Effect of Concept Mapping Method on Nursing Students' Critical Thinking and Independent Knowledge Acquisition

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Abstract

Background: A nurse must be able to think critically, learn how to synthesize information, and be an autonomous learner in today's demanding. Concept mapping method helps nurse educators give students the fundamental skills of critical thinking, inventive problem-solving, and decision-making. The present study **aimed** to evaluate the effectiveness of using concept mapping methods on nursing students' critical thinking and independent knowledge acquisition. **Methods:** A quasi experimental pretest-posttest study design was adopted. The study was conducted at Technical Nursing Institution, Tanta University. **Sample:** A convenient sample consisted of 206 second-year undergraduate nursing students during the second semester of academic years 2022/2023, They were divided randomly into two groups: experimental group (n=103) and control group (n=103). **Tools:** Four tools were used for data collection: Concept Mapping Questionnaire Structure, Concept Mapping Assessment Rubric, Inventory of the California Critical Thinking Disposition Sheet, and Independent Learning Instrument. **Results**: The results showed a statistically significant difference between both pre and post awareness sessions among the study group regarding concept map knowledge. As well as an improvement in critical thinking scores and independent learning of the study group as compared to the control group. In addition, the results confirmed statistically significant correlations between concept mapping and the overall Inventory of the California Critical Thinking Disposition & independent learning. **Conclusion:** There were significant influences of concept mapping on nursing student's critical thinking and independent knowledge acquisition. **Recommendation:** Encourage using of a concept mapping strategy in nursing education that help students develop their critical thinking abilities and autonomous information acquisition while allowing them to take into account the concept of nursing practice in their conceptualization of patient problems.

Keywords: Concept Mapping, Critical Thinking, Knowledge Acquisition, and Nursing Students.

Introduction

Today's complicated healthcare system presents educators with the challenging task of encouraging nursing students' critical thinking and judgment. Additionally, nursing graduates must possess the knowledge and abilities to improve their ability to apply theory in clinical practice as well as to advance their communication, problem-solving, decision-making, and clinical reasoning skills (**Binoy, 2022 and Ahmed et al., 2016**). In addition, the objectives of nursing education are to impart clinical decision-making abilities and equip practitioners with the knowledge and tools necessary to use critical thinking techniques. Also, nursing education continues to rely heavily on the traditional approaches of teaching while students are expected to transfer and apply didactic knowledge in challenging clinical settings. Therefore, old methods of educating nursing students must be examined

(Elmeghawri & Sleem, 2021 and Latif et al., 2016).

To effectively train entry-level nursing professionals, nurse educators must be open to novel and unconventional methods. They must also find ways to give their students more opportunities for creativity, problem-solving, critical thinking, and active participation (**Innis et al., 2023**). Many creative teaching strategies have been developed in recent years in nursing and other fields due to the nature of patient problems and changes in the healthcare system. Clinical assignments, case studies, questioning, group discussion, nursing round, clinical logs, simulations, role play, cooperative learning, concept mapping, and problem-based learning are the most common strategies. These strategies help people improve their ability to communicate, think critically, solve problems, make decisions., and encourage students to work collaboratively with peers (**Lin et al., 2022 and Mohamed et al., 2017**).

Concept mapping is a teaching tool for mapping out the connections between ideas. It is a tool for organizing and planning nursing care visually while highlighting connections between issues. It encourages students for ideas generation, communication, and learning enhancement. Also helps them to develop relationships among different bits of information and build on previous knowledge and skills (**Kassab, 2016, Latif et al., 2016 and Garwood & Hammoud, 2017**).

A concept map is a graphical tool for grouping and showing how concepts are related to one another. Topics are linked together, the linking words and phrases in the line define the connections between the concepts. Prepositions and concepts are typically arranged hierarchically, going from the broadest, most inclusive to the narrowest. The ideal way to create a concept map is to use some questions that the students are trying to answer and have designated as their focus questions. A circumstance or event that we are attempting to comprehend through the structuring of knowledge in the form of a concept map may be the subject of the concept map (**Fawaz & Kavuran, 2021 and Laskowski, 2018**).

In nursing education, concept maps have been utilized to improve cognitive learning, problem-solving, patient-centered, holistic care, academic performance, nursing competency skills, knowledge and understanding levels, and student satisfaction. They have also been used to help students get ready for clinical learning activities and connect theory to clinical practice. Additionally, concept maps support the creation of meaningful learning and improve the teaching abilities of nurse educators (**Kumar, 2021, Khrais & Saleh, 2017**). It is a visual representation of a patient's plan of care. This representation allows the students to see the patient's health problems and visually connect those problems to the intervention. Concept planning might be done in a group or alone. Participatory learning is provided by group learning. Students collaborate in small groups to optimize their learning opportunities for one another. It aids students in organizing their thoughts, planning the care of their patients, setting priorities, and thinking critically. It also helps them make connections between ideas or concepts they are currently studying (**Hanshaw & Dickerson, 2020 and Aein & Aliakbari, 2017**).

Critical thinking is the act of seeking, evaluating, synthesizing, and conceptualizing knowledge, creative thinking, open-mindedness, and an unconstrained curiosity free from preset standards (**Elmeghawri & Sleem, 2021 and Mohamed et al., 2017**)

Critical thinking is meaningful conceptual thinking that includes evidence-based analysis, context setting, enthusiastic intellect, and purposeful insight & organization. The utilization of fundamental nursing skills necessary for problem-solving, which traditionally focus on helping students analyze, diagnose, intervene, and evaluate the effectiveness of a nursing intervention, means the application of several aspects of critical thinking to real-life crucial circumstances.

In nursing, to sustain safe nursing practice and high-quality patient care, critical thinking is the capacity to think analytically, systematically, and with an openness to

question and reflect on the reasoning process. Concept mapping enhances the critical thinking and reasoning processes of nursing students by fostering discovery, the acquisition of clinical knowledge, and meaningful learning (**et al., 2018 and Garwood & Hammoud, 2017).**

Knowledge acquisition is the process of obtaining information through instruction. It is the first stage in the transfer of knowledge. Knowledge must first be obtained before it can be shared. Nursing graduates must gain the knowledge and skills that directly apply to clinical practice to further strengthen their capacity to plan, communicate, teach, solve problems, and confidently make clinical judgments (**Kokcu & Cevik, 2020; Koosha et al., 2020; and Laskowski, 2018**).

The construction of a concept map helps the learner to pull together the knowledge already known about a subject while integrating new knowledge and expanding their understanding. Concept mapping encourages learners to organize and analyze knowledge to discover, visually represent, and link significant concepts. It also helps the learner to completely integrate the concepts by creating his or her conceptual map, which finally leads to meaningful learning (**Binoy and Raddi, 2022).** Additionally, concept mapping is a useful tool that encourages students' learning process to shift from a passive acquisition of knowledge to an active and deep approach to learning (**Yue et al., 2017and Farrag, 2017).**

Significance of the study

Historically, the teaching of students has been teacher-centered and subject-focused. Nursing educators would be required to educate their students on the concepts, techniques, and policies that served as the foundation for nursing practice. Additionally, to prioritize care and deliver successful nursing interventions, nurses must be skilled decision-makers and critical thinkers. This will present a challenge for nurse educators to change education using recent strategies that successfully encourage and strengthen critical thinking, student knowledge acquisition, retention, and the ability to be autonomous

learners. Consequently, nurse students will be able to prioritize patient needs, organize data, link patient medical disease and nursing intervention, and improve clinical reasoning that led to safe clinical judgments. (**Yue et al., 2017, Daley et al., 2016, and Abu-Assi & Alkorashy, 2016).**

Moreover, the philosophy of nursing education is built on three dimensions which are nursing practice, leadership, and research. This requires certain qualities such as critical thinking skills, decision making, problem-solving, and self-learning which enable the nursing students to achieve the objectives of the nursing curricula. In this direction, the researchers start to think about the concept mapping teaching strategy to facilitate the achievement of these objectives.

Aim of the study

This study aimed to evaluate the effectiveness of using concept mapping methods on nursing students' critical thinking and independent knowledge acquisition.

Research Hypotheses:

− After the application of the concept mapping teaching method, the knowledge scores of the nursing students will be increased.

− The nursing students who will teach by concept mapping strategy will show improvements in their critical thinking and self-directed learning.

Subjects and method
Research Design
To conduct this study, a quasi-experimental research design was used.

Setting
The study was conducted at Technical Nursing Institution, Tanta University which includes a technical diploma program consisting of two years divided into four semesters, in addition to the compulsory internship period of 36 hours per week for six months.

Subjects

The study subject included second-year undergraduates technical nursing students during the second semester of academic years 2022/2023. The total number of students was 464.

Sampling technique

A convenient sample was taken randomly and calculated by a scientific formula that was (206) students. They were divided randomly into 103 for the study group and 103 for the control group. **Tools of the study:** Four tools were used for data collection.

Tool I: Concept Mapping Questionnaire Structure: Developed by researchers based on the recent related literature review **(Binoy and Raddi, 2022, Kassab, 2016 and Latif et al., 2016)**. It is divided into two parts:

Part 1: Demographic characteristics of nursing students (age, gender, residence, academic achievement, and previous training programs).

Part 2: Concept Mapping Questionnaire Structure to assess technical nursing students' knowledge regarding concept mapping. It consisted of 30 closed-ended questions (15 true and false questions and 15 multiple-choice questions). It included questions about the definition, purposes, advantages, and disadvantages of concept mapping, components, types, and steps for developing and drawing maps. The questions were scored as "1" for the correct answer and "0" for the incorrect answer. The total score of technical nursing students' knowledge was calculated as; less than 60% considered poor, 60% to less than 75% considered fair, and $\geq$ 75% considered good.

Tool II: Concept Mapping Assessment Rubric: Developed by researchers based on related literature reviews **(Farag, 2017 and Youssef & Mansour, 2013)** to assess technical nursing students' concept mapping, their understanding of the lectures and organize the data of the lectures by themselves in their concept mapping.

This rubric was divided into four sections for evaluation:

▪ Concepts and terminology: show an understanding of the topic's concepts and principles and all significant concepts were selected and related to the topic.
▪ Hierarchical structure section: concepts connected in a hierarchical structure leading to more specific concepts.
▪ Organization section: concept map was assessed on overall organization and concepts from the units are covered in a meaningful way and are thoughtfully organized.
▪ Relationship and communication section: all relationships indicated a connecting line and were accurately labeled with appropriate linking the words with the overall effectiveness of the map structure in communicating the inherent relationships between the main topic and subtopics.

Technical nursing students' responses consist of four category points (4-1) for each statement, which are exemplary, exceed the standard, adequately meet the standard, and below the standard.

Tool III: Inventory of the California Critical Thinking Disposition Sheet. This tool was developed by **(Facione et al.,1994)** and modified by **(Mohamed et al., 2017.** It is used to assess technical nursing students' critical thinking disposition and consisted of 75 items grouped into seven dispositional characteristics: open-mindedness (12 items), truth-seeking (12 items), self-confidence (9 items), analyticity (11 items), systematic (11 items), inquisitiveness (10 items) and cognitive maturity (10 items). Technical nursing students' responses were rated on 5 points Likert Scale as follows: strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), and strongly agree (5). Scoring system: If the score is <50 % indicating negatively disposed. Between 50% to 66.6% indicating ambivalently disposed. If score > 66.6% indicating positively disposed.

Tool IV: Independent Learning Instrument:

This tool was developed by researchers based on **(Atwa, 2018, Cadorin et al., 2017, Ahmed et al., 2016 and Shen et al., 2014)**. It was used to assess technical nursing students' readiness for independent knowledge acquisition. It consisted of 30 items distributed into five domains: learning motivation (10 items), planning and implementation (8 items), self-management (4 items), self-control (4 items), and interpersonal communication (4 items).

Technical nursing students' responses were rated on 5 points Likert Scale ranging from strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), and strongly agree (5). The total score of Independent Learning Instrument ranged from (30 – 150), which is the sum of all students' responses. A higher score in this questionnaire indicated a high motivation and readiness of learners for independent knowledge acquisition.

Method:
Validity & reliability of the tools
The content validity of the tools, their clarity, comprehensiveness, appropriateness, and relevance were reviewed by five experts in Nursing Administration and Education. Modifications were made according to the panel judgment to ensure sentence clarity and content appropriateness. Test reliability was assessed using the Cronbach alpha, which yielded internal consistency ratings of 0.78 to 0.80.

Pilot study
A pilot study carried out involving 10% of the study sample (n=20 students), chosen randomly from the above-mentioned setting to determine the time needed to complete the questionnaire, sample accessibility, and tools' clarity, they were excluded from the sample. No modifications were required based on the pilot study results.

Ethical consideration
Ethical approval was obtained from the Scientific Research and Ethics Committee of the Faculty of Nursing, Tanta University, and official permission was taken from the Dean of the Technical Nursing Institution, Tanta University. Additionally, oral consent was taken from the students' after explaining the nature and the aim of the study, they were assured the right to participate or withdraw at any time during the study.

Data collection phases
The study was conducted through the following four stages: assessment, planning, implementation, and evaluation. All these stages are approximately 4 months into the 2022/2023 academic year. Classes began from February 2023 to May 2023.

Assessment phase:
- Assessment was carried out for all subjects before the beginning of the study and at the beginning of their clinical rotation after explaining the purpose of the study using tools (I, III, and IV). All tools were administered by the researcher as follows:
- Concept Mapping Questionnaire Structure (tool I) to assess technical nursing students' knowledge regarding concept mapping.
- Inventory of the California Critical Thinking Disposition Sheet to assess technical nursing students' critical thinking disposition (tool III).
- Independent Learning Instrument (tool IV) was used to assess the nursing student's readiness for independent knowledge acquisition. The pretest took 50 minutes to be completed.

Planning phase:
The content of concept mapping guidelines

were prepared by the researchers based on the related literature

The content of concept mapping guidelines was prepared by the researchers based on the related literature **(Binoy and Raddi, 2022, Kassab, 2016 and Latif et al., 2016)**.

- Concept Maps were prepared to cover some nursing administration and community health nursing topics related to communication, leadership, conflict management, problem-solving and decision making then given them over to experts to determine the validity of the content and conceptual map clarity. Accordingly, adjustments were made to the concept map.

Implementation phase:
- All subjects were randomly divided into control and experimental groups.

- The study group learned the same material by creating concept maps, whereas the control group received instruction using the traditional method. The educational sessions were divided into 4 lectures: 2 theoretical lectures and 2 practical lectures. The first and second lectures served as orientation lectures for all students, outlining the goals of the educational program, its structure and schedule, and the expected results.

-The experimental group received an adequate explanation of (definition, types, uses, importance, benefits, and applications) of concept mapping and awareness of the steps needed to develop a concept map. The third and fourth sessions include training students on how to design the concept diagram with a focus on the lectures.

- The researchers designed each lecture into the map as they present it to the students, and then they are asked to build their maps (five maps in small groups) to illustrate what they have learned. Using the rubrics system, the researchers revised the concept maps that the students had produced, then the researcher's provided students with encouraging and helpful feedback if there were misconceptions, and a case scenario was also carried out to help students learn how to use the concept map to solve issues in clinical settings.

Evaluation phase:
Evaluation of the training program was done through post-test and conducted to both the experimental and control groups by administering concept mapping questionnaire structure, California Critical Thinking Disposition Inventory (CCTDI), and Independent Learning Instrument. The results of the pre and posttests of the two groups were compared to assess the effect of using a concept map.

Statistical analysis:
Microsoft Office Excel is utilized for data handling and graphical presentation, while the statistics Package SPSS software (version 20) is used for statistical analysis. quantitative variables are described by mean, median, Standard Deviation (SD), and range (minimum & maximum), while qualitative categorical variables are described by proportions and percentages. The normality of the distribution was checked using the Kolmogorov-Smirnov test. The difference between the means of the two groups was calculated using an independent sample t-test. The correlation's accuracy was checked using Pearson's R. The 5% level was used to determine the significance of the obtained data. **Results:**

Table (1) illustrates that technical nursing students' age ranged between 20 to 22 years, 59.2% of the study group and 57.3% of the control group had less than 21 years old with a mean 20.45 ± 0.57 and 20.51 ± 0.65 respectively. 50.5% and 75.7% of both two groups were males. As regards residence, 70.9% and 79.6% of both groups were from urban areas. 43.7% and 54.4% of both groups had very good previous academic achievement. All students of both groups were not attending training programs on independent learning.

Figure (1) shows that (18.4%) of the study group had a good knowledge level about the concept mapping pre-training program which increased to be (91.3%) post-training program.

Table (2) shows study group scores of the concept mapping assessment rubric post-training program. The table illustrates that there was a highly significant improvement (p=0.001) between the five assignments of the concept map assessment rubric due to improvements in the construction content of the rubric from beginning to end.

Figure (2) shows the total level of study and control group regarding inventory of the California Critical Thinking Disposition pre- and post-training program. (7.8%) of the study group had a positive level of overall critical thinking disposition pre-training program which increased to be (87.4%) post-training program. while 75.7% of the control group had a negative level of overall critical thinking disposition pre training program which changed to be (87.4%) had ambivalent level of overall critical thinking disposition post-training program.

Table (3) shows the level of the study and the control group regarding independent learning instrument pre- and post-training program. There was a significant difference between the study and the control group. Also, there was significant improvement between pre- and post-training program at p ≤ 0.05. High percent (64.1%) of study group had a low level of overall independent learning pre training program which improved to be (84.5%) and had a high level of overall independent learning post-training program. 59.2% of the control group had a low level of overall independent learning pre-training program which changed to be (79.6%) had a moderate level of overall independent learning post-training program.

Figure (3) shows the correlation between overall concept mapping and overall Inventory of the California Critical Thinking Disposition. The table confirmed that there was a statistically significant positive correlations between overall concept mapping and overall Inventory of the California Critical Thinking Disposition at p ≥ 0.05.

Figure (4) shows a correlation between overall concept mapping and overall independent learning. The table confirmed that there was a statistically significant positive correlation between overall concept mapping and overall Independent Learning at p ≥ 0.05

Table (1): Distribution of Technical nursing students according to their personal data

Demographic characteristics	Study (n = 103)		Control (n = 103)		Test of Sig.	p
	No.	%	No.	%		
Age						
<21	61	59.2	59	57.3	$\chi^2=$	0.778
≥21	42	40.8	44	42.7	0.080	
Min. – Max.	20.0 – 22.0		20.0 – 22.0		t=	
Mean ± SD.	20.45 ± 0.57		20.51 ± 0.65		0.793	0.429
Median	20.0		20.0			
Gender						
Female	51	49.5	78	75.7	$\chi^2=$	<0.001*
Male	52	50.5	25	24.3	15.119*	
Residence						
Urban	30	29.1	21	20.4	$\chi^2=$	0.146
Rural	73	70.9	82	79.6	2.111	
Previous academic achievement						
Excellent	24	23.3	23	22.3		
Very good	45	43.7	56	54.4	$\chi^2=$	0.150
Good	22	21.4	20	19.4	5.315	
Fair	12	11.7	4	3.9		
Attend previous training programs on independent learning						
Yes	0	0.0	0	0.0	–	–
No	103	100.0	103	100.0		

SD: **Standard deviation**   **t: Student t-test** χ^2: **Chi square test**
p: p value for comparing between the two studied groups   - * Statistically significant at p ≤ 0.05

Figure (1): Total knowledge score and level of concept mapping among study nursing students pre and post-training program
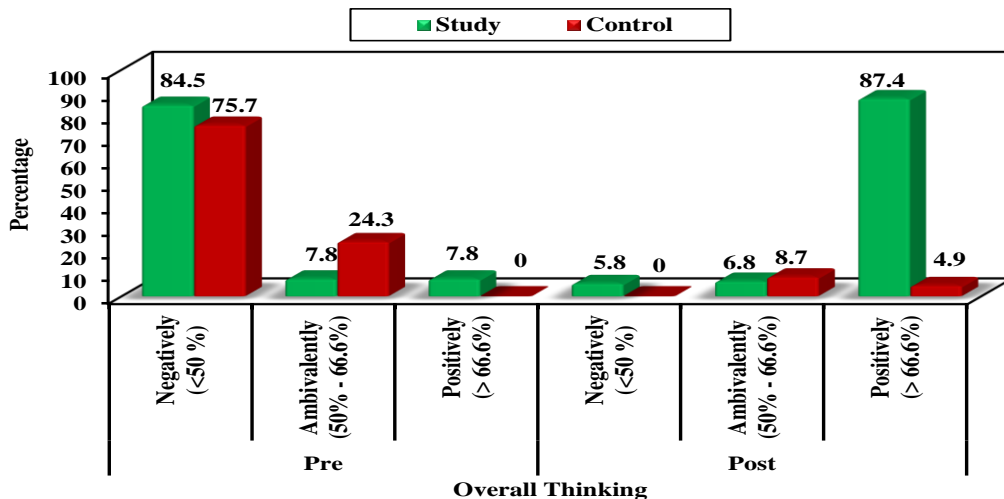

Table (2): Study group scores of concept mapping assessment rubric post training program.

Concept Mapping Assessment Rubric	Score of study group										Fr	P
	First		Second		Third		Fourth		Fifth			
	No.	%	No.	%	No.	%	No.	%	No.	%		
Concepts and terminology												
Below the standard	37	35.9	15	14.6	11	10.7	0	0.0	0	0.0		
Adequately meets standard	33	32.0	27	26.2	21	20.4	7	6.8	6	5.8	304.298*	<0.001*
Exceeds the standard	21	20.4	49	47.6	40	38.8	53	51.5	23	22.3		
Exemplary	12	11.7	12	11.7	31	30.1	43	41.7	74	71.8		
Hierarchical structure section												
Below the standard	43	41.7	18	17.5	13	12.6	5	4.9	1	1.0		
Adequately meets standard	33	32.0	31	30.1	18	17.5	9	8.7	6	5.8	309.977*	<0.001*
Exceeds the standard	17	16.5	39	37.9	20	19.4	16	15.5	8	7.8		
Exemplary	10	9.7	15	14.6	52	50.5	73	70.9	88	85.4		
Organization section												
Below the standard	56	54.4	13	12.6	10	9.7	6	5.8	0	0.0		
Adequately meets standard	27	26.2	17	16.5	10	9.7	7	6.8	3	2.9	314.054*	<0.001*
Exceeds the standard	14	13.6	46	44.7	14	13.6	12	11.7	10	9.7		
Exemplary	6	5.8	27	26.2	69	67.0	78	75.7	90	87.4		
Relationship and communication section												
Below the standard	49	47.6	31	30.1	5	4.9	3	2.9	0	0.0		
Adequately meets standard	30	29.1	30	29.1	10	9.7	9	8.7	0	0.0	334.178*	<0.001*
Exceeds the standard	15	14.6	30	29.1	41	39.8	26	25.2	3	2.9		
Exemplary	9	8.7	12	11.7	47	45.6	65	63.1	100	97.1		

Fr: **Friedman test**

p: p value for comparing between the five studied periods in study group.

*: Statistically significant at $p \leq 0.05$

Figure (2): Level of study and control group regarding inventory of the California critical thinking disposition pre and post training program.
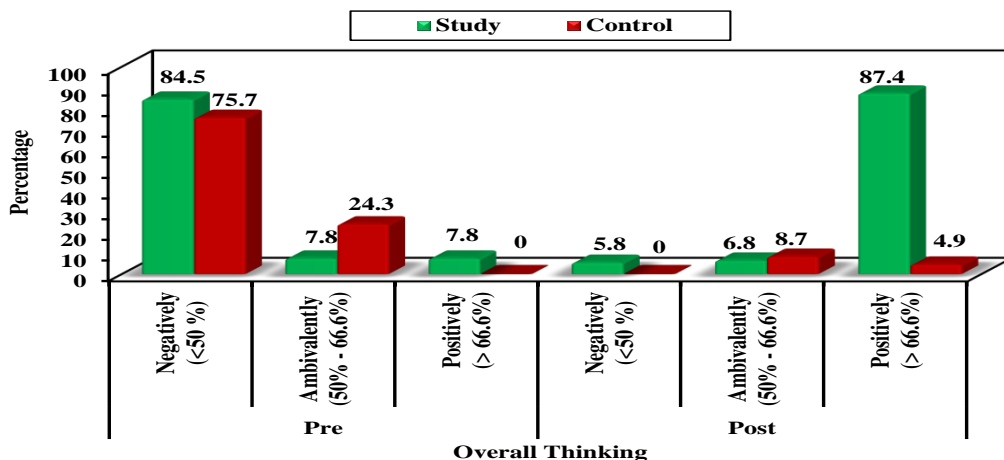

Table (3): Level of study and control group regarding Independent Learning Instrument pre and pos- training program

Independent Learning Instrument	Level of technical nursing students								χ^2	^{MC}p
	Study (n = 103)				Control (n = 103)					
	Pre		Post		Pre		Post			
	No.	%	No.	%	No.	%	No.	%		
Learning motivation										
Low (<50%)	57	55.3	0	0.0	54	52.4	0	0.0		
Moderate (50-75%)	38	36.9	13	12.6	47	45.6	72	69.9	69.722*	<0.001*
High (≥75%)	8	7.8	90	87.4	2	1.9	31	30.1		
Planning and implementation										
Low (<50%)	60	58.3	2	1.9	58	56.3	10	9.7		
Moderate (50-75%)	38	36.9	8	7.8	41	39.8	72	69.9	102.007*	<0.001*
High (≥75%)	5	4.9	93	90.3	4	3.9	21	20.4		
Self-management										
Low (<50%)	69	67.0	7	6.8	61	59.2	13	12.6		
Moderate (50-75%)	30	29.1	9	8.7	34	33.0	78	75.7	113.342*	<0.001*
High (≥75%)	4	3.9	87	84.5	8	7.8	12	11.7		
Self-control										
Low (<50%)	52	50.5	4	3.9	63	61.2	10	9.7		
Moderate (50-75%)	44	42.7	10	9.7	29	28.2	80	77.7	113.643*	<0.001*
High (≥75%)	7	6.8	89	86.4	11	10.7	13	12.6		
Interpersonal communication										
Low (<50%)	71	68.9	0	0.0	61	59.2	8	7.8		
Moderate (50-75%)	30	29.1	8	7.8	40	38.8	79	76.7	136.291*	<0.001*
High (≥75%)	2	1.9	95	92.2	2	1.9	16	15.5		
Overall										
Low (<50%)	66	64.1	7	6.8	61	59.2	0	0.0		
Moderate (50-75%)	37	35.9	9	8.7	42	40.8	82	79.6	116.578*	<0.001*
High (≥75%)	0	0.0	87	84.5	0	0.0	21	20.4		

χ^2: **Chi square test**　　　　　　　MC: **Monte Carlo**

p: p value for comparing between the two studied groups in post.

*: Statistically significant at p ≤ 0.05

Figure (3): Correlation of overall concept mapping and overall Inventory of the California Critical Thinking Disposition
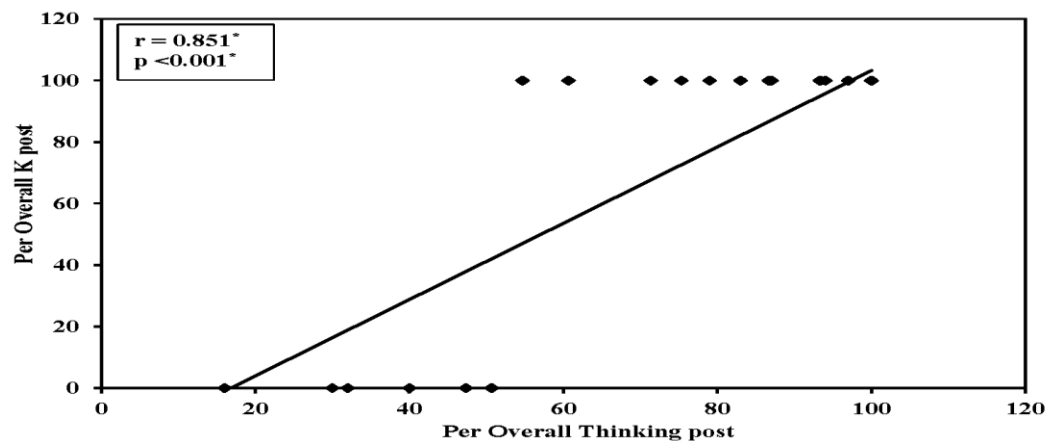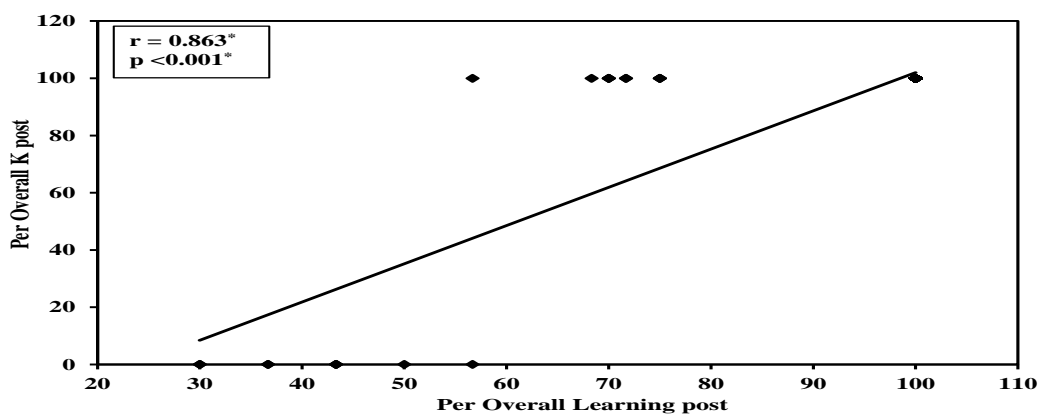

Figure (4): Correlation between overall concept mapping and overall Independent Learning

Discussion:

Due to complex healthcare environments and the quick advancement of social, technological, and medical elements of patient care, nurses nowadays face several difficulties. The strain on nursing educators selecting the most effective teaching strategy that can equip student nurses to work in a variety of healthcare settings, think critically to solve patients' problems, and deliver safe patient care is increased by all these challenges.

The teaching and learning techniques that enhance critical thinking abilities and knowledge acquisition should be considered by nursing educators. In this direction this study aimed to evaluate the effect of using concept mapping methods to enhance nursing student's

critical thinking and independent knowledge acquisition.

The results of the current study revealed that there were great improvements in nursing students critical thinking and independent knowledge acquisition abilities following a concept-mapping teaching strategy. This finding is following the result of a study in Iran on clinical pediatric nursing courses by **Aein and Aliakbari (2017)** who found that concept mapping had more positive impacts than traditional linear nursing care plans, leading to an overall and sub-scale increase in students' CT skills as well as autonomous learning. The results of this study are also supported by those of **Nirmala et al., (2011), Deshatty et al., (2013), Moattari et al., (2013), Orique and McCarthy (2015), Mohamed et al., (2017),**

and Elasrag et al., (2020), who came to the same conclusion that concept mapping was a useful method for enhancing students' capacity for critical thinking and self-learning.   In addition, **Obied & Gad (2017)** helps students better understand and retain material, encouraging them to become more critical thinkers and motivated by self-learning.

According to the current study findings, there was significant improvement in knowledge about concept mapping among the study group regarding (the definition, purposes, advantages, and disadvantages of concept mapping, components, types, and steps for developing and drawing maps) after training while they were not familiar with concept maps befor training, this might be because this teaching method is new, and the students hadn't any background about it. The student must have sufficient knowledge of concept map creation to design diagrams including data that led to nursing interventions and diagnoses, as well as to make it easier to correct the diagrams based on proposed scores.

This finding is consistent with other studies by **Elmeghawri & Sleem (2021) and Latif et al. (2016),** who found that students in the concept map-based learning group had significantly more knowledge than those in the lecture-based group. In addition, **Ghojazadeh et al. (2014)** noted that students at the end of the semester had a thorough understanding of concept maps, their applications in nursing education, and how to create integrated maps following awareness sessions.   This result is also consistent with **Taie's (2014)** who reported that there was a significant difference in the study group's concept mapping expertise.

The present study results illustrate that there was a highly significant improvement in the five assignments of the concept map assessment rubric because of advancements in the rubric's development from start to finish. This may be explained by the researcher's ongoing direction and continuous feedback of the students on their tasks. Rather than having students memorize a list of concepts, concept mapping can help students integrate new knowledge, classify it easily, make it coherent

to create a deeper understanding and create explicit links and relations between concepts to improve understanding and retention.

Elmeghawri & Sleem (2021) support our study's findings and demonstrate that when using the rubric evaluation approach, most students perform better than the standard for map assignments. They emphasized that idea mapping helps students better grasp, synthesize, and reflect on the course material.

This result is consistent with that of **Daley et al. (2013),** who reported that the research group's score on the concept map rubric was increased from the first to the last assignment. Additionally, according to **Nirmala & Shakuntala (2011)**, all parts of the concept map, except for the hierarchy, exhibited a significant difference between the pretest and post-test scores on the concept map rubric. These findings are also supported by **Abd-El-Hay, et al. (2018)**, who found that using concept maps in clinical settings significantly improved nursing students' performance on the simulation case study rubric immediately, after two weeks, and after one month. While these results are in contrast with **Farrag (2017)** who concluded that more than half of the study group's sample had not completed the first assignment with a satisfactory score, less than half had received an average grade, and no one had completed a satisfactory idea map.

The current study revealed that there was a positive correlation between concept mapping and critical thinking deposition which was statistically significant. This result is due to most study groups having a positive level of overall critical thinking disposition post training program. However, when the critical thinking scores of the control group were compared between the pretest and the post-test, there was no discernible difference between the two, indicating that there had not been any improvement in the students' critical thinking abilities, due to the use of traditional method of teaching which makes the student depend on the teacher to think and solve problems and does not help him to be creative.

These findings may be explained by the fact that concept mapping teaching techniques aid in the organization, analysis, and synthesis of knowledge, as well as the development of self-assurance, cognitive maturity, truth-seeking, open-mindedness, and inquisitiveness in study participants. Cognitive abilities like reasoning, critical thinking, and problem-solving are essential for nursing education, and nursing students choose educational methodologies that make the material they learn more useful and long-lasting when applied.

These findings are hand in hand with **Frederick (2020),** They discovered that concept mapping had a beneficial effect on nursing students preparing for licensure's critical thinking and stated that it might be the best strategy in teaching and learning techniques to help nursing students build their critical thinking abilities.

Additionally, **Obied & Gad (2017)** discovered that students who received an experimental conceptual map intervention saw a significant increase in their critical thinking scores from the pretest.

However, these findings are inconsistent with **Bixler et al., (2015)** who examined the effects of teaching medical students with concept maps and found no evidence of a substantial improvement in critical thinking abilities from pre-test to post-test. They suggested that the little period and the small number of topics to which a concept mapping was performed might not have been a sufficient dose to significantly increase critical thinking abilities.

The findings of the current study showed that there was a statistically significant correlation between concept mapping and students independent learning. These results are due to the student in the study group acquiring more experience in planning and implementation, self-management, and self-control. Improving their learning motivation and interpersonal communication skills after the training program. These findings are supported by **Jafarpour et al. (2016),** who found that using concept maps increases the need for

students to think outside of the conventional linear approach in nursing, improves student motivation, and has a positive effect on academic performance. Also, **Abu Hasheesh, et al. (2011)** emphasized that Concept mapping is a teaching strategy that supports independent learning and relies on students' capacity to organize and relate new concepts and information within their cognitive mental systems.

These findings are in the same line with **Kaddoura et. al., (2016)** who asserted that conceptual mapping is a valuable tool for nursing students learning in a clinical setting, similarly **Papathanasiou et al. (2014)** concluded that Concept maps foster both the capacity for learning and creativity. They also facilitate meaningful learning and knowledge acquisition.

Additionally, a study by **Ahmed et al. (2016)** on the self-learning methodology in simulated environments among nursing students demonstrated that the students were able to successfully guide their learning, design simulation scenarios, and discuss the results and pertinent scientific evidence while working under the guidance of teachers.

According to **Tarm, et al. (2022),** concept mapping motivates nursing students to actively look for information and connect new knowledge and experiences to what they already know. This results in the organization of their knowledge and the growth of adaptive expertise in health practice. Additionally, **Elmeghawri & Sleem (2021)** suggested adopting concept mapping teaching techniques to support nursing students' need to learn by doing and experiencing things in a genuine setting. To continue the educational path and to become a professional who can self-direct, the person must be adept at self-learning.

As well as Ghojazadeh et al., (2014) concluded that students had a thorough understanding of concept maps by the end of the semester, their applications in nursing education, and how to develop integrated maps following awareness sessions because of the stark differences in concept mapping knowledge

between the study group. To continue the educational path and to become a professional who can self-direct, the person must be adept at self-learning.

Conclusion:

The current study concluded that after the application of teaching methods, there were statistically significant improvements in nursing students' knowledge of concept mapping. Also, critical thinking and independent knowledge acquisition of the nursing students showed significant improvements after the application of concept mapping method.

Recommendations:

- Encourage using of concept mapping strategies in nursing education to promote students' critical thinking and foster more meaningful learning.
- Offer faculty staff more training so they can master advanced learning techniques like concept mapping and raise student achievement.

-Considering concept mapping as a possible learning approach for a bigger group of students.

-Create standards for instructors on how to evaluate and grade a concept map that needs more work.

-More research is required to compare the impact of concept mapping and other meta-cognition strategies on various learner types.

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