Care plans using concept maps and their effects on the critical thinking dispositions of nursing students

Selma Atay PhD
Assistant Professor, Canakkale 18 Mart University, School of Health Sciences, Canakkale, Turkey

Ükke Karabacak PhD
Assistant Professor, Acıbadem University, Faculty of Health Sciences, Department of Nursing, Istanbul, Turkey

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It is expected that nursing education improves abilities of students in solving problems, decision making and critical thinking in different circumstances. This study was performed to analyse the effects of care plans prepared using concept maps on the critical thinking dispositions of students. An experimental group and a control group were made up of a total of 80 freshman and sophomore students from the nursing department of a health school. The study used a pre-test post-test control group design. The critical thinking dispositions of the groups were measured using the California Critical Thinking Disposition Inventory. In addition, the care plans prepared by the experimental group students were evaluated using the criteria for evaluating care plans with concept maps. T-test was used in analysing the data.

The results showed that there were no statistically significant differences in the total and sub-scale pre-test scores between the experimental group and control group students. There were also significant differences in the total and sub-scale post-test scores between the experimental group and control group students. There were significant differences between concept map care plan evaluation criteria mean scores of the experimental students. In the light of these findings, it could be argued that the concept mapping strategy improves critical thinking skills of students.

**Key words:** critical thinking, concept mapping, nursing care plans.

**INTRODUCTION**

Critical thinking is an important ability for nurses. The ability to critically assess and interpret situations and use our knowledge correctly will enable us to provide optimal comprehensive care and other services.\(^1\) Hoffman *et al.* argue that if the nurses possess optimal critical thinking skills, they will be able to provide improved nursing care and solve clinical problems.\(^2\) This, in turn, is to the benefit of the patients, the nurses and the institutions they serve. Because nursing is an applied discipline, the nursing education must provide theory and practice together. Care plans have an important function in the transfer of the theoretical knowledge into practical use.
The nursing care plan is an important tool that outlines the patient-specific health requirements so that the needed care can be properly provided. The nursing process offers the best combination of care which reflects the experiences of the nurses, their extensive knowledge of many years and their deep concern for the challenges of their profession. In this context, one of the most important goals of nursing students' education is to develop their understanding of the nursing process. As nursing professionals of the future, nurses' training includes learning and understanding the concepts needed for critical thinking and problem solving, autonomy and professionalism. Hence, different learning strategies are used in nursing education.

Concept mapping is one such learning strategy employed by nursing and other disciplines to evaluate the knowledge and the thought processes of the students. Concept mapping was developed by Novak and Gowin based on Ausubel’s theory of learning. It is a learning strategy that facilitates the attainment, organization and the presentation of knowledge. Concept mapping helps the student to understand the placement of concepts in a hierarchy of concepts and to perceive the relationships between them. Learning these skills facilitates the long-term memory retention of the information, the coding of it in a meaningful way and its easy retrieval. Providing the students with a basic framework, concept maps guide students on where to place the details. They also help them see the place of a newly learned concept among other previously learned concepts and draw boundaries.

In her study, Daley argues that concept mapping is a powerful learning strategy in linking clinical practice and theoretical knowledge. Beitz’ study also found that concept mapping facilitates the transformation of acquired knowledge to thought, decreases anxiety and increases motivation and success.

Müller et al. found that conventional care plans suppress the critical thinking abilities of students, that standard care plans are copied and that they prevent comprehensive care. In Schuster’s study, students and educators participating in the research found the care plans prepared using concept mapping to be more comprehensible compared to those using the conventional method. They also suggested that concept map care plans be employed instead of conventional care plans. Similarly, Castelina and Schuster found that concept map care plans enable the provision of a holistic and organized nursing care, improve the critical thinking ability of the students, are less time-consuming and more paper-efficient and make it easier for the students to understand the problems of the patient. These plans have also eliminated the copying from books that has occurred in care plans prepared in the older format.

As Hicks-Moore argues, concept mapping is an efficient teaching and learning strategy in linking theory and practice and makes it easier for the students to learn the nursing process. All et al., in their study on the ‘Effects of Concept Maps on the Critical Thinking Abilities of Nursing Students’, found that the critical thinking abilities of the group that was trained using concept maps were higher than those of the group that did not use them. They also determined that the schematization, coding and visual presentation of the knowledge via concept maps improved memory.

In their study on undergraduate nursing students, Wheeler and Collins found that the linking of theory and practice via concept maps improves the critical thinking abilities of the students. Abel and Freeze argue that concept mapping is an evidence-based strategy of nursing education.

Research shows that concept mapping has a positive effect on academic performance, helps improve the critical thinking abilities of students and is an applicable method of teaching. Both students and educators find concept mapping to be a useful tool in visualizing the concepts used in the nursing process and integrating them into a whole.

Only a few studies have been conducted in Turkey on the importance of concept maps in nursing. In the Dicle et al. study titled ‘An Evaluation of the Use of Clinical Concept Maps by Nursing Students, and an Analysis of Their Views on the Subject’, participating students found concept mapping to be an efficient method of learning. In conclusion, concept mapping can be used as an educational strategy in the nursing curricula in the integration of theory and practice and in the association of basic concepts with each other.

Study objectives

This study was performed to analyse the effects of care plans prepared using concept maps on the critical thinking dispositions of students.

The research questions guiding this study were:

1. Are there any differences between the students who prepared a care plan using concept mapping and those who prepared the plan using a column format?
2. Is there any relationship between concept map care plan evaluation criteria mean scores of the experimental students?

MATERIALS AND METHODS

Design

This study was conducted during the Spring semester academic year of 2008–2009 to analyse the effects of concept map care plans on the critical thinking abilities of students. The study used a pre-test and post-test control group experimental design with 80 freshman and sophomore nursing students from X School who were divided into control and experimental groups. The names of nursing freshman and sophomore students interning in the surgery and internal medicine departments were noted, and control and experimental groups were created via simple random sampling.

Intervention

Following the advice in Kaya and Ebenezer’s study, training on preparing concept map care plans was given to the experimental group students in three sessions of 3–4 h duration.23

In the first session, an introductory presentation was made using a projector on the definition of concept map and its elements (concept, central concept, hierarchy, crossed links, examples, linking words and affixes/supplements). A concept map was subsequently built on the concept of immobility, to which all students are frequently exposed in the clinic.

• In the second session, the focus was on different types of concept maps (Hierarchical, Spider, Flowchart and Systems) and the differences among them. So that students could prepare a care plan using a concept map, they were given a case study and then were asked to create a concept map care plan for that particular case.

• In the last session, the concept map care plans prepared by students for the assigned case were scrutinized, and the students were given feedback on the weaknesses of the concept maps.

• Participating students were asked to create care plans in this way during their clinical practices throughout the semester. The care plans were evaluated on the basis of the evaluation criteria for concept map care plans developed by Schuster.13

Students in the control group prepared care plans using the column format.

Instruments

The critical thinking dispositions of the groups in the pre-test and post-test stages were measured using the California Critical Thinking Disposition Inventory. This index was developed in 1990 as part of the Delphi project run by the American Philosophical Association to evaluate the levels of critical thinking. Kökdemir worked out the Turkish version of this tool for validity and reliability.21 The measure contains 51 definitions and the following six dimensions: truth-seeking, open-mindedness, analysis, systematicity, self-confidence and inquisitiveness. The total Cronbach’s alpha for the measure was found to be 0.88. In addition, the care plans prepared by the students in the experimental group were evaluated using the evaluation criteria developed by Schuster. The total score was assessed by assigning each item one of the following points: complete (1), half-complete (½) or incomplete (0). In the criteria of Concept Map Care Plan Evaluation (CMCPE), an 80% achievement was considered to be successful. The total score for the criteria varied between 0 and 35. Study results showed adequate reliability for the reliability coefficient among the participants (r = 0.98; P < 0.001).

Ethical considerations

This study conformed to the Helsinki Declaration of Human Rights and respected the individual rights of the participants. Prior to the study, written permission was requested from the University Ethics Committee. All students were volunteers who were assured that their identities and other information would be kept confidential. They were also informed of the aim of the study, how it would be carried out and the potential benefits to be gained.

Data analysis

The California Critical Thinking Disposition Inventory (CCTDI) total scores and scores on each of the sub-scales were analysed using SPSS software (SPSS Inc, Chicago, IL, USA), and the t-test was used to compare scores between the control and experimental groups.

RESULTS

Freshman students comprised 53.7% of the experimental group and 62.5% of the control group. Females were in the majority for both groups with 85% in the experimental group and 87.5% in the control group. There were no significant differences in the group averages for age and Grade Point Average between the experimental and control groups.
When we examined the pre-test critical thinking disposition scores of the experimental and control group students, the mean score for the experimental group was 220.0 ± 17.7; and the mean score for the control group was 221 ± 19.0. It was established that there were no statistically significant differences in the pre-test mean scores of the two groups (t = 0.37, P > 0.05).

The comparison of the post-test mean scores of experimental and control group students for critical thinking disposition and its sub-scales is given in Table 2. The mean total score for critical thinking disposition was 225 ± 19.2 in the control group and 247 ± 16.4 in the experimental group. In addition, the difference between the post-test mean scores of the experimental and control groups for critical thinking disposition and its sub-scales was statistically significant (t = 5.37, P < 0.05).

Looking at the mean scores of the experimental group students for concept map care plan evaluation criteria, given in Table 3, we see that the mean scores have increased in the second, third and fourth care plans, and there are statistically significant differences between the mean scores (f = 90.73, P < 0.05).

**DISCUSSION**

The fact that there were no statistically significant differences in the pre-test mean scores of experimental and control group students for critical thinking disposition and its sub-scales (Table 1) shows that prior to the intervention, the students in the two groups were similar in their critical thinking dispositions.

The statistically significant differences in the post-test mean scores of the experimental group and control group students for critical thinking and its sub-scales (Table 2) show that preparing concept map care plans is an important factor in increasing critical thinking disposition.

<table>
<thead>
<tr>
<th>CCTDI and sub-scales</th>
<th>Experimental (n = 40)</th>
<th>Control (n = 40)</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t ± S</td>
<td>t ± S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open-mindedness</td>
<td>42.7 ± 5.8</td>
<td>43.7 ± 5.6</td>
<td>0.74</td>
<td>0.45</td>
</tr>
<tr>
<td>Truth-seeking</td>
<td>36.0 ± 6.4</td>
<td>37.1 ± 6.0</td>
<td>0.79</td>
<td>0.37</td>
</tr>
<tr>
<td>Analyticity</td>
<td>49.6 ± 4.6</td>
<td>48.6 ± 5.1</td>
<td>0.89</td>
<td>0.18</td>
</tr>
<tr>
<td>Systematicity</td>
<td>42.2 ± 5.4</td>
<td>44.2 ± 5.0</td>
<td>1.34</td>
<td>0.00</td>
</tr>
<tr>
<td>Self-confidence</td>
<td>39.9 ± 7.3</td>
<td>40.1 ± 5.8</td>
<td>0.12</td>
<td>0.73</td>
</tr>
<tr>
<td>Inquisitiveness</td>
<td>44.3 ± 5.8</td>
<td>43.9 ± 6.5</td>
<td>0.33</td>
<td>0.00</td>
</tr>
<tr>
<td>Total</td>
<td>220.0 ± 17.7</td>
<td>221 ± 19.0</td>
<td>0.37</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Table 1 Comparison of the pre-test scores of experimental and control group students for critical thinking disposition and its sub-scales

<table>
<thead>
<tr>
<th>CCTDI and sub-scales</th>
<th>Experimental (n = 40)</th>
<th>Control (n = 40)</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t ± S</td>
<td>t ± S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open-mindedness</td>
<td>44.2 ± 5.8</td>
<td>48.7 ± 5.2</td>
<td>3.55</td>
<td>0.000</td>
</tr>
<tr>
<td>Truth-seeking</td>
<td>37.0 ± 5.9</td>
<td>44.5 ± 5.7</td>
<td>5.71</td>
<td>0.000</td>
</tr>
<tr>
<td>Analyticity</td>
<td>49.5 ± 4.8</td>
<td>52.9 ± 3.0</td>
<td>4.03</td>
<td>0.000</td>
</tr>
<tr>
<td>Systematicity</td>
<td>44.6 ± 5.6</td>
<td>47.6 ± 5.5</td>
<td>2.61</td>
<td>0.011</td>
</tr>
<tr>
<td>Self-confidence</td>
<td>42.4 ± 5.4</td>
<td>45.6 ± 4.5</td>
<td>289</td>
<td>0.005</td>
</tr>
<tr>
<td>Inquisitiveness</td>
<td>44.7 ± 5.4</td>
<td>48.3 ± 4.5</td>
<td>3.18</td>
<td>0.002</td>
</tr>
<tr>
<td>Total</td>
<td>225.8 ± 19.2</td>
<td>247.3 ± 16.4</td>
<td>5.37</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Table 2 Comparison of the post-test scores of experimental and control group students for critical thinking disposition and its sub-scales
In Hicks-Moore and Pastirik’s study, students were trained on Schuster’s concept map care plan in a 5-week clinical application, and they were asked to prepare care plans using this method for a full semester. At the end of the semester, they found that the mean critical thinking scores of the students were higher, and that preparing concept map care plans increased critical thinking ability. These results are also parallel with our findings.

In another study by Studley, which had a quasi-experimental design and analysed the effects of concept mapping on the critical thinking ability, the post-test mean scores of the experimental group students for critical thinking were found to be higher than the critical thinking mean scores of the control group students. The difference was statistically significant, which also parallels the results of our study.

Similarly, Pickens found that the post-test critical thinking scores of the students in the experimental group were significantly higher, and the students stated that concept mapping stimulated them to think critically. These results were, again, similar to those of our study.

On the other hand, in Wheeler and Collins’s quasi-experimental pre-test post-test study with undergraduate nursing students, no significant differences were found between the pre- and post-test scores of the students for critical thinking disposition and its sub-scales. This result was explained by reference to the design of the study which had the students prepare concept map care plans in the first 7.5 weeks of the study and conventional care plans in the final 7.5 weeks.

When the results of the study were analysed, there were significant differences in the critical thinking abilities of the students who prepared concept map care plans, and those who had prepared conventional care plans. Students who prepared concept map care plans had the better scores. Based on the results of the study, it is possible to argue that preparing care plans using the strategy of concept mapping makes a bigger contribution to the development of the critical thinking abilities of the students than does preparing care plans using conventional methods.

The evaluation results for the concept map care plans of the experimental group students are given in Table 3. When we examine the table, the mean scores of the students for concept map care plan evaluation criteria show an increase as we go from the first concept map to the fourth, and the differences between the scores are statistically significant (P < 0.05).

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>( \pm S )</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>CMCP</td>
<td>40</td>
<td>23.47 ( \pm ) 5.6</td>
<td>90.73</td>
</tr>
<tr>
<td>II.</td>
<td>CMCP</td>
<td>40</td>
<td>31.06 ( \pm ) 3.06</td>
<td></td>
</tr>
<tr>
<td>III.</td>
<td>CMCP</td>
<td>40</td>
<td>32.67 ( \pm ) 3.53</td>
<td></td>
</tr>
<tr>
<td>IV.</td>
<td>CMCP</td>
<td>40</td>
<td>32.93 ( \pm ) 2.50</td>
<td></td>
</tr>
</tbody>
</table>

Hsu and Hsieh have examined the applicability of concept mapping as a learning strategy in nursing education in their study. As part of the study, students were asked to prepare a total of six concept maps throughout the semester. They received relatively lower scores for their first concept maps, but their scores improved with the third and fourth maps. At the end of the study, it was clear that the students had acquired critical thinking and problem solving abilities by organizing mixed patient records, analysing the relationships and defining the interventions. These results are also parallel with our findings.

Wilgis and McConnell analysed the effects of concept mapping on the critical thinking abilities of the nurses during the orientation programs of the nursing graduates. In the study, Schuster’s concept map care plan evaluation tool was adapted to measure the critical thinking abilities of the nursing graduates. They found that the mean scores the nurses received in the beginning and at the end of the orientation program were significantly different. The results of the study carried out by Wilgis and McConnell and our findings are parallel. We recommend the educators to use this strategy to develop the critical thinking abilities of their students. As the scores for Schuster’s concept map care plan evaluation criteria increase, the critical thinking abilities of the individual increase on both studies as well.

In their separate studies, Daley and King and Shell found that concept mapping teaches the students the connection between recently learned and previously learned knowledge by encouraging them to think cognitively rather than use memorization.

Daley et al. evaluated the concept maps prepared by senior college students in the beginning and at the end of the clinical application process using the concept map score developed by Novak and Gowin. They found significant differences in the first and last concept map scores and recommended that concept mapping be used in undergraduate curricula as a strategy to improve critical
thinking. Students participating in the study thought that ‘concept mapping is very useful and should be placed on undergraduate curricula as soon as possible’. The educators, on the other hand, found that ‘concept mapping improves the critical thinking abilities of the students’ and their findings are supporting the outcomes of our study.

Similarly, Roop measured the critical thinking abilities of students using Novak and Gowin’s concept map score in a study examining the effects of concept mapping strategy on academic success and critical thinking ability. Significant differences were found in the first and last concept maps prepared by the students. The study recommended that concept mapping strategy be used in nursing education to improve critical thinking abilities. As seen on Table 3, we found that concept map evaluation scores increased at the later concept map care plans.

Castellino and Schuster, in their study examining the effects of concept map care plans on the critical thinking and problem solving abilities of the students, found that concept mapping enables the students to provide comprehensive care to the patient and to comprehend their complaints better. It also improves their critical thinking abilities.

In this study, a statistically significant increase was identified in the mean scores that students received on different concept map care plans they had prepared over time. It could be claimed that this finding corroborates the increase in the mean critical thinking post-test scores.

Limitations
Several limitations to this study have been recognized. Our study sample was small and the results are limited to this study only. Providing a template for the students to use for their concept map care plans may have limited the student’s creativity and made the process more restrictive and difficult to understand. Students complete four care plans during a semester, and this may not be enough. More time should be made available for students to have a better understanding of the method being instituted.

CONCLUSIONS AND RECOMMENDATIONS
There were significant differences between the post-test mean scores of the experimental and control group students for critical thinking disposition and its sub-scales (P < 0.05). The mean scores for experimental group students regarding concept map care plan evaluation criteria increased in the second, third and fourth care plans, and there were statistically significant differences between the mean scores (f = 90.73, P < 0.05).

In the light of these findings, it could be argued that the concept mapping strategy improves critical thinking skills of students. The findings also justify the following recommendations: concept mapping strategy should be included in the curriculum; overall student satisfaction with preparing concept map care plans should be further studied; and longitudinal studies with a larger sample size should be conducted.

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