CJ	Score			
	1	**2**	**3**	**4**
Engagement: The extent to which a student identifies something as a problem & assertively becomes engaged in solving it.	Even in simple, common, or familiar situations, has difficulty interpreting or making sense of data; The patient's problems were left unrecognized, and no action was taken.	Confused by the clinical situation & the amount and kind of data. As a result, the student: Focuses on one thing at a time & missing most deviations; unsure how to continue the assessment. Decides not to get involved in the situation or withdraws from the scene.	Recognizes most obvious deviations in data and uses these to assess continually; misses the most subtle signs.	Assertively recognizes deviations from expected patterns in assessment data Assumes responsibility even when facing complex, contrary, or confusing data by doing the following: Reassessing the patient, Reporting findings to the Primary Nurse, or Monitoring patient's progress closely.
Background Information/ Knowledge: The extent to which student accesses and uses appropriate information.	Even when informed about the patient's problem or relevant intervention by the Instructor or Preceptor, he/she can still not compare the identified patterns with known patterns or even recognize/use available data sources in the unit.	Only in simple situations compares the patient's data patterns with those known & to develop or explain intervention plans; it has difficulty, however, with situations that are within the expectations of students. Passive in seeking information.	In most situations, interprets the patient's data & compares it with known patterns to develop intervention plans and accompanying rationale.	In all situations, appropriately compare the identified patterns with known patterns (from the nursing knowledge base, research, experts in the field and his/her personal experience) to develop intervention plans; Assertively seeks information.
Process: The extent to which students know & uses appropriate reasoning strategies (i.e., analytical & narrative reflective) and his/her CR is free of biases, which will result in appropriate CJ and desired patient outcomes.	Except in routine situations, is Stressed & disorganized, Lacks control, Makes patients & families anxious or less able to cooperate; Focuses on developing a single intervention, addressing a likely solution, but it may be confusing, incomplete, and inaccurate; Unable to select and perform nursing skills; Accompanying rationale is vague, confusing, and reflects many reasoning errors; Even when prompted, decision points are irrelevant.	Reassures patients and families in relatively simple situations but becomes stressed & disorganized easily; Develops interventions for simple cases based on the most obvious data; unable to make adjustments as indicated by the patient's response; Hesitant or ineffective in using nursing skills; Accompanying rationale indicates a reasoning error; Has difficulty imagining alternative choices.	Generally, displays confidence, able to control or calm most situations; stressed in particularly complex situations, but able to seek the needed assistance; reassures patients & their families; Develops interventions based on relevant patient data; monitors progress regularly but does not expect to have to change treatments; Displays competence in the use of most nursing skills (could improve speed or accuracy); Accompanying rationale shows appropriate reasoning; Key decision points are identified with minimal prompting, and alternatives are considered.	Assumes responsibility and Displays leadership & confidence Able to control & calm all situations; Involves team; Reassures patients & their families and check to understand; Interventions are tailored for the individual patient & all decisions are accurate; Displays competence in the use of nursing skills (as per student's scope of practice); Accompanying rationale shows appropriate reasoning; Decision points, elaborating alternatives, & accurately evaluating choices against alternatives.
Representation: How effectively can the student communicate his/her decision/ solution/CJ & the thinking processes behind it? This includes effective self-analysis and evaluation.	Has difficulty communicating Explanations are confusing; directions are unclear or contradictory; patients & families are made confused or anxious & are not reassured; Justifies personal decisions & choices without evaluating them and appears uninterested in improving performance or unable to do so.	Shows some communication ability when prompted Communication with patients, families, & team members is only partly successful and displays caring but not competence; Self-protective in evaluating personal choices; makes some effort to learn from experiences.	Generally communicates well (verbally & in writing); Explains carefully to patients, families, & team members; could be more effective in establishing rapport; Reflects on and evaluates experiences; identifies strengths & areas for improvement; could be more effective in evaluating weaknesses.	Communicates effectively; Explains interventions fully to patients, families, & team members; effective in establishing rapport; Reflects on nursing experiences; accurately identifies strengths & areas for improvement and develops specific plans to eliminate weaknesses.

Demographically, improved CJ ($t = 2.250$, $p = .035$) and better independence in both CR ($t = 2.812$, $p = .010$) and CJ ($t = 2.106$, $p = .047$) were exhibited by female, rather than male, students at the end of the clinical rotation. Moreover, the independent variables of CR and CJ were correlated, respectively ($r = 0.364$, $p = .032$; 0.360, $p = .034$), with students' age at the end of the rotation. The latter variable was also correlated with students' age ($r = 0.335$, $p = .049$) at the commencement of the semester, as observed by the clinical instructors.

4. DISCUSSION

Results of this study indicated that students' overall scores on both CR and CJ improved significantly at the end of an adult medical-surgical course. The significant positive changes also included students' independence in both CR and CJ and their general CR behavior and performance of overall clinical judgment. This finding indicates that students can figure out subtle cues, problems, or needed actions and interventions[24] enriched in adult healthcare nursing courses. Moreover, students' CJ ability due to CR[1] improved at the end of the course. The author described the details of these results in two reports.[25, 28] The current study results also indicated that students' general CR behavior was strongly linked with their overall clinical judgment performance and their independence in both CR and CJ at the end rather than the beginning of the course. The beginning of the course witnessed strong links between students' overall clinical judgment performance and their independence in both CR and CJ, as observed by their clinical teachers. This finding indicates that, even with limited experience at the general adult units, it is obvious that students' clinical judgment abilities will also increase as the independence in CR and CJ increases. As these abilities evolve, their links and contextual general CR behavior become well-defined (see Figure 3).
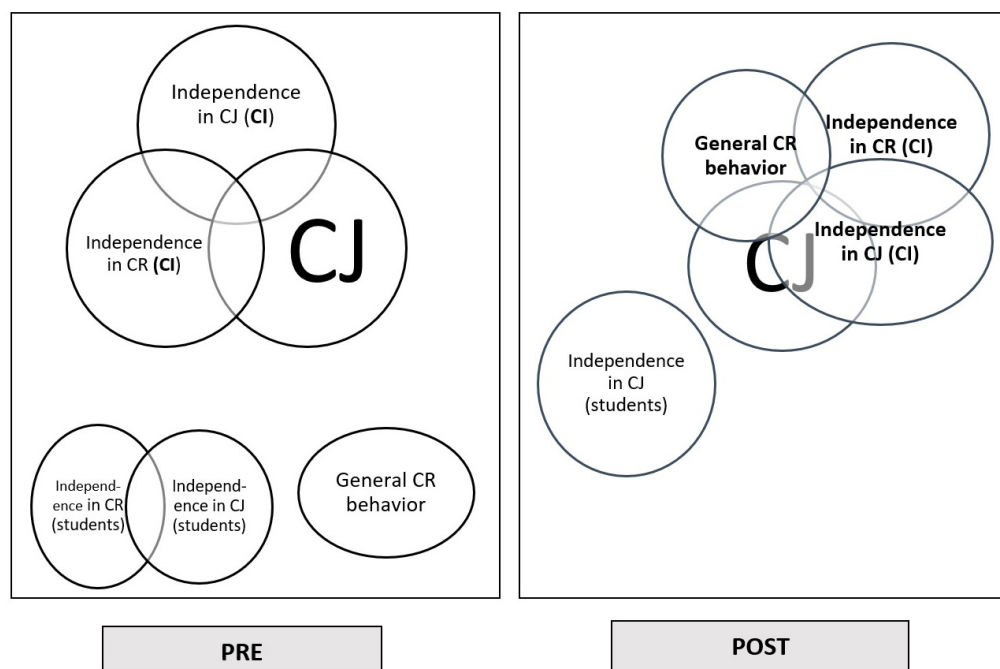
Figure 3. Links between variables at both the beginning and end of the clinical rotation

The study also indicated significant improvements in the CJ aspects of background, process, and representation as students gain more experience in general adult care settings. It is proven that conceptual learning approaches help students apply patterns of deep learning – sensing, integrating, and responding – across various contexts.[13] As students construct concepts while progressing through adult nursing care courses, they learn to access and use appropriate information, reasoning strategies, and communication skills.[25] Unlikely, their ability to recognize deviations from expected patterns and become engaged in solving patients' problems did not significantly improve when students completed their clinical courses. The lack of improvement in students' engagement in CJ may be explained by the insignificant results linked with various aspects of the general CR behavior of students.[28] Among these are students' lack of confidence, poor therapeutic communication skills, and lack of belonging to the nursing team. Students were not accepted as care providers by either the team or the patients. Sedgwick et al.'s findings[28] paralleled the current study's findings. The

authors indicated that the weak interaction between novices and unit staff members had a negative effect on their interest in clinical reasoning and judgment.[7] Moreover, nurses' low confidence level hindered their ability to manage during deterioration events.[6]

5. CONCLUSIONS

This study provides a workable approach that serves the dual purposes of studying and enhancing students' CR and CJ abilities. When the contextual CR behavior of nursing students is explored, it will broaden academicians' understanding of the contextual factors that may enhance or hinder students' CR and CJ abilities, including their independence in these mental functions. In addition, it is best to investigate the effect of implementing contemporary teaching techniques, such as concept-based learning and concept mapping. These constructivist approaches can enhance deep learning and help desaturate the curriculum[13] as reflection, accurate use of prototypes, and comparisons of a particular clinical situation to similar types occur 19. The approaches can also encourage students to think aloud and to explain their reasoning as listening to each other and an expert's line of reasoning, exposing the subtleties of nursing clinical judgment 19. Students' CR and CJ testing procedures may consider some demographical variables – like gender and age – to enrich subsequent interventions. For example, a future grouping of students in the clinical areas should consider these variables to enhance students' engagement abilities. Future studies may use a control group and bigger sample sizes to enhance the testing procedure, thus increasing the validity of the adopted design. The national competency-based framework for nursing practice and undergraduate nursing education includes the components of CR and CJ as essential elements. Expanding on the measurements of CR and CJ as fundamental elements of the clinical competence of undergraduate nursing students is one of the implications of the current study for clinical training.

CONFLICTS OF INTEREST DISCLOSURE

The authors declare they have no conflicts of interest.

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