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Iranian nursing students' perceptions regarding use of concept mapping: a content analysis

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Abstract

Background: Nursing education provides opportunities for students to create positive changes in a clinical setting. Thus, the use of modern teaching approaches such as concept mapping (CM) in nursing can be useful. The aim of this study is to explain nursing students' perception of applying CM.

Methods: This qualitative study reports CM in nursing students. Research areas were nursing colleges affiliated with the Iran and Tehran Universities of Medical Sciences. The participants comprised 25 nursing students who entered the research purposefully. Interviews were conducted face-to-face and semi-structured. All interviews were recorded, transcribed, reviewed, and the results were then extracted.

Results: Two categories and four subcategories were identified. The categories included transcendence of meaningful learning and improvement clinical skills. Transcendence of meaningful learning had 2 subcategories: favorable perception and deliberative interpretation. Improvement of clinical skills also had 2 subcategories: reinforcing critical thinking and facilitating patient-centered care.

Conclusion: Identifying nursing students' perception of CM techniques can assist nursing education administrators in providing better education to students both theoretically and practically based on the use of the aforementioned technique.

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Introduction

Today, organizations opt to seek specific changes in their health care professionals, theories of changes which per se require applying creative strategies to the educational process.¹ In the meantime, nursing education provides opportunities for students to create positive changes in a clinical setting.² Thus, the use of modern teaching approaches such as concept mapping (CM) in nursing can be useful. CM is designed based on the inclusion of cross-links: learning occurs by establishing relationships or links between new concepts and themes and those already stored in the learner's cognitive structure. New material will be learned when it detects and travels into its association area in the learner's cognitive structure, and starts building connections as a new loop in association with previously-stored loops of concepts.³ In this regard, and for a successful development, the nursing education curriculum could change its course and present a paradigm

shift from the traditional model towards one of making students active in discovering knowledge and learning goals. Students who learn content in a rote fashion often find education a difficult and unsuccessful experience.⁴ The reason behind this change in curriculum focus lies in the fact that nursing as a career has suffered from major setbacks in recent years, and nurses, forced to provide care to patients with a variety of known and unknown diseases, need cognitive and metacognitive skills for enhanced performance in clinical settings.^{5,6}

A wide range of CM studies have been documented. Researchers in the United States conducted an experimental study and findings showed that nursing students in the CM group performed much better in the health education system than students in the control group.⁷ Results of a study in Brazil showed that CM is a valid strategy to evaluate the learning-teaching process and can be used for education, research and reflection in nursing.⁸ Find-

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ings of one study in France highlight the fact that CM facilitates the development of metacognitive skills for nursing students and has shown benefits in contributing to a diagnostic assessment of clinical reasoning learning.⁹ According to studies in Taiwan, outcome-based CM as an educational method can encourage nursing students to take a bio-psycho-social approach to medicine, which can result in better nursing care.^{10,11} Furthermore, based on the results of an Iranian study with the participation of nursing students, the use of this educational practice can have a positive impact on the academic performance of students.⁴

Taking into account the advantages already enumerated, the role of CM is important in nursing education. However, the use of this method is currently highly complex and contains multidimensional concepts⁶ and the existing knowledge base is limited in Iran. Although some quantitative researches in Iran have focused on CM and its effects on education, no qualitative studies have been conducted. Thus, CM has not been clearly identified within an Iranian context. Furthermore, the lack of qualitative studies around this concept in the field of research has narrowly limited its application. Therefore, the use of qualitative research methods to evaluate viewpoints as well as factors involved in this field under natural and real-life circumstances were of interest to the researcher. Put differently, the researcher, using qualitative research, will attempt to identify the nursing students' perspectives on using CM in nursing education. Taking into consideration the fact that no research study on the content analysis of the nursing students' understanding about CM has ever been conducted in Iran, it seems appropriate to do research in this regard. Accordingly, the present study has been conducted aiming at explaining nursing students' understanding of bringing into effect the function of the CM in education.

Materials and Methods

The present research is a qualitative study using content analysis, a technique for systematically describing and analyzing written, spoken, and/ or visual communications through which inferred raw data are summarized and grouped within categories. In this study, a conventional content analysis approach was used: coding categories were derived directly from the data.¹²

Participants for the study were selected through purposeful sampling. In order to obtain other participants, snowball sampling was used, with students offering names of other participants. Students were selected through maximum variation sampling in terms of variables such as gender, age, and educational level. The criteria for selecting nursing were their theoretical and clinical nursing education and their willingness to communicate with the researcher. This study involved 25 nursing students at the master's and doctoral levels. Undergraduate students were not familiar with CM in their curriculum and were excluded. Student ages ranged from 24 to 39 years old. The majority of students ($n = 14$) were female. In terms of ed-

ucational level, there were 10 PhD and 15 Master's level (ML) students. Research areas were nursing colleges affiliated with the Iran University of Medical Sciences and the Tehran University of Medical Sciences, respectively.

Each student was interviewed once, with a total of 25 interviews conducted. Semi-structured face-to-face interviews were conducted for 45 to 55 minutes. Interviews continued until data saturation was reached at the point where no new data were being observed. The participants' voices were recorded. Interviews with students were conducted at nursing colleges by the researcher. The participants were told that they could refuse to participate in the study any time they wished, but none of the students left. The students were asked one general question during the interview: "What is your opinion/ experience about CM in nursing education?" To seek further information, interviews continued with probing questions such as, "Any idea how to use this technique in nursing?"; "Why should this be so?" "What do you mean by that?"; or phrases such as "Please explain more on that."

Graneheim and Lundman's method¹³ was used to analyze the data. Collection and analysis of the data were done simultaneously, a process which lasted for four months. For this purpose, first, the recorded interviews were transcribed to paper along with field notes, and then typed out. The interview texts were broken down into constituent units of meaning and codes after having been reviewed several times. Then the codes were read again in order to be assigned under the subcategories and the main categories based on semantic similarity. The researcher also tried, as much as possible, not to enter her presumptions in the process of data analysis.

To evaluate the rigor of the data, the criteria credibility, dependability, confirmability and transferability were utilized.¹³ To determine the credibility of the data, there was ongoing scrutiny of the data and the subject. The research team's comments were used in relation to the interview process as well as in the data analysis. The interview texts and findings were returned to participants for comment and correction. To determine the dependability of the data, the comments of an independent supervisor, as a researcher familiar with nursing education and research methodology who was not part of the research team, were used, and unanimous agreement was reached about the results. To determine confirmability of the data, all activities were recorded, and a report was prepared on the research process. In order to determine the transferability, the results, shared with three nursing students, who were not part of the research, and had similar conditions, were confirmed.

Results

Based on the findings of the content analysis, 2 categories and four subcategories were identified. The categories included transcendence of meaningful learning and promoting clinical skills. Transcendence of meaningful learning encompassed subcategories of favorable percep-

tion and deliberative interpretation. Improvement of clinical skills also covered subcategories of reinforcing critical thinking and facilitating patient-centered care.

Transcendence of meaningful learning

This category underscored the transcendence of meaningful learning for nursing students using CM to be developed under favorable perception and deliberative interpretation.

Favorable perception

As believed by the nursing students, CM will lead to favorable perceptions: by determining the learning path and creating a bond and association between concepts, the perception is desirable. In this regard, the students said:

“Concept maps in nursing act like a road map that set the learning path by drawing graphical models for better learning” (Participant 3, PhD student).

“Concept maps helps us find out opportunities for better understanding of subjects by bridging the gap between the known and the unknown as well as understanding the inner relationship of issues” (P 5, ML student).

According to the views of the students, use of CM in nursing education brings with it stability and sustainability of data in the memory with optimal learning coming along. An example of their narratives is as follows:

“CM leads to the stability of learning; it makes students conquer different components related to the content of subject by maintaining the key points contained in it” (P 14, ML student).

“Learning by this way is extremely helpful in storing the data in memory and using it again, especially for data retrieval” (P 8, ML student).

“CM helps the student to remember the learned concepts over a more extended period, because the student commits to memory the visual relationship between concepts and whenever necessary, he/she goes over the map” (P11, PhD student).

In the opinion of the students, application of the concept map in nursing education was perceived to accompany the easing of ambiguity in learning and correcting wrong perceptions, thus helping them with desirable and optimal learning.

“Since the maps manifest themselves in the form of a visual network of knowledge; they minimize uncertainties relating to our learning” (P 16, PhD student).

“With this method, students interpret what they have learned... In case of an incorrect understanding, they do correct it” (P 2, ML student).

One of the students described how learning takes place by using the CM technique:

“When I use this method, I put the general topics on top of the map, then I identify specific topics and in the next stage relate them one way or another. This is how it makes me grasp the topic more comfortably”

(P 17, ML student).

Deliberative Interpretation

From the perspective of participants, learning through concept maps requires engaging in a process of interpretation. One of them stated such in this regard:

“Many of our courses are designed in a way that they are learnt meaningfully using the maps. This follows an interpretative process that complies with the interpretation. By this interpretative process, using the maps, we classify the curriculum information and then interpret those” (P 15, PhD student).

Nursing students believed that they could turn into interpretive nurses using CM that leads to the integration of knowledge. One of the students remarked:

“Nursing students integrate their knowledge by using this technique and create new interpretations. Thus they can become good interpretive nurses too” (P 7, ML student).

From the viewpoint of the participants, the CM technique, across all nursing degrees, is seen as an interpreter-driven approach. One of the students commented:

“This technique across all levels operates as an interpreter-centered approach for nursing students. Students piece together their previous and new learnt stuff, and offer a different interpretation about one subject” (P 20, PhD student).

From the standpoint of the participants, the flexibility of this method leads to profound understanding. In this regard, one of the students said:

“Flexibility in this approach creates an opportunity for reflection, so we can compare and deeply interpret the different aspects of curriculum materials related to some of the sessions” (P 19, ML student).

Students held the view that unison between old and new concepts and analysis of the differences and similarities between them would lead to a depth of interpretation, and in the end, meaningful learning.

One student believed:

“For a deep and profound interpretation and yet a consistent learning to take place, the new concepts and the previous concepts, which reside in our cognitive structure, should be related in order to reach a conclusion through the analysis of the similarities and differences between them” (P 22, ML student).

Promoting clinical skills

Clinical skills category contains subcategories of reinforcing critical thinking facilitating patient-centered care due to the use of CM method in nursing education.

Reinforcing critical thinking

Participants believe that CM, due to the strengthening of the spirit of seeking in students and enjoying its own exact nature, strengthens their critical thinking abilities. A sample student narrative regarding this was as follows:

“CM elevates seeking spirit, and that's why I believe if

CM is taught properly could make a clinically critical thinker out of a nursing student” (P 9, PhD student). “Critical thinking is based on a precise assessment of affairs, and CM endows us with this skill on the merit of its exact nature ... it is right to say that CM helps us be effective clinically” (P 13, ML student).

As believed by the students, promoting critical thinking skills, under critical conditions, is possible using CM in the clinics. One of them expressed her views in this way:

“Sometimes we come across circumstances, especially in intensive care units, which need to be decided upon with good judgement. Use of concept maps can make more accurate decisions in practice” (P 24, ML student).

From the perspective of students, taking advantage of CM skills, because of acquiring problem solving skill, promotes their power of critical thinking as well. One of the participants made the following statement:

“When we practice drawing concept maps we acquire the skill of problem solving too. So we can better solve clinical issues in proper ways... Definitely we will also possess advanced critical thinking in the long run” (P 18, PhD student).

Students hold that the CM technique can promote their critical thinking by dealing with the framework in the clinic. One student said:

“At the moment, stereotypical framework ruling nursing care plans is just a barrier to our critical thinking in the clinic, but using concept map prevents the development of these wrong framework” (P23, ML student).

Facilitating patient-centered care

To the mind of the participants, the use of CM techniques, by reducing the intricacies of the theoretical lessons, creating interest in the clinics environment and augmenting the motives in nursing students, leads to patient-centered care. An example quote is as follows:

“The concept map, the complexity of the theory lessons, and we are interested in the environment and in particular the patient bedside. Therefore, me and the rest of my classmates, students, wish to carry out in the practice for the patients whatever we’ve learned” (P 4, ML student).

“Concept mapping tends to increase students’ motive to practice a lot, and makes it easier for them to manage various problems of patients” (P 25, PhD student).

According to the students, the use of concept maps will involve full understanding of the patient, a comprehensive look at the patient, and can provide better patient-focused care; so much so that these characteristics will eventually end in the improvement of students’ clinical skills. Illustrations of this are shown here:

“I think the use of concept maps is helpful for all nursing students because it makes provide better care for patient through having a thorough understanding

towards them”(P 21, ML student).

“Undoubtedly by using this method we are encouraged to have a thorough look at our as far as care is concerned, and not just have a biological look at them” (P 6, PhD student).

“In fact, the maps make it easy for us to implement the plans of executing patient-focused nursing process... each and every one of these maps, allows for a kind of scheme towards implementing nursing care with a better quality and comprehensively” (P 10, PhD student).

One of the students who attributed improved clinical skills to the use of CM during apprenticeship, said:

“One of the professors ran this method for us during apprenticeship and asked us to go ahead this way. By doing, we developed a diagram for cross-links between patient’s different problems that provided a more specialized care of /her/him” (P 12, ML student).

Discussion

In this study, nursing students’ understanding of applying the technique of CM in education was investigated. The findings of the research showed that the nursing students believe the use of this technique in education would elevate meaningful learning and improve clinical skills. From the perspective of participants, CM can elevate meaningful learning by favorable perceptions and deliberative interpretation. This occurs by creating continuity between concepts, stability of learning, retention of information in memory, reduction of ambiguity in learning, and correction of wrong perceptions. Nursing students believe that using concept maps is to engage in a process of interpretation. This method is also an interpreter-based approach which leads to offering deliberative interpretation by students through integrating knowledge, linking old and new concepts, analyzing similarities and differences across curriculum materials, and reflecting, thus providing an opportunity for meaningful learning.

Together with the results of this study, the effectiveness of using concept maps in education has also been shown to promote meaningful learning in other investigations. The findings of a study in Australia were indicative of improved learning in the area of pathogenesis of disease by medical students when using CM.¹⁴ By the same token, the results of a study in Canada suggested that the application of CM in a cardiovascular therapeutics course developed meaningful learning for students.¹⁵ According to the results of a study in Iran as well, the use of CM for training medical students on the topic of diabetic ketoacidosis promoted meaningful learning for them.¹⁶ In another study conducted in the United States, of those students who used CM for training dental hygiene; meaningful learning resulted.¹⁷ The results of our study as well as other research done in this field indicate that CM is a useful strategy to promote meaningful learning in the field of clinical sciences.

Additionally, the effectiveness of the use of CM in basic science education has been a matter of investigation for

students, such that medical students in India, by taking advantage of it, have been able to improve their learning skills and attain deeper understanding in this regard.¹⁸ Also, CM has been effective for learning physiology. The results of research conducted in the U.S. also showed that with the use of CM, organizing information, identifying the causal relationships as well as the principles governing the curriculum has become easier for students.^{19,20} By putting together these findings along with the results of the present study, we can acknowledge that CM, in addition to the transcendence of meaningful learning in the field of clinical sciences, can have similar effects in the field of basic sciences. These findings stress the importance of using this technique in education more than ever.

Other findings of the present study showed that the use of CM in nursing education can improve clinical skills of students in strengthening critical thinking and facilitating patient-centered care. The results of other studies have confirmed this hallmark of CM, i.e., promotion of clinical skills. Based on the results of the research done in Iran, the application of CM in the clinical setting led to improved clinical skills in nursing students.⁵ The results of a study in the United States indicated that the use of concept maps gave new insights to nursing students at the clinics, which resulted in improved clinical judgment.²¹ Similarly, the findings of another study found that concept map improved skills of nursing students in practice.²²

In the opinion of the students who were interviewed, reinforcing curiosity, acquiring problem-solving skills, and improving the ability to make decisions, all of which exist in the framework of CM, lead to the reinforcement of students' critical thinking in clinical practice. In addition, employing this technique by dealing with the existing less-optimal framework of clinics will strengthen students' critical thinking, and ultimately improves their clinical skills. Acknowledging our research findings, results of a study in Brazil suggested that the use of CM by nursing students has assisted them in dealing with clinical problems.²³ Furthermore, studies in Turkey and Oman indicated nursing students who applied concept maps for the implementation of their care projects enjoyed improved critical thinking skills.^{23,24} The results of a study also found that novice nurses could manage to promote their critical thinking by employing CM.²⁵ Therefore, the necessity of using critical thinking skills in the nursing profession in order to improve the quality of nursing care must be stressed.²⁶

Other findings of the study suggest that use of CM helps facilitate the provision of patient-centered care by reducing the complexity of theoretical lessons, creating interest towards the clinical environment and increasing motivation in students. The results of a study in Taiwan showed that those students who underwent a neurological nursing course using CM became more interested in the relevant topics. They also grasped the necessary information in a more transparent and less complex way.²⁷

In students' opinion, the value of CM lies in having full

knowledge of the patient, and an all-round look at providing better patient-centered care. In such a way these cases will ultimately improve clinical skills in students. In the present study, use of CM triggers a holistic view of patients and provides better patient-centered care. In fact, CM may help the students see the patient as a full human being. The researcher believes that what drives the participants towards a patient-centered view lies in the fact that nursing and caring, which are the intrinsic essence of this profession, require a holistic view of human beings. This is reinforced by using CM; students provide patient care. From the findings of the present study we infer that the use of CM is an efficient technique for nursing students both theoretically and clinically. Along with these findings, the results of a study in Canada also indicated that CM made the process of teaching and learning in nursing education more effective in the area of theory and practice, from the perspective of the students in this discipline.²⁸ One of the benefits of CM for nursing students is creation of a link between theory and practice, from which circumstances the care of patients is best generated.²⁹

The study's limitations included not analyzing the perspective of other people involved in professional nursing education, including the professors of this discipline. Therefore, it is recommended that on account of the important role faculty play in the field of nursing education, similar qualitative studies should be conducted. The small sample size and the nature of the study limit the ability to generalize these results. However, as with most qualitative studies, the findings were not intended to be generalized. Nevertheless, the results of this study add to the body of knowledge in this area.

Conclusion

The results of the present study clearly indicate that CM is an effective teaching method in nursing education. The most important feature, from the viewpoint of the students, is that it enhances the quality of learning in the realm of theory and practice in such a way that in the realm of theory it elevates meaningful learning triggered by favorable perception and deliberative interpretation, and in the realm of clinical practice, it leads to promoting clinical skills in the form of reinforcing critical thinking and facilitating patient-centered care. Thus, identifying students' perception of CM will assist the nursing education administrators in offering better educational services to these students both theoretically and clinically based on the use of the aforementioned technique. Therefore, the CM can be viewed as a powerful tool in nursing education which is better to be replace traditional practices.

Ethical approval

This article is part of the research project number IR.SAVE-HUMS.REC139504 approved by Saveh University of Medical Sciences. The human subject protection committee approved this study after reviewing the informed consent.

Competing interests

Authors declare that they have no competing interests.

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References

- Pilcher J. Education and learning: what's on the horizon? *Neonatal Netw.* 2014;33(1):24-8. doi: 10.1891/0730-0832.33.1.24.
- Shellenbarger T, Robb M. Technology-based strategies for promoting clinical reasoning skills in nursing education. *Nurse Educ.* 2015;40(2):79-82. doi: 10.1097/NNE.0000000000000111.
- Moattari M, Soleimani S, Moghaddam NJ, Mehbodi F. Clinical concept mapping: does it improve discipline-based critical thinking of nursing students? *Iran J Nurs Midwifery Res.* 2014;19(1):70-6.
- Jaafarpour M, Aazami S, Mozafari M. Does concept mapping enhance learning outcome of nursing students? *Nurse Educ Today.* 2016;36:129-32. doi: 10.1016/j.nedt.2015.08.029.
- Rasoul Zadeh N, Sadeghi Gandomani H, Delaram M, Parsa Yekta Z. Comparing the effect of concept mapping and conventional methods on nursing students' practical skill score. *Nurs Midwifery Stud.* 2015;4(3):e27471. doi: 10.17795/nmsjournal27471.
- Jamison T, Lis GA. Engaging the learner by bridging the gap between theory and clinical competence: the impact of concept mapping and simulation as innovative strategies for nurse-sensitive outcome indicators. *Nurs Clin North Am.* 2014;49(1):69-80. doi: 10.1016/j.cnur.2013.11.004.
- Kaddoura M, Van-Dyke O, Yang Q. Impact of a concept map teaching approach on nursing students' critical thinking skills. *Nurs Health Sci.* 2016;18(3):350-4. doi: 10.1111/nhs.12277.
- Bittencourt GK, da Nóbrega MM, Medeiros AC, Furtado LG. Concept maps of the graduate programme in nursing: experience report. *Rev Gaucha Enferm.* 2013;34(2):172-6.
- Paucard-Dupont S, Marchand C. Exploratory study of clinical reasoning in nursing students with concept mapping. *Rech Soins Infirm.* 2014;(117):85-112.
- Hsu LL, Pan HC, Hsieh SI. Randomized comparison between objective-based lectures and outcome-based concept mapping for teaching neurological care to nursing students. *Nurse Educ Today.* 2016;37:83-90. doi: 10.1016/j.nedt.2015.11.032.
- Tseng HC, Chou FH, Wang HH, Ko HK, Jian SY, Weng WC. The effectiveness of problem-based learning and concept mapping among Taiwanese registered nursing students. *Nurse Educ Today.* 2011;31(8):e41-6. doi: 10.1016/j.nedt.2010.11.020.
- Elo S, Kyngas H. The qualitative content analysis process. *J Adv Nurs.* 2008;62(1):107-15. doi: 10.1111/j.1365-2648.2007.04569.x.
- Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Educ Today.* 2004;24(2):105-12. doi: 10.1016/j.nedt.2003.10.001.
- Ho V, Kumar RK, Velan G. Online testable concept maps: benefits for learning about the pathogenesis of disease. *Med Educ.* 2014;48(7):687-97. doi: 10.1111/medu.12422.
- Carr-Lopez SM, Galal SM, Vyas D, Patel RA, Gnesa EH. The utility of concept maps to facilitate higher-level learning in a large classroom setting. *Am J Pharm Educ.* 2014;78(9):170. doi: 10.5688/ajpe789170.
- Saeidifard F, Heidari K, Foroughi M, Soltani A. Concept mapping as a method to teach an evidence-based educated medical topic: a comparative study in medical students. *J Diabetes Metab Disord.* 2014;13(1):86. doi: 10.1186/s40200-014-0086-1.
- Canasi DM, Amyot C, Tira D. Evaluating meaningful learning using concept mapping in dental hygiene education: a pilot study. *J Dent Hyg.* 2014;88(1):20-9.
- Surapaneni KM, Tekian A. Concept mapping enhances learning of biochemistry. *Med Educ Online.* 2013;18:1-4. doi: 10.3402/meo.v18i0.20157.
- Henige K. Use of concept mapping in an undergraduate introductory exercise physiology course. *Adv Physiol Educ.* 2012;36(3):197-206. doi: 10.1152/advan.00001.2012.
- Burdo J, O'Dwyer L. The effectiveness of concept mapping and retrieval practice as learning strategies in an undergraduate physiology course. *Adv Physiol Educ.* 2015;39(4):335-40. doi: 10.1152/advan.00041.2015.
- Gerdeman JL, Lux K, Jacko J. Using concept mapping to build clinical judgment skills. *Nurse Educ Pract.* 2013;13(1):11-7. doi: 10.1016/j.nepr.2012.05.009.
- Ferreira PB, Cohrs CR, De Domenico EB. Software CMAP TOOLS™ to build concept maps: an evaluation by nursing students. *Rev Esc Enferm USP.* 2012;46(4):967-72. [Portuguese].
- Atay S, Karabacak U. Care plans using concept maps and their effects on the critical thinking dispositions of nursing students. *Int J Nurs Pract.* 2012;18(3):233-9. doi: 10.1111/j.1440-172X.2012.02034.x.
- George A, Geethakrishnan R, D'Souza P. Concept mapping: a child health nursing practical exercise. *Holist Nurs Pract.* 2014;28(1):43-7. doi: 10.1097/HNP.0000000000000001.
- Wahl SE, Thompson AM. Concept mapping in a critical care orientation program: a pilot study to develop critical thinking and decision-making skills in novice nurses. *J Contin Educ Nurs.* 2013;44(10):455-60. doi: 10.3928/00220124-20130916-79.
- Sinatra-Wilhelm T. Nursing care plans versus concept maps in the enhancement of critical thinking skills in nursing students enrolled in a baccalaureate nursing program. *Creat Nurs.* 2012;18(2):78-84.
- Pan HC, Hsieh SI, Hsu LL. A study on the cognitive learning effectiveness of scenario-based concept mapping in a neurological nursing course. *Hu Li Za Zhi.* 2015;62(6):57-67. doi: 10.6224/JN62.6.57.
- Harrison S, Gibbons C. Nursing student perceptions of concept maps: from theory to practice. *Nurs Educ Perspect.* 2013; 34(6):395-9.
- Hunter Revell SM. Concept maps and nursing theory: a pedagogical approach. *Nurse Educ.* 2012;37(3):131-5. doi: 10.1097/NNE.0b013e31825041ba.