

# Effects Of A Structured Pediatric Nursing Course Based On A Concept Map (PNC-CM): A Randomized Controlled Trial

## Kavram Haritasına Temellendirilerek Verilen Pediatri Hemşireliği Dersinin Etkileri: Randomize Kontrollü Çalışma

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### ABSTRACT

**Aim:** To evaluate the effects of the Pediatric Nursing course based on concept mapping on the critical thinking, lifelong learning, self-sufficiency and problem-solving skills of student nurses.

**Material and Methods:** The content and curriculum of this course were developed by the researcher. The lessons and data collection were conducted face to face. The sample of the study consisted of 72 students. The participants were randomly divided into two groups (Training-Control Group). In both groups, a pre-test was administered before the training, a post-test was administered after the training, and a follow-up was administered three months later.

**Results:** The scores of the training group in the "California Critical Thinking Disposition Inventory", "Lifelong Learning Disposition Scale" and "Self-Efficacy-Competence Scale" were significantly higher than the control group ( $p<0.05$ ). After taking the Pediatric Nursing course based on concept mapping, a significant difference was observed between the groups and between the measurements in the training group ( $p<0.05$ ). However, there was no significant difference between the groups and measurements only in the Interpersonal Problem Solving Inventory scores ( $p>0.05$ ).

**Conclusion:** Delivering the pediatric nursing course based on the concept map is an effective method in educating the nursing students. The use of concept maps improves nurses' critical thinking, lifelong learning, self-efficacy skills.

**Keywords:** Concept Map, Education, Higher Education, Nursing, Student Nurse

### ÖZ

**Amaç:** Kavram haritasına temellendirilerek verilen Pediatri Hemşireliği dersinin öğrenci hemşirelerin eleştirel düşünme, yaşam boyu öğrenme, öz yeterlilik, problem çözme becerilerine etkisini değerlendirmektir.

**Gereç ve Yöntem:** Bu dersin içeriği ve müfredatı araştırmacı tarafından geliştirilmiştir. Dersler ve veri toplama yüz yüze gerçekleştirilmiştir. Araştırmanın örneklemini 72 öğrenci oluşturmuştur. Katılımcılar rastgele iki gruba (Eğitim-Kontrol Grubu) ayrılmıştır. Her iki grupta da eğitimden önce ön-test, eğitimden sonra son-test, üç ay sonra ise izlem yapılmıştır.

**Bulgular:** Eğitim grubunun "Kaliforniya Eleştirel Düşünme Eğilimi Envanteri", "Yaşam Boyu Öğrenme Eğilim Ölçeği" ve "Öz-Yeterlilik-Yeterlilik Ölçeği" puanları kontrol grubuna göre anlamlı derecede yüksektir ( $p<0,05$ ). Kavram haritasına temellendirilmiş Pediatri Hemşireliği dersini aldıktan sonra eğitim grubunda gruplar arasında ve ölçümler arasında anlamlı fark gözlemlenmiştir ( $p<0,05$ ). Ancak sadece Kişilerarası Problem Çözme Envanteri puanlarında gruplar ve ölçümler arasında anlamlı fark yoktur ( $p>0,05$ ).

**Sonuç:** Pediatri hemşireliği dersinin kavram haritasına temellendirilerek verilmesi hemşirelik öğrencilerinin yetiştirilmesinde etkili bir yöntemdir. Eleştirel düşünme, yaşam boyu öğrenme ve öz-yeterlilik becerilerini geliştirdiği belirlenmiştir.

**Anahtar Kelimeler:** Kavram Haritası, Eğitim, Yükseköğretim, Hemşirelik, Öğrenci Hemşire

### Introduction

The basics of the concept map developed in 1984 by Novak and Gowin were based on Ausubel's theory of learning (1). Concept maps are defined as "schemas that fill the gap between previously acquired knowledge and newly learned knowledge and show how individuals associate concepts in their minds" (2,3,4). The map combines learning

strategies such as straight narrative, discussion, and feedback.

While concept maps facilitate learning by visualizing, it is stated that traditional education methods in nursing are insufficient for student nurses to analyze, prioritize, organize and develop new information required for effective learning, and even hinder these skills (5,6,7,8). It is difficult to establish the connection between the pathophysiology-symptoms-treatment-nursing approach of the disease with direct explanation. Just explaining is not a sufficient way to make the student understand the relationship between

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concepts (3,9). For this reason, it is difficult to understand diseases and learn the right approach through traditional methods. However, the situation is very different in the concept map, there is visualization. Association is aimed. This is very important in the education of pediatric nursing and in approaching pediatric diseases. The concept map is exactly important at this point (2,8,10).

Studies indicate that making abstract disease development and nursing care visible with a visual such as a concept map facilitates nursing students' understanding, strengthens their creativity, improves their learning skills and ensures cooperation (3,4,8,9). It has been stated that the essence of the concept map method is based on students' ability to associate new concepts with concepts they already know, and this strengthens the student (2). In a study, it was emphasized that this method has an important place in increasing students' self-regulation and self-efficacy, as it is both a teaching and evaluation method (9).

It may be thought that the development of knowledge, skills, self-efficacy and problem-solving skills of nurses trained in the pediatric population is more difficult. Because disease development in the pediatric population is different from the adult population. Students should know adult diseases and additionally learn about pediatric differences. Because reference values that are normal for adult patients are different in pediatrics. Similarly, conditions that are healthy/physiological in adults can be pathological in pediatrics. For this reason, students should know the disease conditions of the adult patient, and in this course, they should also learn the pediatric differences. This situation can be complicated for the student. Additionally, practicing in pediatric clinics increases anxiety and stress in students. At this point, a method that is far from memorization and teaches by establishing a visual relationship in the disease-symptom-treatment cycle is very important. Studies in which concept map-based education is provided in pediatric nursing have shown that students taking this course contribute to providing competent nursing care to the child by acquiring, maintaining and constantly improving

the knowledge, skills, attitudes and judgments necessary to meet the needs of a sick child. What is expected from current nursing education is that nursing students not only improve their knowledge and skills, but also contribute to their problem-solving, decision-making and critical thinking skills under different conditions (8,9).

Problem solving skills, lifelong learning skills, critical thinking skills and self-efficacy and competencies are not variables that can change in the short term, such as knowledge, but are variables that can change and develop in the long term. It appears that there are deficiencies in this field in the literature. For this reason, the parameters used in the study were chosen as problem solving skills, lifelong learning skills, critical thinking skills and self-efficacy and competencies.

## **Aim**

There are four hypotheses in the study.

Students in the education group were compared with those in the control group:

Hypothesis 1 (H1): Their interpersonal problem-solving skills are higher

Hypothesis 2 (H1): Their critical-thinking skills are higher

Hypothesis 3 (H1): Their lifelong-learning skills are higher

Hypothesis 4 (H1): Their self-efficacy and competencies are higher.

## **Material and Methods**

### **Design and Participants**

This single-center, two-group, randomized controlled trial was conducted between March and July 2022. The study was reported based on the Consolidated Standards of Reporting Trials (CONSORT) statement (11).

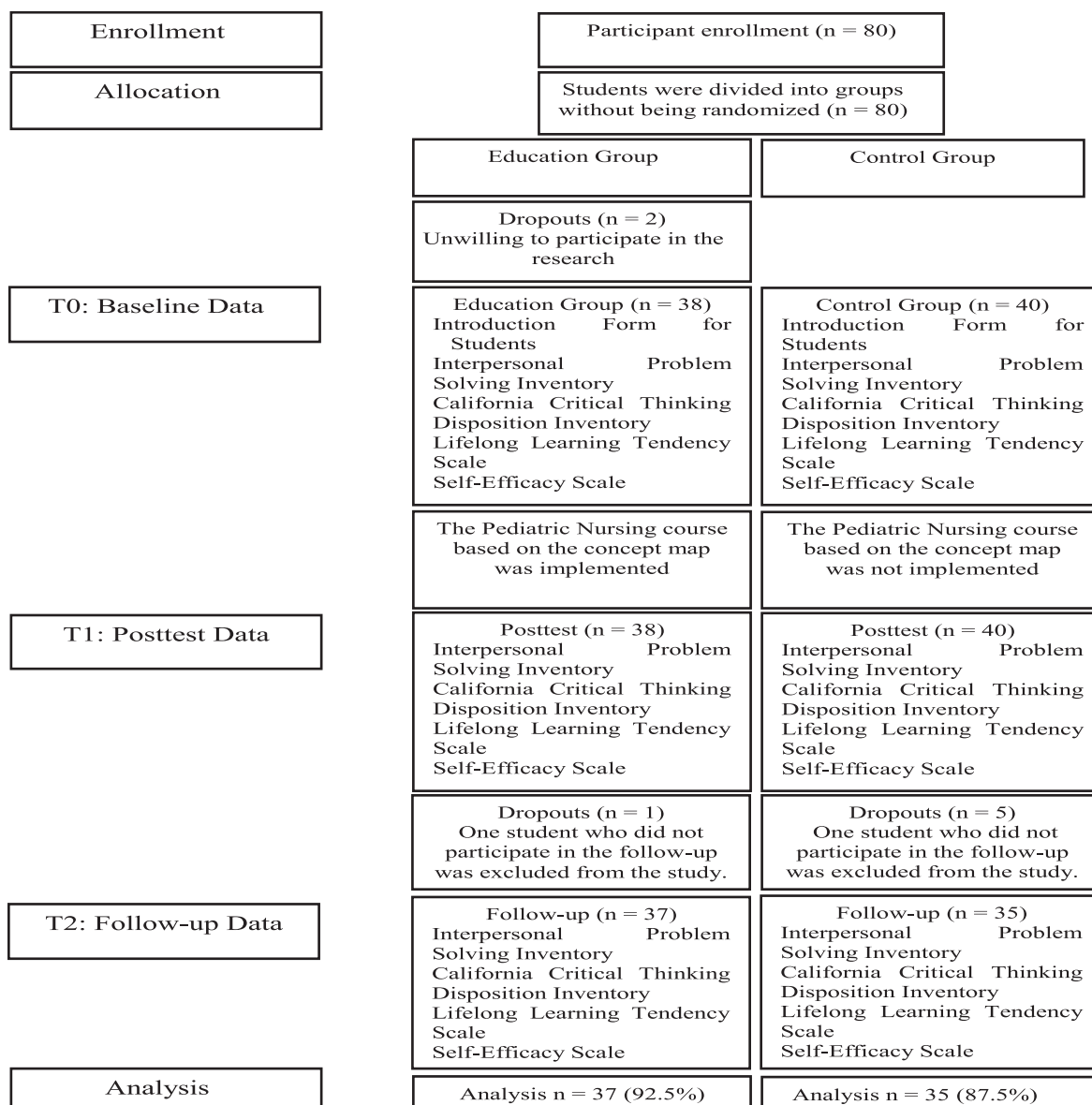
### **Setting**

The education group of the study consisted of students who voluntarily agreed to participate in the study, participated in at least 80% of PNC-CM

(minimum 11 weeks), and gave written informed consent. The control group of the study consisted of students who voluntarily agreed to participate in the study, did not participate in PNC-CM, and whose written informed consent was obtained. These criteria are the inclusion criteria of the study. All cases other than these criteria are the exclusion criteria of the study.

The education group comprised 40 students who took the PNC-CM. Two students who took the course but did not volunteer to participate

were excluded. Moreover, the posttest was not performed by one student. Therefore, the education group included 37 students. The control group included 40 fourth-year students who did not take this course. All students in the control group were voluntary participants; however, five students did not participate in the follow-up study. Overall, 72 participants were included in the study, with 37 in the education group and 35 in the control group. While PNC-CM was applied to the education group, it was not applied to the control group (Figure 1).



**Figure 1.**CONSORT Allocation, Folow Up, and Analysis Diagram

## **Participants**

A sample calculation was performed for this controlled study with a control group based on a pretest–posttest follow-up process. Computer software was used (G\*power). The power analysis in the study was calculated with 80% reliability and 0.05 type 1 error, and the result was 70. Considering a 10% risk of loss, it was planned to start the study with 80 participants (education group:40, control group:40) (Figure 1).

“Purposive sampling” method, which is one of the non-probability sample selection methods, was used in sample selection. 3rd and 4th year nursing students were used to calculate the sample size. The education group of the research was selected from the students of the class taking PNC-CM in the second semester of the 3rd grade. Because the pediatric nursing course is given during this period. PNC-CM, which was given within the scope of the course, was also completed during this period. The control group was selected from the first semester of the 4rd grade students who did not take PNC-CM, had just completed the pediatric nursing course with the traditional method, and did not take any other courses in the meantime. Care was taken to ensure that there were no differences between these two groups of students that would change the effectiveness of the education other than PNC-CM.

In the research, “PNC-CM” was developed by the researcher in line with the literature. First of all, a education curriculum was developed (PNC-CM). Expert opinion was taken. The agreement coefficient obtained from expert opinions ( $W = 0.876$ ) was found to be quite high. The PNC-CM, which was subsequently developed, revised and finalized with expert opinion, was applied in the education group. Both groups, those who received training or not, were evaluated simultaneously using the same measurement tools.

## **Recruitment, randomization, and allocation concealment**

All of these procedures were carried out during the preparation phase of the research. There are three stages in the research. These are preparation stage,

application stage and follow-up stage. Processes such as randomization and permissions were carried out at this stage.

A simple randomization method was used to provide equal sampling to the two groups and was performed in the computer environment using the website <https://www.random.org>. Since randomization was provided by the program, the researcher had no involvement. In the study, an education group was created by randomizing the students who received the nursing course in the nursing department of a state university. A control group was created by randomizing the students who took the course a year ago using the traditional method with a straight narrative, which was not based on the concept map. In this way, two groups were randomly assigned (education group  $n=40$ , control group  $n=40$ ) (Figure 1).

The contents and weekly curricula of the PNC-CM were produced using relevant literature, case studies, and guides to develop the curriculum for the students within the scope of the course. Following the development of PNC-CM, the researcher prepared a questionnaire form to collect data on the participants’ sociodemographic and cultural characteristics. Permission to use additional measurement instruments was obtained via e-mail from the scale owners. Permissions from the ethics committee and the institution were obtained.

After the data collection, while entering the data into the statistics program, the research groups were entered into the system as Group X and Group Y. A statistician also conducted the statistical analysis, and this expert did not know which of groups X and Y was the education group and which was the control group. To eliminate bias, the researcher used a program for randomization and named the groups as X and Y during data entry. Blinding the participants and the study staff was not possible due to the design of the intervention.

## **Measurement times in research**

The students in both groups were given a baseline assessment. This first evaluation was called T0 measurement. T0 measurement meant pre-test.

The Introduction Form for Students, Interpersonal Problem-Solving Inventory (IPSI) (12), California Critical Thinking Disposition Inventory (CCTDI) (13,14), Lifelong Learning Tendency Scale (LLTS) (15), and Self-Efficacy-Sufficiency Scale (SES) (16,17) were used to determine the T0 values for all students. The students in the education group took the PNC-CM after completing the T0 assessment. The researcher directed the structured 14-week course. Both groups underwent T1 measurements after the 14 weeks (Figure 1). This T1 evaluation was the first evaluation after the concept map-based training of the training group and the classical training of the control group. T1 measurement meant post-test. Data collecting methods for the T1 measurements were the same as those for the baseline (T0). Both groups completed the T2 measurements 3 months after the completion of the T1 measurements (Figure 1). T2 measurement meant follow-up measurement at the 3rd month after education. Data collecting methods for the T2 were the same as those for the T0 and T1.

### **Intervention (“Pediatric nursing course based on the concept map (PNC-CM)” and “Implementation”)**

The PNC-CM was used as the intervention in this study. The content and curriculum of this course was developed by the researcher. PNC-CM was provided face to face. Data collection tools were also collected face to face at measurement times. Only the weekly performance assignments, which were given as homework at the end of the topics, were uploaded to the students’ online systems. However, when the students completed their homework, this was discussed with the students face to face.

The concept map was used as the sole basis for the education. Diseases seen in children, their physiopathology, diagnostic and treatment methods, as well as all nursing processes (nursing diagnoses, nursing interventions, practices, and evaluations) were performed through the concept map. All case analyses and case reports were discussed based on the concept map. The course was conducted three times a week for 22 hours for a duration of 14 weeks. Following the

introduction of each system disease based on the concept map, the conductor of the research and the course introduced a case analysis and discussions on the case, which were again interactively based on the concept map. Each week, after introducing a system disease based on the concept map, the case report discussed during that week was uploaded on the students’ system on weekends as a performance assignment. The students were asked to analyze these cases based on the concept map and were given a week for each performance assignment. For 14 weeks, the students received a PNC-CM for a total of 22-hours, 3-days a week. Case analyses were consistently introduced and discussed, and the students completed the nursing approaches based on a total of 14 concept maps as performance assignments at the end of each week. As a result, each student discussed the concept map throughout the course, developed a nursing approach to the systems and diseases based on it, discussed the case analyses based on a concept map once a day, and uploaded the case analysis to the online system as a performance assignment over the weekend. Each session was attended by all students in the education group. During the course, all students were given the opportunity to ask each other and the trainer questions about the curriculum materials in the classroom verbally.

The first 4 weeks of course included characteristics of growth and development periods in children, approach to a healthy child, physical examination in children, and fluid and electrolyte balance in children. As can be seen, in the first 4 weeks, no sick children were discussed and only healthy children were studied, and these issues were explained based on the concept map.

In the last 9 weeks of the course (5–13 weeks), issues related to approaches to a sick child (all systemic diseases) were explained. In this period, the respiratory, cardiovascular, gastrointestinal, nephrological, neurologic, endocrinological, hematologic, oncologic, and collagen systems were thoroughly explained. The educational methods and style were identical to those used during the first 4 weeks. The neonatal issues were discussed in depth in the 14th week. Table 1 shows the course content.

**Table 1.** Content of the pediatric nursing course based on the concept map (PNC-CM)  
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| Procedure (14 weeks) | Chapter             | Curriculum                                 | Activities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Materials                                                                                                                                                                                                                     |
|----------------------|---------------------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                   | Healthy Child       | Growth and Development Periods in Children | <ul style="list-style-type: none"><li>● Definition of concept map</li><li>● Questions and answers based on the concept map</li><li>● Group discussion based on the concept map</li><li>● Brainstorming based on the concept map</li><li>● Recommendations on the topic based on the concept map</li></ul>                                                                                                                                                                                                          | <ul style="list-style-type: none"><li>● Concept Maps</li><li>● Slides</li><li>● Videos</li><li>● Brochures</li><li>● Journal articles</li><li>● Systematic Review and Meta-analysis</li><li>● Bibliometric analysis</li></ul> |
| 2.                   |                     | Approach to a Healthy Child                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |
| 3.                   |                     | Physical Examination in Children           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |
| 4.                   |                     | Fluid Electrolyte Balance in Children      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |
| 5.                   | Children's Diseases | Respiratory System                         | <ul style="list-style-type: none"><li>● In the first 3 hours, explanation of system diseases for the related system based on the concept map</li><li>● Group discussion based on the concept map</li><li>● For an hour, an explanation of nursing interventions for the related system (electrocardiography, oxygen administration, insertion of a nasogastric tube, etc.)</li><li>● In the last 2 hours, analysis of a case on the related system with all of its aspects based on the concept map only</li></ul> |                                                                                                                                                                                                                               |
| 6.                   |                     | Cardiovascular System                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |
| 7.                   |                     | Gastrointestinal System                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |
| 8.                   |                     | Nephrological System                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |
| 9.                   |                     | Neurologic System                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |
| 10.                  |                     | Endocrinological System                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |
| 11.                  |                     | Hematologic System                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |
| 12.                  |                     | Oncologic System                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |
| 13.                  |                     | Collagen System                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |
| 14.                  |                     | Neonatology                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |

### Data Collection Instruments

The data were collected using the Introduction Form for Students, IPSI, CCTDI, LLTS, and SES, all of which were completed face to face.

Student Identification Form was developed the researcher based on the literature (5,8,9). The questionnaire included six questions that included sociodemographic (age, gender, marital status) and other variables that were expected to affect students' views on the concept map and learning methods (do you have an adopted education

method, which study method do you use, what are the sources you frequently use while studying).

To measure interpersonal problem-solving skill score, Interpersonal Problem-Solving Inventory (IPSI) was used (12). The inventory was developed by Çam and Tümkaya to assess the problem-solving approaches and skills of university students between 18 and 30 years of age. This scale includes 50 items and five sub-dimensions. The internal consistency values of Cronbach alpha for the sub-scales were between

0.67 and 0.91. The Cronbach's alpha value in this study was 0.82.

To measure critical thinking skill score, California Critical Thinking Disposition Inventory (CCTDI) developed by Facione et al. was used (13). The scale comprised 75 items and 7 sub-dimensions. Cronbach's alpha for the scale was 0.90. The validity-reliability study of the inventory in Turkey was analyzed by Kökdemir & Ali (14). The scale comprised 51 items and 6 sub-dimensions. Cronbach's alpha for the scale was 0.88. In this study, the Cronbach's alpha value for the scale was 0.87.

To measure lifelong learning skill score, the Lifelong Learning Tendency Scale (LLTS) was used (15). The validity-reliability study of the inventory in Turkey was analyzed by Gür Erdoğan & Arsal. The scale included 17 items with 2 sub-dimensions. Cronbach's alpha for the scale was 0.86. In this study, the Cronbach's alpha value for the scale was 0.91.

To measure self-efficacy-sufficiency score, the Self-Efficacy-Sufficiency Scale (SES) was used. This scale was developed in 1995 (17). Aksayan and Gozum validated the validity and reliability of the scale in Turkey (16). There were 23 items on this scale with 6 sub-dimensions. The scale's Cronbach's alpha was 0.81. In this study, the Cronbach's alpha value was 0.79.

For all measurements, all groups received three of these measurement tools (T0, T1, T2). The Student Identification Form was used to collect sociodemographic and other variables that were thought to affect the parameters measured with the scales from all students at baseline (T0). This form was only used at baseline because the sociodemographic variables did not change during the measurements (T0).

### **Data Analysis**

SPSS 25.0 was used to perform statistical analyses on the study data. The statistician used numbers, percentages, the chi-square test, the t-test, and the Kolmogorov-Smirnov test. For the categorical variables in the demographic data, descriptive

statistical analysis was used to summarize quantitative variables such as mean and standard deviation; frequency counts and percentages were used for the categorical variables. A 0.05 p-value was accepted as the significant level. A statistician with no prior knowledge of the study analyzed the data.

### **Ethics Statement**

The research received written approval from the Ethics Committee of the university where the research was conducted (date: 22.12.2021; number: 2021/05-36). Moreover, participants who volunteered to participate in the research provided written informed consent. The research was conducted in accordance with the Helsinki Declaration.

### **Results**

#### **Sample characteristics of the students**

Approximately 56% (n=40) of the participants in the study were girls, 46% (n=33) stated that they benefited from a learning method while studying, as reading the most used in the 79% (n=26)." and documents given in the course are the most used documents in %59 of the students (n=43). Between the education and control groups, there were no significant differences in sociodemographic characteristics or baseline scale mean scores (Table 2).

#### **Main outcomes**

Table 3 shows the mean problem-solving, critical thinking, lifelong learning, and self-efficacy-sufficiency scores at T0, T1, and T2 during the PNC-CM. These findings are the findings obtained as a result of the evaluation of the hypotheses of the research. The results demonstrate that the course improved the critical thinking, lifelong learning, self-efficacy, and competency of the nursing students, while it did not change their problem-solving skills. Therefore, three of the research hypotheses were supported, and one was rejected.

After the program, the education group's mean scores for critical thinking, lifelong learning, and

self-efficacy-sufficiency increased statistically significantly ( $p < 0.05$ ). However, the mean problem-solving scores of nursing students in the education group did not change significantly over the period ( $p > 0.05$ ). The mean scores for problem-

solving, critical thinking, lifelong learning, and self-efficacy-sufficiency in the control group were low and did not change significantly during the follow-up ( $p > 0.05$ ) (Table 3).

**Table 2.** Characteristics of the nursing students ( $n = 72$ ) Aksaray, 2022

| Characteristic                               | Education<br>( <i>n</i> = 37)  |       | Control<br>( <i>n</i> = 35)    |       | Total<br>( <i>n</i> = 72) |       | $\chi^2$        |
|----------------------------------------------|--------------------------------|-------|--------------------------------|-------|---------------------------|-------|-----------------|
|                                              | <i>n</i>                       | %     | <i>n</i>                       | %     | <i>n</i>                  | %     | <i>P</i> -value |
| Mean age                                     | $\bar{x} \pm SS$<br>22.66±2.24 |       | $\bar{x} \pm SS$<br>23.56±1.29 |       | $t$ $p$<br>1.667 0.143    |       |                 |
| Sex                                          |                                |       |                                |       |                           |       |                 |
| Female                                       | 19                             | 51.4  | 21                             | 60.0  | 40                        | 55.6  | 1.8891          |
| Male                                         | 18                             | 48.6  | 14                             | 40.0  | 32                        | 44.4  | 0.2732          |
| Marital status                               |                                |       |                                |       |                           |       |                 |
| Married                                      | 1                              | 2.7   | 2                              | 5.7   | 3                         | 4.2   | 3.1172          |
| Single                                       | 36                             | 97.3  | 33                             | 94.3  | 69                        | 95.8  | 0.2273          |
| Do you have a method for studying?           |                                |       |                                |       |                           |       |                 |
| Yes                                          | 15                             | 40.5  | 18                             | 51.4  | 33                        | 45.8  | 2.7741          |
| No                                           | 22                             | 59.5  | 17                             | 48.6  | 39                        | 54.2  | 0.3472          |
| If yes, what is your method?                 |                                |       |                                |       |                           |       |                 |
| Only reading                                 | 10                             | 66.7  | 16                             | 88.9  | 26                        | 78.8  | 4.8864          |
| Following the subject on the web             | 3                              | 20.0  | 0                              | 0.0   | 3                         | 9.1   | 1.9832          |
| Only taking notes/<br>studying by writing    | 2                              | 13.3  | 2                              | 11.1  | 4                         | 12.1  |                 |
| What resources do you use most for studying? |                                |       |                                |       |                           |       |                 |
| Only the documents given in the course       | 22                             | 59.5  | 21                             | 59.4  | 43                        | 59.7  | 4.8264          |
| Textbooks                                    |                                |       |                                |       |                           |       | 1.2912          |
| Notes taken during the class                 | 7                              | 18.9  | 10                             | 29.0  | 17                        | 23.6  |                 |
| Web                                          | 4                              | 10.8  | 1                              | 2.9   | 5                         | 6.9   |                 |
| Case study books                             |                                |       |                                |       |                           |       |                 |
| Databases                                    | 2                              | 5.4   | 1                              | 2.9   | 3                         | 4.2   |                 |
|                                              | 1                              | 2.7   | 1                              | 2.9   | 2                         | 2.8   |                 |
|                                              | 1                              | 2.7   | 1                              | 2.9   | 2                         | 2.8   |                 |
| Total                                        | 37                             | 100.0 | 35                             | 100.0 | 72                        | 100.0 |                 |

**Table 3.** Comparison of the education and control groups' follow-up mean scores on the "Interpersonal Problem-Solving Inventory," "California Critical Thinking Disposition Inventory," "Lifelong Learning Tendency Scale," and "Self-Efficacy-Sufficiency Scale"

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|           | Follow-up         | IPSI*<br>$\bar{x} \pm SS$ |              | CCTDI**<br>$\bar{x} \pm SS$ |              | LLTS***<br>$\bar{x} \pm SS$ |              | SES****<br>$\bar{x} \pm SS$ |              |
|-----------|-------------------|---------------------------|--------------|-----------------------------|--------------|-----------------------------|--------------|-----------------------------|--------------|
| Education | T0                | 3.11±0.22                 |              | 2.58±0.43                   |              | 2.32±0.27                   |              | 2.43±0.37                   |              |
|           | T1                | 3.21±0.71                 |              | 4.66±1.09                   |              | 4.71±0.23                   |              | 4.72±0.25                   |              |
|           | T2                | 3.17±0.92                 |              | 4.71±1.06                   |              | 4.72±0.33                   |              | 4.74±0.61                   |              |
| Control   | T0                | 3.15±0.26                 |              | 2.45±0.32                   |              | 2.20±0.33                   |              | 2.41±0.27                   |              |
|           | T1                | 3.19±0.98                 |              | 2.32±0.34                   |              | 2.40±0.34                   |              | 2.42±0.44                   |              |
|           | T2                | 3.22±0.97                 |              | 2.43±0.32                   |              | 2.47±0.41                   |              | 2.41±0.47                   |              |
|           |                   | F                         | p            | F                           | p            | F                           | p            | F                           | p            |
| Test      | Follow-up         | 96.32                     | <b>0.061</b> | 7.71                        | <b>0.001</b> | 3.46                        | <b>0.022</b> | 3.97                        | <b>0.021</b> |
|           | Group             | 143.73                    | <b>0.052</b> | 544.32                      | <b>0.002</b> | 214.67                      | <b>0.020</b> | 145.3                       | <b>0.020</b> |
|           | Follow-up x Group | 94.77                     | <b>0.051</b> | 55.68                       | <b>0.001</b> | 1.44                        | <b>0.018</b> | 1.44                        | <b>0.002</b> |

\* Interpersonal Problem-Solving Inventory

\*\* California Critical Thinking Disposition Inventory

\*\*\* Lifelong Learning Tendency Scale

\*\*\*\* Self-Efficacy-Sufficiency Scale

## Discussion

The aim of the study is to evaluate the effect of the PNC-CM, on the critical thinking, lifelong learning, and self-efficacy and problem-solving skills of student nurses. These outcomes indicate the significant impact of the course. The impact on critical thinking, lifelong learning, and self-efficacy effectiveness are not limited to the present; a positive effect can also have long-term consequences (1,3,8,9,16,18,19,20).

In a meta-analysis, it was found that 'concept map users have significantly higher critical thinking sensory tendencies, such as open-mindedness, fact-searching, analytical thinking, systematicity, self-confidence, curiosity, and maturity' when compared with the users of the traditional methods. According to the same meta-analysis, the visual formation of themes and relationships establishes an information network and organizes old and new information between this network, which produces an information pattern in the

student (21). In addition, the use of concept mapping has been shown to improve analysis, deduction, and induction skills among the nurses (18). It has been stated in these studies that the concept map method has been able to achieve this by giving students the opportunity to establish relationships and making inferences as a result of the analysis of the students' theoretical knowledge and ideas. There is evidence that maps become more detailed with practice. It is also stated in the results of this study that providing initial training for inexperienced students, clarifying concept mapping for them, and checking that all students can create concept maps appropriately will increase the effectiveness. It has been pointed out that the dominant visual features of concept maps will support their use for collaborative and critical activities. Finally, it was stated that the concept map is a method that attracts the attention of the student and encourages to increase the critical thinking, lifelong learning, and self-efficacy parameters when they work in cooperation with

the student and the instructor. This finding is similar to the significant increase in critical-thinking, lifelong-learning, and self-efficacy and competency skills among the students in the education group observed in the present study.

In the literature, it has been stated that the concept map contributes to the results of the current research by providing data mining in education as well as being an effective information visualization tool.<sup>1</sup> Similarly, this research evaluated and revealed what a concept map means in nursing education through data mining by interviewing the group that received the education. The findings are expected to enrich nursing education and nursing practices and therefore widen the literature.

The results of this study indicate that the critical-thinking, critical-approach, and lifelong-learning skills scores of the students increased with the use of the concept map (Table 3). In nursing education literature, the development of educational tools to measure the students' critical thinking skills, guide their application skills, and support their critical-thinking and reasoning skills has been clearly recommended (18). The importance of enriching the nursing profession, which is a practical discipline that is open to innovative learning methods, with methods aimed at accelerating the learning process and providing a critical view of nursing practices at a decision-making point has been emphasized, especially in recent years (22). There are also studies showing that the concept map contributes to the critical-thinking skills of the nursing students. However, no study has evaluated the long-term effects (problem-solving, critical thinking, lifelong learning, and self-efficacy and competency) of a pediatric course based on the concept map, which is the strength and originality of our research.

### **Limitations of the study**

Participants were recruited from only one university. Including other universities with different student populations will help generalize the results. Results were measured twice, immediately after (posttest (T1)) and 3 months after (Follow-up (T2)) the PNC-CM

was completed due to time constraints. Longer and repeated follow-ups may have obtained different findings. Future studies should take this into account. However, the long-term effects of nursing education have rarely been evaluated. This is a challenge for future nursing education.

### **Conclusion**

The statistically significant lower mean scores of the students in the control group who had taken the same course through the classical method (except for problem-solving skill scores) shows the positive effects of the concept map on critical thinking, lifelong learning, and self-efficacy and competency. However, the course did not have an impact on the problem-solving skills. Therefore, while the hypothesis written in the research that problem-solving skills would be improved was rejected, other hypotheses were accepted.

Concept mapping is a powerful and proven method in nursing education. In addition, sustainable learning will be provided in the professional development of nurses. The research has important results that will shed light on higher education. The parameters evaluated in this study are parameters that will contribute to higher education and nursing undergraduate education in the long term. In addition, the education method used is an education method used for the first time in the faculty where the study was conducted, and it was stated by the students that it contributed greatly to the development. In this regard, the study reveals the feasibility results of using a teaching method that has not been used before in the institution. It evaluates the effectiveness of a training method that has not been used before. The results of the research were extremely important indicators for the institution. Improving long-term parameters is extremely important.

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## Conflict of interest

No conflict of interest has been declared by the author.

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