Effect of Concept Mapping Teaching Method on Critical Thinking Skills of Nursing Students

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Abstract

**Introduction:** Improving critical thinking is one of the most important objectives in nursing education. This study was performed to investigate the effect of concept mapping on critical thinking skills of the nursing students.

**Methods:** This quasi-experimental study was done with two groups design, and pre-test post-test method in 2009. 66 5\(^{th}\) semester nursing students were selected through census method and randomly divided into two intervention and control groups. Control and intervention groups received education using lecture method and concept mapping, respectively, for 8 sessions during 2 months. The statistical analysis was done by software SPSS 15. Descriptive statistics, independent t-test, chi-square and ANOVA were used.

**Results:** Performing concept mapping led to a significant increase in critical thinking skills scores in all domains except analysis domain \(p=0.286\) and deductive reasoning domain \(p=0.104\) in the intervention group in comparison with the control group. In spite of the significant increase in the mean score of critical thinking of the intervention group, comparing the mean difference of pre and post tests in the two groups \(p=0.053\), only analysis domain showed no significant difference.

**Conclusion:** Using concept mapping in the education of nursing students may lead to develop critical thinking skills as one of the important duties of higher education.

**Keywords:** Concept mapping, Critical thinking skills, Nursing education.

**Introduction**

Today, nurses, in the field of health care, confront with many complex issues and problems every day which need to have critical thinking for making decisions about them because critical thinking increases clinical decision making in identifying patient needs and selecting the best nursing practices and methods [1]. Critical thinking considered as an important and essential aspect of the professional practice in nursing, midwifery, health and different clinical areas [2]. In fact, critical thinking is an essential component of the clinical decision-making and professional competence of the nurses [1].

Critical thinking is a cognitive process during which the individual makes decision and judges through investigating the reasons and analysis of the available data and their conclusion. In other words, it is a purposeful and self-regulate judgment process which causes the problems to be solved through appropriate decision-making [3].

Currently, the universities with common classic methods of teaching send graduates to the society with lots of theoretical data and concepts who would not be able to solve the smallest problems of the society in the future. In fact, the traditional educational methods in the universities convey a blend of information and concepts to the students, but would leave them with analyzing, prioritization and organizing the emerging knowledge which are necessary for critical thinking and would lead to an effective and meaningful learning [4]. Therefore, in order to expand and develop critical thinking, the role of the universities...
as the information repository and professors
as the speakers and information transmitters
should be changed and students should
increase their skills in thinking and
reasoning and apply them after information
processing rather than merely gain and
maintain their information [4].

Brunner (1984) also believed that the
learners should not be exposed to the
knowledge, but he/she should be faced with
the problems so that he/she can discover the
relationship between the affairs and search
the information for gaining knowledge and
their solution. Training programs should
also be designed and organized in a way
that obliges the learner to act and cause
positive attitude and motivation in him/her [5].

Zarghi (2000) aimed to evaluate nursing
student critical thinking in a study on 89
first to fourth-year BS nursing students of
Rasht School of Nursing, using critical
thinking test which revealed critical
thinking of the students in different
semesters had no significant difference. The
mentioned study emphasized the necessity
of revising current educational strategies
and using more active learning strategies
[6].

On the other hand, observations and studies
which recently have been conducted on the
clinical and educational environments
indicated that nursing students lack the
appropriate critical thinking skills. All the
traditional methods focus on the linear
models of thinking. Therefore, they cannot
be used in today’s complex educational
environments. Concept mapping is a
modern meta-cognitive strategy in
education which can promote students’
critical thinking skills and decision-making
[7].

This is part of active teaching methods and
a schematic and two-dimensional tool for
presenting a set of concepts within the
predicate frame. In fact, concept mapping is
the presentation of an associated schema of
a concept with another one and also their
association with other concepts related to a
specific topic which orders in a hierarchical
model [8].

A knowledge which is learned through
meaningful method like concept mapping
would last longer time in the mind and
would improve the critical thinking skills
and cause problem solving abilities in
nursing students [9].

In this regard, a study showed that concept
mapping has increased critical thinking and
communication skills of nursing students
and has helped them in decision-making
and clinical judgments [10].

Delay et al. (1999) believed that concept
mapping is a useful technique which
provides teaching and evaluation of critical

A study, which evaluated the effect of
concept mapping on critical thinking of 54
nursing students, reported the significant
improvement of the critical thinking skills
of students (p=0.001).

It can be concluded that concept mapping is
like critical thinking which is a non-linear
cognitive function and a suitable strategy
for improving high level cognitive
functions [10].

Since implementing this technique might be
time-consuming for the nursing instructors
and on the other hand might considered
challenging for the new instructors,
investigating its effects on nursing fields
seems necessary.

On the other hand, reviewing the literature
showed that implementation and effects of
this method in nursing in Iran has been
given little attention. Therefore, this study
aimed to determine the effect of concept
mapping on nursing students’ critical
thinking skills.

**Methods**

This was a two-group quasi-experimental
study with pre and post-test design. This
study conducted to determine the impact of
concept mapping teaching approach on
critical thinking of nursing students.

The study population included the fifth
semester nursing students of one of the
Nursing Schools of Tehran who selected
theoretical course of Cardiovascular
Nursing during the first semester of 2009-
2010 (n=66).

Before starting the course classes, pre-test
of critical thinking skills was conducted,
and then the students were divided into two
groups using simple random sampling
method. One of the groups considered as the intervention group (concept mapping) and the other considered as the control group (lecture).

For evaluating of critical thinking, California Critical Thinking Skills Test, form B was used. It consisted of 34 four-choice questions designed for the evaluation of critical thinking in after high school levels. This test evaluates central critical thinking skills which in academic training considered as the key elements and no substantive knowledge in a specific academic level is required to answer these questions [12].

This questionnaire was designed for specific measurement of critical thinking skills levels in five domains of analysis, inference, evaluation, deductive reasoning and inductive reasoning. In this test, each correct answer dedicates one score to the individual. The minimum and maximum obtainable scores were 0 and 34, respectively. The considered time was also 45 minutes. In Iran, the reliability and validity of this test have already been determined and approved. Thus, the confidence test obtained 0.62 using Kuder Richardson #20 formula (KR-20) and factor analysis in determination of construct validity of the test indicated that the test consisted of five factors (analysis, inference, evaluation, deductive reasoning and inductive reasoning) and all five factors had a high and positive correlation with total score of the test. The mentioned test was also able to recognize the difference of critical thinking skills level between philosophy and nursing students [4]. Before starting the classes, the intervention group placed in a 90-minute session under the training concept mapping methods and the way to draw that; besides, a self-made educational booklet about making concept map was given to the students by the researcher. Then, the students of both groups of control and intervention passed 8 sessions of "Cardiovascular Nursing" course in 8 consecutive weeks in lecture and concept mapping methods, respectively. Concept maps were designed using power point software from lots of information in the internet sites and were sent to the faculty members of Schools of Nursing in Tehran in order to determine their validity. Removing the problems, the maps used for training of the intervention group; every student was required to prepare a concept map for all the presented topics for the following next session. In each training session, the maps were assessed by the researcher and the students were given feedback. Training of the control group was in lecture method using power point software. Finally, finishing the 8 sessions, again both groups participated in California Critical Thinking Skills Test, form B. The statistical analysis was done using software SPSS version 15. In addition to descriptive statistics (relative frequency and mean), after ensuring about normal distribution of the variables (Kolmogorov-Smirnov test), independent t-test was used for comparing critical thinking scores between the two groups before and after the intervention and also comparing the changes of mean difference scores of critical thinking between the two groups. Comparing demographic characteristics of both groups was done. Fisher's exact test for comparing gender and marital status, ANOVA test for previous knowledge about nursing course and interest rate to it and independent t-test for comparing age and average score of their previous semester were used.

Results

The results of demographic data showed that 60.6% of the students were female and 81.8% of the total samples were single. Mean age of the intervention group and control group was 21.23 (1.40) and 21.21 (0.82) years, respectively and their previous term’s average score was 17.05 (0.94) in intervention group and 16.88 (1.02) in control group. The students of both groups had a moderate knowledge (47.7%) about nursing field of study and their interest rate was also medium (53.3%).

Fisher’s exact test used for comparing gender and marital status, ANOVA applied for comparing their previous knowledge about nursing course and interest rate to it (because considered responses to these two questions was more than two forms) and
independent t-test used for comparing age and their previous term’s average score and no significant difference was observed between the two groups.

Discussion
The findings indicated that the concept mapping had a positive effect on critical thinking skills. So, that the obtained findings showed that intervention and control groups after intervention in all the domains had a significant and positive change (p < 0.05) except analysis domain (p=0.286) and inductive reasoning (p=0.104). And comparison of the difference in mean score changes of both groups showed the increase of intervention group scores compared with the control group score using independent t-test in all the domains and total score (p<0.05) except analysis domain (p=0.053).

It should be noted that California Critical Thinking Skills Test, form B measures critical thinking skills in evaluation, analysis, inference, and inductive reasoning which none of these skills has specific aspect. Therefore, it can be said that increase of intervention group scores in the total test was a valuable reflection of the positive effect of the concept mapping [4].

In addition, the study results of Wheeler and Collins (2003) which was on the effect of concept mapping on the critical thinking skills of nursing students indicated that score of the intervention group in total score and analysis and evaluation domains significantly increased (p<0.05), while the score of the control group in evaluation domain increased significantly and decreased in inference domain significantly [13]. Another study, which was about association between concept mapping and critical thinking on 54 nursing students, showed that after implementing this method, there was a significant improvement in critical thinking skills of the students (p=0.001; t=-5.69) and the similar results of such study obtained in evaluating the impact of concept mapping on critical thinking skills of 21 medical residents brought about a significant enhance in their critical thinking abilities [10].

The finding of this study was not in accordance with the study of Leppa (1997). This might be due to the reason that California Critical Thinking Skills Test, form B not to be the best assessment tool for determining the impact of concept mapping on the critical thinking skills of the students [14].

In the study of Leakman about training methods for a group of students and comparing them with students who were trained by traditional methods showed that using methods which promote critical thinking of the students, increased their learning level which supported the results of the present study [15].

Table 1. Comparing mean and SD of critical thinking skills and its subscales in concept mapping and lecture groups before and after the intervention

<table>
<thead>
<tr>
<th>Skills</th>
<th>Time</th>
<th>Analysis Mean (SD)</th>
<th>Inference Mean (SD)</th>
<th>Inductive Mean (SD)</th>
<th>Deductive Mean (SD)</th>
<th>Evaluation Mean (SD)</th>
<th>Total score Mean (SD)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>2.24 (1.27)</td>
<td>2.42 (1.17)</td>
<td>2.24 (1.52)</td>
<td>4.67 (1.29)</td>
<td>2.67 (1.40)</td>
<td>7.30 (2.1)</td>
<td>0.283</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.64 (1.65)</td>
<td>2.64 (1.27)</td>
<td>1.73 (1.66)</td>
<td>4.96 (1.72)</td>
<td>2.18 (1.44)</td>
<td>7.45 (2.07)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.484</td>
<td>0.194</td>
<td>0.422</td>
<td>0.172</td>
<td>0.770</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>4.18 (1.26)</td>
<td>5.30 (1.48)</td>
<td>6.84 (1.83)</td>
<td>7.60 (1.99)</td>
<td>7.03 (1.59)</td>
<td>16.51 (3)</td>
<td>0.286</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.84 (1.25)</td>
<td>4.15 (1.27)</td>
<td>4.45 (1.54)</td>
<td>6.90 (1.37)</td>
<td>4.90 (3.31)</td>
<td>12.90 (2.1)</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>0.000</td>
<td>0.104</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Pre and post test mean difference scores in critical thinking skills and its subscales in concept mapping and lecture

<table>
<thead>
<tr>
<th>Mean difference methods</th>
<th>Pretest-posttest</th>
<th>Pretest-posttest</th>
<th>Pretest-posttest</th>
<th>Pretest-posttest</th>
<th>Pretest-posttest</th>
<th>Pretest-posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis</td>
<td>1.94 ± 1.45</td>
<td>2.88 ± 1.6</td>
<td>4.61 ± 1.61</td>
<td>2.94 ± 1.8</td>
<td>4.36 ± 1.55</td>
<td>9.21 ± 2.27</td>
</tr>
<tr>
<td>Inductive</td>
<td>1.21 ± 1.53</td>
<td>1.52 ± 1.3</td>
<td>2.73 ± 1.56</td>
<td>1.94 ± 1.02</td>
<td>2.73 ± 1.23</td>
<td>5.45 ± 1.88</td>
</tr>
<tr>
<td>Deductive</td>
<td>0.008</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Evaluation</td>
<td>0.053</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

The cause of promoting critical thinking in concept mapping is because this method represents the related subjects in a way that one can easily understand the relation between information units forming the main theme. This promotes the understanding and also helps the learner to add new information to their knowledge (the cognitive construction) and thus promotes the meaningful learning and critical thinking [16]. And since, in concept mapping method, the learner has an active role in his/her own learning, therefore this leads to promotion of high level learning (critical thinking). In this regard, John Dewey admitted that if the learner actively collects and prepares the findings from which concept are extracted, those findings will be so meaningful for him/her, will last for a longer time in the mind and will be easily accessible in the future [17]. Schuster also quoted from Erwin and Daily that these clear and apparent organizing of the concepts allow the learner and instructor to exchange their perspective on how to communicate internal concepts and they also would be able to discover missing concepts and communications and determine new educational needs and restart the realignment of the map, which is the very self-assessment process that is part of the main critical thinking skills. Therefore, concept mapping can significantly increase this skill [18].

The presence of cross-communications between concepts of different levels in concept mapping will be caused by creative thinking of the learners; because by construction of a conceptual map they will answer to this question whether one can create other communicational concepts in addition to the existing relationships. They would be able to achieve high levels of cognitive ability (critical thinking) by answering this question [19].

Concept mapping can be used in nursing education in order to provide comprehensive and patient-centered care, prepare the student for clinical activities and make a connection between theory and clinical courses [20]. In addition, considering the advantages of this method in terms of reducing students’ anxiety, increasing higher learning level and increasing students’ motivation for learning, using this method in a more practical way in students’ education is recommended [10, 21].

Conclusion

Developing high level of thinking skills as one of the important missions of higher education makes it necessary to use appropriate approaches for developing critical thinking skills. According to the results of the present study, concept mapping is considered as an effective educational method to promote critical thinking skills and also an appropriate technique for evaluating critical thinking skills, that is because concept mapping reflects an image from the learners’ thinking process. Due to limitations of the
present study, for more comprehensive investigation of this approach in the future, providing concept mappings by the students in small groups and based on the given scenarios is recommended. The instructors and planners are expected to apply this educational method for improving critical thinking skills.

Acknowledgments

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