



THE EFFECT OF CONCEPT MAPPING PROGRAM ON THE CRITICAL THINKING AND DECISION-MAKING OF NICU NURSES

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ABSTRACT

Critical thinking and clinical decision-making are crucial competencies in nursing practice. Concept mapping, a modern and constructive educational technology, promotes deep and meaningful learning. This study aims to determine the impact of concept mapping program on the critical thinking and clinical decision-making of Neonatal Intensive Care Unit (NICU) nurses. This semi-experimental study was conducted on nurses working in the NICU of Vali-Asr Hospital in Birjand, Iran from September 2013 to January 2014. Nurses who had bachelor degree in nursing were selected to take part in the study and nurses who missed two consecutive training sessions were excluded from the study. Over five consecutive weeks, 30 NICU nurses who had been selected by convenience sampling underwent training using concept maps covering five NICU scenarios. Data were collected before and after the intervention using a three-part questionnaire that included a demographic information form, the California critical thinking skills test - form B, and clinical decision-making cards with the Q-Sort method. Statistical analysis (version 16) was performed using paired and independent t-tests at the significance level of $P < 0.05$. The mean scores of critical thinking and clinical decision-making significantly improved after the intervention, rising from 12.6 ± 3.3 and 84.3 ± 4.9 before the intervention to 26 ± 5.1 and 98.2 ± 1.9 after the intervention, respectively ($P < 0.001$). The increase in clinical decision-making score was notably higher among nurses who were not officially recruited compared to those who were ($P < 0.001$). Additionally, nurses with less than 10 years of work experience obtained higher score of decision-making compared to those with longer experience ($P < 0.001$). Incorporating concept mapping into nursing education can significantly enhance critical thinking and decision-making skills of NICU nurses. Hence, this method is recommended for use in clinical nursing education programs.

Keywords: Critical thinking, clinical decision making, Nursing.

INTRODUCTION

The process of making a choice lies at the heart of decision-making means a clinical decision making. This process is often regarded as intricate. The complexity of clinical decision-making (CDM) demands an extensive knowledge base, reliable sources of information, and the ability to operate within a supportive environment. Appropriate clinical decision-making, particularly for newborns, significantly reduces neonatal mortality and morbidity—critical indicators of community health (1). Such decision-making diminishes morbidity, accelerates patient recovery, optimizes resource and equipment usage, and ultimately enhances patient care quality (2). Accurate and effective decision-making is the primary criterion for assessing a nurse's skill. Conversely, incorrect decisions hinder patient recovery and increases resource wastage, leading to diminished care quality and complications in the care process (3). Nurses' inability to make independent decisions in crisis can result in substandard care, whereas specialized wards need nurses capable of delivering expert care. To boost nurses' clinical decision-making, it is imperative to strengthen critical thinking, which encompasses evaluation, analysis, inference and inductive/deductive reasoning. When nurses think critically, they make logical decisions, while anxiety and dependence in unfamiliar situations elevate error rates among non-critical thinkers, creating problem for them in crises (4). Critical thinking is essential for nurses to process and manage extensive information. Numerous studies underline this, and nursing education planners have adopted steps to improve it. Studies in Canada show that 98.2% of nursing students have a desirable level of critical thinking, but in China and Japan, nursing students have a low level of critical thinking. Research conducted in Iran also shows that the critical thinking ability of 93% of first-semester students, 94% of final-semester students, and 98.3% of clinical nurses is poor. Studies suggest that even in developed countries, only 55% of provided care is based on scientific evidence. Research from the United States and the Netherlands has also shown that patient care often lacks evidence-based practices. One study indicated that about 4-6.16% of hospital patients in the US, Australia, and the UK suffer from errors due to inadequate and incorrect decisions made by nursing and healthcare personnel, leading to permanent disability and death (5). Multiple studies in Iran indicate that nurses' clinical decision-making skills range from poor to moderate (6, 7). If competent nurses are to be developed, the content of educational programs must be meticulously selected (6).

One of the modern educational strategies, including metacognitive approach, involves concept mapping (5). Concept mapping facilitate advanced learning processes and improve essential nursing skills such as critical thinking, organizing information, understanding of complex relationships, and integrating theory, knowledge, and practice (8). Also, recent studies show that education-centered strategy can greatly strengthens nursing students' clinical decision-making abilities (9). This underscores the value of integrating this approach into nursing curricula to foster critical thinking and enhance decision-making in real-world clinical settings.

A recent study also showed that the mean score of decision-making was significantly higher among nurses in the intervention group than the control group (who did not receive workshops about concept mapping). These findings suggest that the use of concept mapping can be an effective tool for nursing students to develop clinical decision-making skills (5).

Conceptually learned knowledge, through concept maps, tends to be retained longer and helps nurses in problem-solving. Nurses who use concept maps demonstrate better communication in relation to patient problems and interventions, and achieve higher levels of problem-solving (5). However, study results on the impact of concept maps on critical thinking vary. Some studies have shown a significant increase in critical thinking following concept maps training (10-12), while others found no significant relationship between clinical decision-making (13) and conceptual thinking (14) before and after the intervention (8).

Given the noted weak to moderate decision-making skills among nurses, and the limited use of concept maps and constructivist educational methods by NICU nurses, this study was

conducted to determine the effect of a conceptual map educational program on the clinical decision-making skills and critical thinking of NICU nurses.

METHODS

This semi-experimental study utilized a pre-test and post-test design among group of nurses. Thirty NICU nurses who met the inclusion criteria were selected from Vali-Asr Hospital (Aj) in Birjand, Iran according to convenience Sampling method. Nurses who had bachelor's degree in nursing were included in the study and nurses who missed two consecutive training sessions were excluded. Three-part questionnaires were employed for data collection. The first part gathered demographic information, including age, work experience and employment status. The second part was the California critical thinking skills test, form B to assess the critical thinking. This test, with 34 multiple-choice questions, covers evaluation, analysis, inference, and inductive/deductive reasoning. Each correct answer receives one point. This tool is completed within 45 minutes and has a maximum score of 64. The evaluation section has a maximum of 14 scores, analysis has a maximum of 9 scores, inference has a maximum of 11 scores, inductive reasoning has a maximum of 14 scores, and deductive reasoning has a maximum of 16 scores (it is necessary to clarify that some questions are common in various sections). Thus, six scores are calculated for each individual, including an overall critical thinking score and five critical thinking skills scores. The reliability of this test has been previously determined at 0.78% in Iran (15) .

The Q-sort method performed to measured decision-making (16). This method is a tool for obtaining information about specific topics. During the use of this method, the samples select, classify and rate the presented options according to their attitude. In fact, this is a method for rating comparisons of topics in which different aspects of the topic are divided into sentences and these sentences, which are the different aspects of the topic from the best to the worst, are written on separate cards. A total of 20 items are scored based on a standard card to prioritize care and connections in the decision-making process, and if some of the mentioned cases are not observed in drawing the map, a lower score would be obtained. For example, a score of 10 means that the clinical decision of the person is inappropriate. To complete the Q-sort method, a standard classification is needed, such as Williamson method. In this study, the Williamson method (12) was used for scoring. The useful card in this tool receives 20 points, common card receives 15 points, facility card receives 18 points, uncomfortable card receives 13 points, and inappropriate card receives 10 points, with a maximum score of 100 and a minimum of 50. The tool's reliability was calculated to be 0.85 using Cronbach's alpha coefficient in a pilot study conducted on 10 nursing personnel.

Validation of clinical decision-making cards were confirmed according to a group-based method and expert panel. Five specific NICU scenarios (apnea, hypoglycemia, convulsive seizures, neonate requiring surgery, and thermoregulation disorder) were designed by two neonatal specialists, the ward supervisor, and the senior ward trainer. Clinical decision cards, as a concept map based on our special scenarios, were prepared and scored. The cooperation of participants was through informal invitations, with the training sessions planned for earning the educational credits. Written consent was obtained before training, and then pre-test including demographic form, California critical thinking form B and clinical decision-making cards were conducted at the start of training (under ethical code 92/01). The pre-test was confuted within a day at the beginning of working shift (with nurses from both shifts being present).

The training sessions were planned based on the educational needs of nurses in coordination with the supervisors and the clinical conditions of NICU. First, during two general 60-minute sessions, the process of concept mapping and critical thinking was explained.

In these sessions, the concept mapping method, how to draw it, and the characteristics and features of this method were taught in the following manner:

1. Identify the main problem and place it in the middle of the page
2. Causes of its occurrence
3. Important nursing diagnoses
4. List of subjective and objective data
5. List of causal information about the medical diagnosis, risk factors and its causes, diagnostic tests and medications
6. List of nursing interventions
7. Expected consequences related to nursing interventions
8. Drawing lines and connections.

Then, the nurses drew concept maps individually during 5 two-hour sessions in 5 consecutive weeks after the training, based on the scenarios presented. In each session, the presented concept maps were discussed and exchanged with the instructor, and feedback was given to the nurses. Two weeks after completing the training sessions, the California critical thinking test and the clinical decision cards were completed again as a post-test.

Statistical Analysis:

Data were analyzed using SPSS for Windows, version 16. Continuous data were expressed as mean $\pm$ SD, and normality was checked using the Kolmogorov–Smirnov test. After ensuring the normal distribution of variables (using the Kolmogorov–Smirnov test), a paired T-test was used to compare the mean scores of clinical decision-making and critical thinking before and after the intervention. A p-value of less than 0.05 was considered statistically significant.

RESULT

This study was performed on 30 NICU nurse, who had the mean age of 34 ± 7.5 years old and the mean work experience 9.5 ± 6.9 years (data as Mean $\pm$ Standard error of Mean). Our study results are presented in Table 1. This table shows that mean score of decision-making was increased significantly among studied nurses after the intervention ($P < 0.001$).

Table 1: Comparison of the scores of different aspects of critical thinking among studied nurses

Variable	Before Test Mean $\pm$ Standard Deviation	After Test Mean $\pm$ Standard Deviation	P-value	T
Evaluation	2.4 ± 1.2	5.7 ± 1.9	<0.001	9.5
Analysis	1.2 ± 1	2.7 ± 1.7	<0.001	6.2
Inference	2.8 ± 1.3	5 ± 1.4	<0.001	7.4
Inductive reasoning	3.3 ± 1.2	6.5 ± 1.8	<0.001	8.2
Deductive reasoning	2.8 ± 1.2	6 ± 1.8	<0.001	8
Critical thinking score	12.6 ± 3.3	26 ± 5	<0.001	13.7

Clinical decision-making score was calculated based on the studied scenarios (apnea, hypoglycemia, convulsive seizures, neonate requiring surgery, and thermoregulation disorder), (Table 2). Our study result showed that the total score of clinical decision-making based on

evaluated scenarios were increased significantly after the intervention ($P<0.001$).

Table 2: Comparison of the scores of different scenarios related to clinical decision-making among studied nurses

Variable	Before Test Mean± Standard Deviation	After Test Mean± Standard Deviation	P value
Apnea	22.5±2.4	24.5±1.4	<0.001
Convulsive seizures	12.8±1.8	14.9±0.4	<0.001
Surgery	17.9±3	19.4±0.9	<0.001
thermoregulation disorder	15.8±2.4	19.8±0.6	<0.001
Hypoglycemia	15.3±3.4	19.6±0.4	<0.001
Clinical Decision	84.3±4.9	98.2±1.9	<0.001

Also, the comparison of critical thinking, decision making and by demographic variables among studied nurses were investigated (Table 3). The mean changes in critical thinking score before and after the intervention did not show a significant difference according to the type of recruitment, but the changes in the clinical decision-making in informal employed nurses were significantly higher than in formal employed nurses ($P=0.004$). These changes in decision-making score ($P=0.002$) were significantly higher in nurses with less than 10 years of work experience than nurses with more than 10 years of work experience. No difference in critical thinking and decision-making scores was observed by the variable of age (Table 3).

Table 3: Comparison of the scores of critical thinking and decision making by demographic variables among studied nurses

Variable		Frequency	Critical thinking score Mean± SD	Clinical decision Mean± SD
Age	Below 30 years of age	11	13.4±4.7	15.3±4.4
	Above 30 years of age	19	13.4±5.8	13.2±5.5
	P-value	--	0.97	0.29
Employment status	Official	15	12.8±5.9	11.4±3.9
	Not-Official	15	14±4.9	16.5±5
			0.55	0.004
Work Experience	Below 10 years of age	15	14.2±4.7	16.7±4.9
	Above 10 years of age	15	12.6±5.9	11.2±3.8
			0.42	0.002

SD: Standard Deviation

DISCUSSION

Encouraging nurses to develop critical thinking is the main objective of nursing education. Additionally, it serves as an evaluation and accreditation standard for baccalaureate and advanced nursing programs (17). Various methods such as problem-based learning, concept mapping, simulated clinical scenarios, and case studies are recommended to foster critical thinking. However, the effectiveness of these strategies varies in the literature (18). Concept mapping, in particular, stands out as a beneficial teaching tool that allows both instructors and learners to visually assess what has been learned. This method helps learners reflect on their existing knowledge, and promotes a more critical and complex thought process beyond simple linear thinking (19). Critical care nurses must be able to apply their critical thinking skills effectively when caring for patients. Strong clinical judgment is essential, as it allows nurses

to not only make swift decisions but also take immediate action based on those decisions (20). This study aimed to determine the effect of concept mapping training on the critical thinking and clinical decision-making of NICU nurses. The results showed that concept mapping training significantly increased the critical thinking and clinical decision-making skills of NIU nurses, which is consistent with other studies (21-23). We found that by decreasing the age and work experience, the clinical decision score increased among nurses. This mean that involving young personnel in all training programs increases their learning due to their higher motivation compared to older experienced personnel. These personnel also need more education to advance their careers. Having the critical thinking skills leads to problem-solving, motivation for learning, better decision-making, and creativity, which can also increase the accumulated knowledge of nurses.

In a study conducted in China, researchers confirmed the effect of concept mapping training on the inference and overall critical thinking score of nursing students (22). Another study confirmed that the concept mapping training increased the scores of all five critical thinking dimensions in nursing students after the intervention (24). In Iran, Moattari et al (2013) aimed to determine the effect of concept mapping training on critical thinking skills of nursing students and found that total score of cognitive skills of critical thinking in the concept mapping training group increased significantly compared to the control group (25). Another research, by using concept maps in clinical pediatric education, the concept mapping scores of nursing students increased significantly after the intervention compared to before intervention (26).

Another study conducted on nursing students found a significant increase in the score of critical thinking skills of participants in the intervention group. However, increasing the score of analysis was not significant after the experiment (27). Our study's similarities with other studies include scenario-based learning, and use of concept maps. In these methods, the clinical environment can be used to teach learners how to draw concept maps. The NICU was one of the variables in this study, unlike other studies. However, the results of some studies that examined the effect of conceptual map of criticism on thinking indicated the absence of such an effect. Study aimed to determine the effect of combined training of simulation strategies and critical thinking on the clinical decision-making of operating room students, showed no significant difference between the two groups in terms of the clinical decision-making scores before and after the intervention (28). Results of Wheeler and Collins study, on the effect of concept mapping method on the critical thinking skills of North Carolina nursing students showed that the intervention group's overall scores of analysis and evaluation domains increased significantly, while only the control group's score of evaluation significantly increased, but the area of inference decreased (29). In our study, the mean of decision-making process increased significantly after the intervention.

Another research showed that concept mapping training significantly improved the ability of Turkish nursing students to plan and evaluate care (30). Another study by Gerdeman used concept mapping to build the clinical judgment skills of American nursing students, showing that the ability of nursing students in detecting patients' problems and using patients' document for assessments to determine the priorities and interventions improved significantly after the training (23). Another small-scale study in Malaysia identified a link between ICU nurses' critical thinking disposition and clinical decision-making (20). Another descriptive study conducted on nursing personnel showed that nurses who delivered high-quality care demonstrated strong competence and performance. Nursing managers play a vital role in continuously motivating and monitoring nurses to ensure optimal patient care, as critical thinking significantly influences nursing behavior. Nurses with well-developed critical thinking skills can enhance their performance in delivering patient-centered care (31).

Results of studies conducted on the impact of concept mapping on critical thinking are varied, and the reasons for this have been suggested to include educational deficiencies and the conditions of participants at the time of study. Because completing the critical thinking

questionnaire requires a high level of concentration, attention, and precision, and it is not possible to create these conditions in various educational settings (5).

In this study, due to the high workload of nurses and the inability to have all individuals in the classroom at the same time, a program was implemented in two round groups. Educational training sessions were planned according to the educational needs of nurses, in coordination with the supervisors and the opportunity for nurses to attend the sessions. This issue is one of the limitations of this study. One of the strengths of this research is the acceptance and participation of all sides and the high motivation of nurses to learn about different dimensions of critical thinking. The literature review shows that in the field of nursing education in Iran; little attention is paid to the implementation concept mapping programs and their effects. The decision was made clinically, so that most nurses would not be familiar with the concept mapping. Another strength of this study was the use of Q-sort method to assess the clinical decision-making. Q-sort method, which is a score card based on specific criteria for neonatal care decision-making, was also used to measure the clinical decision-making stages in a specialized manner.

CONCLUSION

According to the results of this study, we concluded that the use of concept mapping method in nursing education can lead to the development of critical thinking and clinical decision-making skills among nurses. Since the active participation of learners is vital in the concept mapping method, we can conclude that it leads to the higher-level of thinking in learning, which is necessary for appropriate and correct decision-making in the hospital department. The use of concept maps helps to organize care, and analyze and interpret related documents in complex clinical care environments including NICU. Our results showed that by integrating concept mapping into nursing education, we can greatly improve critical thinking and clinical decision-making abilities of nursing students. Therefore, this method is highly encouraged as an effective strategy in clinical nursing education.

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