

## The Effect of Concept Map-Based Education Given to Nursing Students on Medication Administration Self-Efficacy in Children: A Quasi-Experimental Study

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### ABSTRACT

This study was conducted as a control group, pretest-posttest quasi-experimental study between March 2024 and May 2024 with a total of 140 nursing students in the 3rd and 4th grades at a Nursing Department in the Western Black Sea Region of Türkiye. Data were collected as pre-test and post-test using the "Introductory Information Form", "Self-Efficacy Scale for Medication Administration in Children for Nursing Students" and "Scale for the Effectiveness of Concept Maps in Nursing Education". The nursing students in the education group (n=70) received face-to-face four-session education on medication administration in children based on concept mapping. Nursing students in the control group (n=70) did not receive any training on medication administration in children based on concept mapping. Chi-square tests, dependent sample t test and independent sample t test were used to analyze the data. In the post-test, the scores of the Self-Efficacy Scale for Medication Administration in Children and the Effectiveness of Concept Mapping in Nursing Education Scale of the nursing students in the education group were significantly higher than those of the nursing students in the control group. It was found that the concept map-based education given to nursing students had positive effects on increasing the level of medication administration self-efficacy in children.

## Hemşirelik Öğrencilerine Verilen Kavram Haritasına Dayalı Eğitimin Çocuklarda İlaç Uygulama Öz-Yeterliliğine Etkisi: Yarı Deneysel Çalışma

### MAKALE BİLGİSİ

### ÖZ

*Bu çalışma 16-19 Mayıs 2024 tarihleri arasında 10. Hitit Öğrenci Kongresi'nde sözlü bildiri olarak sunulmuştur. indicate in this section*

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#### Anahtar Kelimeler

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Bu araştırma hemşirelik öğrencilerine verilen kavram haritasına dayalı eğitimin çocuklarda ilaç uygulama öz-yeterliliğine etkisinin değerlendirilmesi amaçlı, kontrol gruplu, ön test-son test yarı deneysel olarak Mart 2024-Mayıs 2024 tarihleri arasında Türkiye'nin Batı Karadeniz Bölgesi'ndeki bir Hemşirelik Bölümü'nde eğitim alan 3. ve 4. sınıftaki toplam 140 hemşirelik öğrencisiyle gerçekleştirildi. Veriler "Tanıtıcı Bilgi Formu", "Hemşirelik Öğrencileri İçin Çocuklarda İlaç Uygulamaları Öz-Yeterlilik Ölçeği" ve "Hemşirelik Eğitiminde Kavram Haritasının Etkinliği Ölçeği" ile ön test ve son test olarak toplandı. Eğitim grubundaki hemşirelik öğrencileri (n=70) kavram haritasına dayalı çocuklarda ilaç uygulamaya yönelik yüz yüze dört oturumlu eğitim aldı. Kontrol grubundaki hemşirelik öğrencileri (n=70) ise kavram haritasına dayalı çocuklarda ilaç uygulamaya yönelik ise eğitim almadı. Verilerin analizinde; ki-kare testi, bağımlı örneklem t testi ve bağımsız örneklem t testi kullanıldı. Son testte, eğitim grubundaki hemşirelik öğrencilerinin Çocuklarda İlaç Uygulamaları Öz-Yeterlilik Ölçeği puanları ve Hemşirelik Eğitiminde Kavram Haritasının Etkinliği Ölçeği puanları kontrol grubundaki hemşirelik öğrencilerine göre anlamlı derecede yükseldi. Hemşirelik öğrencilerine verilen kavram haritasına dayalı eğitimin çocuklarda ilaç uygulama öz yeterliliği düzeyinin artmasında olumlu etkileri olduğu bulundu.

## INTRODUCTION

Medication administration has an important place in terms of patient safety and is more risky in infants and children than in adults (1). Medication administration errors increase the duration of hospitalization, patient care costs and mortality rates (2,3). There are differences in age, body weight, metabolic rate for medication administration between children and adults (4). Since the digestive system and kidney function in children differ from adults, there may be effects on the absorption, distribution and excretion of drugs (5). In addition, children often have different allergic reactions than adults and may be more sensitive to certain medicines (6). Therefore, it is important for pediatric nurses to carefully observe signs of allergic reactions in children, drug tolerance, use safe methods of administration and assess the effects on the child's overall health (1,5). Education for nurses on medication administration should start with undergraduate nursing education. In nursing schools in Türkiye, principles of safe medication administration and dose calculations in children are included in the curriculum within the field of pediatric health and diseases courses and limited time is allocated to these subjects (6). At the end of the theoretical and practical education that nursing students receive about medication administration, they should be able to use the information in clinical practice and have independent decision-making and execution skills (7). It may cause nursing students to avoid pediatric clinics and pediatric patient approach as one of the clinics where they experience anxiety and stress in clinical practice (8).

There is a need for the implementation of an active student-centered learning environment and innovative teaching methods for the continuous improvement and development of nursing education (9,10). In the literature, there are studies in which simulation, group discussion, role-playing methods are used in trainings for nurses and nursing students (11–13). In addition, as one of the innovative teaching methods, concept maps are used as a learning method for the development of clinical skills in nursing students to reinforce learning (14–16). Concept maps are a strategy that helps nursing students use problem solving, questioning and critical thinking skills and make cognitive progress while organizing and presenting concepts of interest to them (16). As a new thinking method, concept maps can create keywords, colors, memory connections, increase permanent storage space in memory, increase motivation and encourage creative thinking in students (17). It can provide nursing students with more enjoyable and positive motivation in clinical teaching. There are few studies in the literature on the use of concept maps used in education (7,10,18). In these studies, it was emphasized that concept maps increase meaningful learning through group work by developing students' skills of discussing, associating, distinguishing and correcting misconceptions in a meaningful way (14,18). However, there is a lack of evidence regarding the effectiveness of concept maps are effective in integrating nursing students into medication administration in children. Therefore, the aim of this study is to evaluate the effect of concept map-based education on the self-efficacy of medication administration in children in nursing students. The research hypotheses are as follows in line with the general purpose:

**H1:** The self-efficacy scores of nursing students who received education on medication administration based on concept mapping are higher than those of students in the control group.

**H2:** The concept map efficacy scores of the nursing students who received concept map-based medication administration education are higher than the students in the control group.

## MATERIALS AND METHODS

### Study Design

This study was designed as a control group, pretest-posttest quasi-experimental design.

### Study Population and Setting

The study was conducted between March 2024 and May 2024. The population of the study consisted of 166 nursing undergraduate students in the 3rd and 4th grades studying at a nursing school in the Western Black Sea Region of Türkiye. Nursing education in Turkey is four years (8 semesters) and is given at least at undergraduate level. The inclusion criteria for nursing students were (a) Being a 3rd and 4th year nursing student (the effect of taking a course on pediatric nursing on self-efficacy of medication administration in children was assumed) and (b) successfully completing the pharmacology course. Exclusion criteria for nursing students: (a) having problems speaking and understanding Turkish (b) unwilling to participate in the study. In the study, 26 nursing students did not meet the inclusion criteria. The study was completed with 140 undergraduate nursing students, reaching 84.33% of the sample. All students who volunteered to participate in the study were included in the education group (n=70) and the control group (n=70) without any sample selection method. In the Nursing Department where the study was conducted, 3rd and 4th grade students were divided into A and B branches according to the student number as of the 1st grade. In this study, the students in branch A were included in the training group and the students in branch B were included in the control group.

### Data Collection

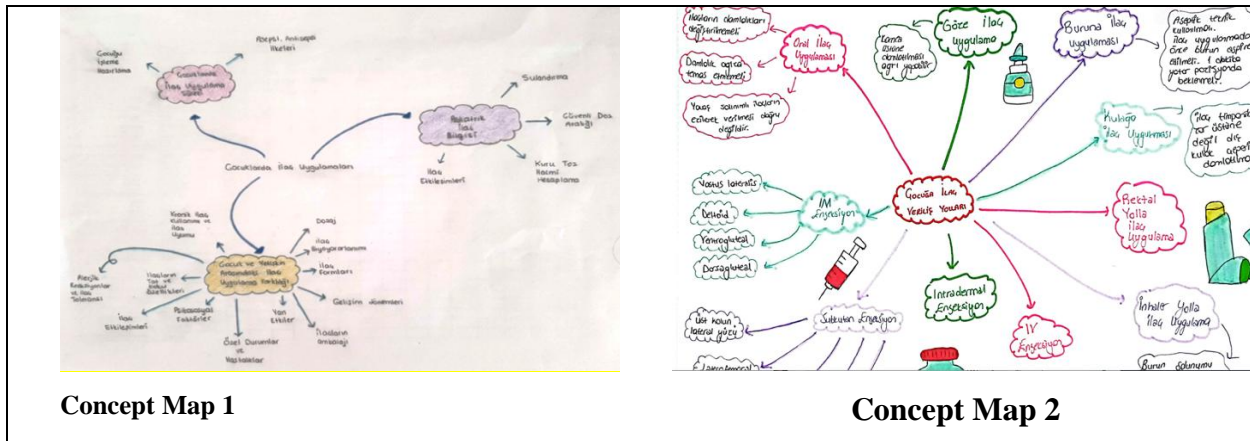
Informed written consent was obtained from the nursing students about the study before data collection. Implementation of the education program and completion of the data collection tools were carried out at times that would not affect the nursing students' course schedules. In the first week, the "Introductory Information Form" containing the introductory information of the nursing students and the "Self-Efficacy Scale for Medication Administration in Children for Nursing Students" were administered. Nursing students were asked to answer the questions individually based on self-report. The data collection process took an average of 10 minutes. In order to prevent contamination between the training and control groups, nursing students were invited to the study on different days and the study was administered in the classroom environment when the class was interrupted. The pre-test and post-test were administered to the nursing students in the training and control groups in the same weeks.

All nursing students in the Department of Nursing take pediatric nursing course in the 2nd semester of the 3rd year. In the first week of the pediatric nursing course, the subject of drug administration in children is explained theoretically by the instructors to the nursing students. In addition, they observe and apply drug administration in children in pediatric nursing clinical practice throughout the semester.

**Control group:** All nursing students in the control group received information about medication administration in children only in the pediatric nursing course. They did not receive training on medication administration in children based on concept maps.

**Education group:** All nursing students in the education group received information about drug administration in children in the pediatric nursing course. In addition, nursing students in the education group first received a power point presentation on medication administration in children and then concept maps were created. The education program was given face-to-face once a week for 60 minutes in a total of 4 sessions. In each session, nursing students were divided into groups

of 4-6 students by lottery method. Nursing students in the education group were given paper, pencil, colored pencil and a template containing instructions for creating a concept map. Then, basic concepts for the content of each session were created with the students and the connections between the concepts were shown with arrows. The students in the training group performed a concept map application in each session with senior nursing students (N.S., T.N.K, E.D.) under the supervision of a pediatric nursing faculty member.



**Figure 1. Examples of Concept Maps Created in the Education Given to Nursing Students About Medication Administration in Children**

### Education Program

The content of a literature-based training program for nursing students on medication administration in children based on concept mapping was developed by taking the opinions of five experts in the field of pediatric nursing (7,17,18). In order to increase the content validity of the education program, it was subjected to a content validity test consisting of 16 items evaluating the structure, effectiveness, content and applicability of the program by five experts. The test questionnaire was a 4-point Likert scale (“1 not very valid”, “4 very valid”) and the results showed that all items scored at least three points. The education on medication administration in children based on concept mapping was implemented in four sessions (Table 1).

**Table 1. Education Sessions and Content.**

Topics	Content
The importance of medication administration in children	<ul style="list-style-type: none"> <li>• Age period characteristics in children</li> <li>• Developing communication skills appropriate to children’s emotional needs</li> </ul>
Pharmacokinetics and pharmacodynamics in children	<ul style="list-style-type: none"> <li>• Differences in drug absorption, drug metabolism and drug excretion in children</li> </ul>
Methods of administration of medicines in children	<ul style="list-style-type: none"> <li>• In children, rectal, inhalation, intramuscular, subcutaneous, intravenous medication administration, eye, nose, ear medication administration</li> <li>• Explanation of safe and effective medication administration methods for children</li> </ul>
Medication calculation in children	<ul style="list-style-type: none"> <li>• Awareness of the efficacy and safety of medication administration in children</li> <li>• Accurate drug and dry powder volume calculation</li> </ul>

The education program was planned as follows:

Week 1: A session was held on the importance of medication administration in children and nursing responsibilities in medication administration.

Week 2: A session was held on pharmacokinetics and pharmacodynamics (differences in drug absorption, drug metabolism and drug excretion) in children.

Week 3: A session was held on administration methods of drugs in children (oral, rectal, inhalation, intramuscular, subcutaneous, intravenous. Intramuscular, intramuscular, subcutaneous, intravenous medication administration, eye, nose, ear medication administration).

Week 4: A session was held on drug calculation in children (dry powder volume calculation, drug unit conversions) was held.

One week later after the final session the “Development of Medication Administration Self-Efficacy Scale in Children for Nursing Students” and “Scale for the Effectiveness of Concept Maps in Nursing Education” posttest were administered. All nursing students participating in the study completed the education program. The data collection process took an average of 10 minutes.

## Data Collection Tools

### *Introductory Information Form*

This form includes 4 questions about academic year, education on medication administration in children outside the scope of the course, education on medication errors, and willingness to work in pediatric clinics after graduation.

### *Development of Medication Administration Self-Efficacy Scale in Children for Nursing Students (MASSCNS)*

This scale was developed by Bektaş et al. (2021) to assess medication administration self-efficacy in children for nursing students (19). The scale consisted of 16 items and 2 subscales (medication preparation sub-dimension, medication administration sub-dimension). The sub-dimensions consisted of questions from 1 to 8 (medication preparation sub-dimension) and from 9 to 16 (medication administration sub-dimension). The lowest score that can be obtained from the scale is 16 and the highest score is 80. Although this scale does not have a cut-off point, as the score obtained from the scale increases, students' self-efficacy regarding medication management in children increases. Cronbach's alpha coefficient for the whole scale was 0.94, 0.91 for the first medication preparation sub-dimension and 0.87 for the second medication administration sub-dimension. In this study, Cronbach's alpha coefficient for the whole scale was 0.93.

### *Scale for the Effectiveness of Concept Maps in Nursing Education (SECMNE)*

This scale was developed by Tarım et al. (2022) to evaluate the effectiveness of the concept map used in nursing education (20). The scale questions the attitudes and perceptions of nurses using concept mapping towards the effectiveness of concept mapping from a broad perspective. The scale has three sub-dimensions: “Integration of the care plan”, “Integration of information” and “Perception”. The four-point Likert scale (1=never, 2=sometimes, 3=often, 4=always) consists of 30 items. Items 4, 18 and 21 are reverse scored. The lowest score of 30 and the highest score of 120 can be obtained from the scale and the cut-off point of the scale was determined as  $\leq 73$  and  $>73$  indicates that the concept map method used in nursing education is effective. The Cronbach's alpha reliability coefficients of the scale and its sub-dimensions are 0.97 for the whole scale. In this study, Cronbach's alpha coefficient of the whole scale was 0.96.

## Data Analysis

The research data were analyzed using IBM SPSS Statistics 23 software. Descriptive statistics including percentages, numbers, means and standard deviations were used to present the

demographic characteristics of nursing students. The normality of the data was checked using the Kolmogorov-Smirnov test and it was determined that the data were normally distributed. Chi-square was used to analyze the data, Independent Samples t-Test was used to determine the differences between the groups, and Paired Samples t-Test was used to reveal the differences between the pre-test and post-test averages within the groups. The results of this study were evaluated at 95% confidence interval and  $p < 0.05$  significance level.

### Ethical Approval

For the scales used in the study, permission was first obtained from the scale owners via e-mail. Ethical approval was obtained from the Social and Human Ethics Committee of a university to conduct the study (Protocol No: 2024-SBB-0086, Decision No: 24.01.2024/2). Prior to the study, institutional permission was obtained from Bartın University Faculty of Health Sciences Dean's Office where the study would be conducted (No: E-71504618-605-2400026121, Date: 05.03.2024). Nursing students were informed about the purpose of the study before starting the data collection and education program. It was emphasized that their identity information would be kept confidential, their written consent was obtained and they were informed that they could leave the study at any time.

## RESULTS AND DISCUSSION

The groups showed homogeneity in terms of academic year, receiving education on medication administration in children outside the scope of the course, receiving education on medication errors, and willingness to work in pediatric clinics after graduation ( $p > 0.05$ ) (Table 2).

**Table 2. Descriptive Characteristics of the Education and Control Groups**

Characteristics	Education Group		Control Group		Test	p value
	n	%	n	%		
<b>Academic Year</b>						
3rd year	30	42.9	36	51.4	1.032 <sup>a</sup>	0.31
4th year	40	57.1	34	48.6		
<b>Receiving education on medication administration in children outside the scope of the course</b>						
Yes (course, seminar...)	18	25.7	14	20	2.857 <sup>a</sup>	0.091
No	52	74.3	56	80		
<b>Receipt of education on medication errors</b>						
Yes	19	25.7	14	20	0.991 <sup>a</sup>	0.319
No	51	74.3	56	80		
<b>Willingness to work in pediatric clinics after graduation</b>						
Yes	18	35.7	14	20	2.287 <sup>a</sup>	0.332
None	52	65.3	56	80		

<sup>a</sup>Chi-squared,

In the posttest, the mean score of the MASSCNS of nursing students in the education group was significantly higher than that of the control group ( $t = -8.676$ ;  $p < 0.001$ ). Nursing students in the

education ( $t=-8.676$ ;  $p<0.001$ ) and control groups ( $t=-4.233$ ;  $p<0.001$ ) scored higher on the MASSCNS in the posttest compared to the pretest (Table 3).

**Table 3. Medication Administration Self-Efficacy Scale in Children for Nursing Students in Education and Control Groups**

		Education Group	Control Group	Test	p value
		Mean±SD	Mean±SD		
Medication preparation sub-dimension	Pre-test	21.10±7.56	22.94 ±6.11	1.580 <sup>c</sup>	0.116
	Post-test	31.80 ± 5.8	26.02 ± 6.41	6.198 <sup>c</sup>	<b>0.000</b>
	Test	-9.198 <sup>d</sup>	-3.487 <sup>d</sup>		
	p value	<b>0.000</b>	<b>0.001</b>		
Medication administrationsub-dimension	Pre-test	24.05 ± 9.18	25.85 ±6.83	-1.315 <sup>c</sup>	0.191
	Post-test	33.01 ±5.62	29.65 ± 6.80	-7.590 <sup>c</sup>	<b>0.000</b>
	Test	-7.599 <sup>d</sup>	-3.683 <sup>d</sup>		
	p value	<b>0.000</b>	<b>0.000</b>		
Medication Adminstration Self-Efficacy Scale in Children for Nursing Students	Pre-test	45.15 ± 15.98	48.80 ± 12.00	-1.523 <sup>c</sup>	0.130
	Post-test	64.81±11.07	55.68 ±10.90	-8.676 <sup>c</sup>	<b>0.000</b>
	Test	-8.676 <sup>d</sup>	-4.233 <sup>d</sup>		
	p value	<b>0.000</b>	<b>0.000</b>		

SD=standard deviation, <sup>c</sup>Independent-samples t-test ( $t$ -table value), <sup>d</sup>Paired-samples t-test ( $t$ -table value)

Compared with the nursing students in the control group, the nursing students in the education group scored significantly higher on the SECMNE in the posttest ( $t=-5.104$ ;  $p<0.001$ ) (Table 4).

**Table 4. Scale Scores of the Effectiveness of Concept Mapping in Nursing Education Scale of Education and Control Groups**

		Education Group	Control Group	Test	p value
		Mean±SD	Mean±SD		
Scale for the Effectiveness of Concept Maps in Nursing Education	Post-test	35.48 ± 6.18	29.48 ± 8.40	-4.810 <sup>c</sup>	<b>0.000</b>
	Post-test	52.22 ± 9.17	43.37 ± 12.56	-4.764 <sup>c</sup>	<b>0.000</b>
	Post-test	6.35 ± 2.79	5.75 ± 2.22	-1.403 <sup>c</sup>	0.163
	Post-test	94.07 ± 15.25	78.61 ± 20.22	-5.104 <sup>c</sup>	<b>0.000</b>

SD=standard deviation, <sup>c</sup>Independent-samples t-test ( $t$ -table value),

The aim of this study was to evaluate the effect of the education given to nursing students based on concept mapping on medication administration in children on medication administration self-efficacy in children. The preliminary results of the study showed that after the education given to nursing students on medication administration in children based on concept mapping, the level of self-efficacy of medication administration in children and the effectiveness of concept mapping in nursing education were higher in the education group than in the control group.

The fact that the education group of this study had higher levels of self-efficacy in medication administration in children after the education program compared to the control group supports H1 of the study. In pediatric practice, unlike other practices, when the child starts to calculate the dose, students better understand how important and sensitive drug dose calculation and medication administration are (21). Nursing students may experience high levels of anxiety and stress in pediatric clinical settings due to thoughts such as harming the child, not having

sufficient knowledge and skills specific to pediatric patients, and doing something wrong, and this may cause a decrease in self-efficacy levels (8). In a study, it was found that nursing students who did not experience anxiety during drug treatment scored higher on the self-efficacy scale (22). In a systematic review and meta-analysis study examining the effectiveness of concept mapping on the development of critical thinking in nursing education, it was shown that concept mapping may affect critical thinking cognitive skills (10). In this study, it is thought to be effective in increasing nursing students' self-efficacy for medication administration in children with interesting, interactive and easy-to-learn concept maps as a part of student-centered education. In addition, concept maps may have increased nursing students' self-learning abilities, sense of achievement and productivity. In the literature, it was found that trainings given to nursing students using different teaching methods such as simulation, video-assisted, peer mentoring increase their self-efficacy for medication administration in children (6,23, 24, 25). In this context, it can be said that nursing students' experience of different learning methods for medication administration in children may increase their self-efficacy in medication administration in children.

The fact that the education group of this study had higher levels of effectiveness of concept mapping in nursing education after the education program compared to the control group supports H2 of the study. In the literature, there is no study comparing the effectiveness of concept mapping in nursing students after concept map-based education. Studies have shown that concept maps enable nursing students to learn about the basic concepts used in care, to reach the whole by establishing connections between parts, and to combine new information with old information (7,17,18).

The study has some limitations. Firstly, the fact that the study was conducted with the nursing department students of a university in only one province limits the generalizability of the findings. Secondly, the results obtained from the study are limited to the scales used in the data collection phase and are based on students' self-reports.

## CONCLUSIONS

It was found that the education given to nursing students based on concept mapping had positive effects on increasing the level of medication administration self-efficacy in children. The concept map-based education on medication administration in children used in this study may increase both the theoretical knowledge and self-efficacy of students. What was learned in this study will open many doors for further research on this topic in nursing education. Determining the areas where nursing students are inadequate in practice with this concept map-based education can guide the use of different educational methods. The findings of this study will contribute to nursing education, especially pediatric nursing education, and will be a source of data for future studies for pediatric nursing education. In addition, the increase in nursing students' self-efficacy for medication administration in children may also increase their competencies in clinical and laboratory applications. In line with these results, it is recommended that the use of concept maps in nursing education should become widespread. Concept maps can be used to take notes, complete homework, prepare for exams, analyze and think about nursing practice. As an alternative learning experience in the undergraduate nursing education process, students' use of concept maps in evaluating nursing interventions and case discussions may make learning more enjoyable as well as improving critical decision-making, problem solving and analyzing skills (26). It is recommended that different teaching approaches should be integrated into the clinical teaching process to prepare nursing students to become self-confident and competent nurses by providing them with medication administration skills in children.



## REFERENCES

1. Özyazıcıoğlu N, Aydın Aİ, Sürenler S, Çınar HG, Yılmaz D, Arkan B, et al. Evaluation of students' knowledge about paediatric dosage calculations. *Nurse Educ Pract.* 2018;28:34–9.
2. Tsegaye D, Alem G, Tessema Z, Alebachew W. Medication administration errors and associated factors among nurses. *Int J Gen Med.* 2020;13:1621–32.
3. Wondmieneh A, Alemu W, Tadele N, Demis A. Medication administration errors and contributing factors among nurses: A cross sectional study in tertiary hospitals, Addis Ababa, Ethiopia. *BMC Nurs.* 2020;19(1):1–9.
4. Ridling, D., Christensen, P., Harder, L. R., Gove, N., & Gore, S. (2016). Pediatric nurse performance on a medication dosage calculation assessment tool. *Journal of pediatric nursing*, 31(2), e133-e140.
5. Luokkamäki S, Härkänen M, Saano S, Vehviläinen-Julkunen K. Registered Nurses' medication administration skills: a systematic review. *Scand J Caring Sci.* 2021;35(1):37–54.
6. Öztürk Şahin Ö, Aközlü Z, Taşdelen Y. Pediatric nursing students' self-efficacy regarding medication administration and clinical comfort and worry: A pre-posttest comparative study of nurse mentoring versus peer mentoring. *Nurse Educ Pract.* 2023;71(April):103712.
7. Ordu Y, Caliskan N. The impact of a web-based mind map learning technique on students' nursing knowledge of the nursing process. *Int J Nurs Knowl.* 2023;34(2):108–15.
8. Can Gezer M, Küçük Alemdar D. The mediating role of pediatric nursing competence in the relationship between pediatric drug administration self-efficacy and medical error tendency in nursing students. *Nurse Educ Pract.* 2024;79(May):104067.
9. Rosciano A. The effectiveness of mind mapping as an active learning strategy among associate degree nursing students. *Teaching and Learning in Nursing* 2015;10(2), 93-99.
10. Yue M, Zhang M, Zhang C, Jin C. The effectiveness of concept mapping on development of critical thinking in nursing education: A systematic review and meta-analysis. *Nurse Educ Today.* 2017;52:87–94.
11. Sandra PC, Alba CP, Cristina MM. Use of simulation to improve nursing students' medication administration competence: a mixed-method study. *BMC Nurs [Internet].* 2022;21(1):1–10. <https://doi.org/10.1186/s12912-022-00897-z>
12. Colman N, Figueroa J, McCracken C, Hebban K. Simulation-based team training improves team performance among pediatric intensive care unit staff. *J Pediatr Intensive Care.* 2019;8(2):83–91.
13. Fırat Kılıç H, Cevheroğlu S. The effect of video-assisted education on nursing students' tracheostomy care skills, anxiety levels and satisfaction with educational methods: A randomized controlled study. *Türkiye Klin J Nurs Sci.* 2023;15(2):386–94.
14. Liu Y, Li Y, Cui X, Zhou H, Wang J, Zhang Y. Clinical study on flipped classroom and mind map in newly recruited nurses' pre-job training. *BMC Nurs [Internet].* 2022;21(1):1–6. <https://doi.org/10.1186/s12912-022-00843-z>
15. Kotcherlakota S, Zimmerman L, Berger AM. Developing scholarly thinking using mind maps in graduate nursing education. *Nurse Educ.* 2013;38(6):252–5.
16. Seckman C, Van de Castle B. Understanding digital health technologies using mind maps. *J Nurs Scholarsh.*

2021;53(1):7–15.

17. Ramya C, Sandhya VK, Ramya P, Renuka IV, Atchyuta M, Anusha M, et al. A study on perception of students regarding newer teaching methods in medical education. *J Clin Diagnostic Res.* 2020;14(8):JC01–4.
18. Wu HZ, Wu QT. Impact of mind mapping on the critical thinking ability of clinical nursing students and teaching application. *J Int Med Res.* 2020;48(3):1–8.
19. Bektaş İ, Yardımcı F, Bektaş M. Hemşirelik öğrencileri için çocuklarda ilaç uygulamaları öz-yeterlilik ölçeği'nin geliştirilmesi ve psikometrik özellikleri. *Dokuz Eylül Üniversitesi Hemşirelik Fakültesi Elektronik Derg.* 2021;14(4):320–7.
20. Tarım SL, Boy Y, Şanlıtürk D. Effectiveness of the concept map in nursing education; developing a tool for student opinions. *Hosp Pract Res.* 2022;7(2):69–76.
21. Taş Arslan F, Sonay Türkmen A, Çelen R, Özkan S, Altıparmak D, Şahin A. Comparing traditional and simulation-based experiences in pediatrics with undergraduate nursing students in Turkey. *Clin Simul Nurs.* 2018;16(November 2017):62–9.
22. Akça K, Berşe S. Nursing students' self-efficacy and clinical decision-making in the context of medication administration to children: A descriptive-correlational study. *Nurse Educ Pract.* 2023;72(June):103775.
23. Thelen MA. The impact of online synchronous simulated clinical immersions on nursing students' pharmacology self-efficacy: A pre-test post-test intervention pilot study. *Nurse Educ Today [Internet].* 2021;100(March):104833. <https://doi.org/10.1016/j.nedt.2021.104833>
24. Kim H, Suh EE. The effects of an interactive nursing skills mobile application on nursing students' knowledge, self-efficacy, and skills performance: A randomized controlled trial. *Asian Nurs Res (Korean Soc Nurs Sci) [Internet].* 2018;12(1):17–25. <https://doi.org/10.1016/j.anr.2018.01.001>
25. Avraham R, Shor V, Kimhi E. The influence of simulated medication administration learning on the clinical performance of nursing students: A comparative quasi-experimental study. *Nurse Educ Today [Internet].* 2021;103(January 2020):104947. <https://doi.org/10.1016/j.nedt.2021.104947>
26. Ergin Doğan S, Aslan H. Hemşirelik eğitiminde kullanılan güncel öğretim yöntem ve teknikleri. *Bingöl Üniversitesi Sağlık Derg.* 2024;5(1):224–35.