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Research Article

The Effect of Using Puzzles as a Teaching Method on The Study Process and Motivation of Students Taking The Operating Room Nursing Course

Nevra KALKAN[1], Sedanur DEMİR[2], Zahide Güler EZER[3], Cansu DALGIÇ[4]

ABSTRACT

Aim: This study was conducted to determine the effect of puzzles applied within the scope of the operating room nursing course on their study process and motivation.

Material and Methods: The study sample, which employed a one-group pretest-posttest design and quasi-experimental, consisted of 97 students in the second-year grade of the Nursing Department at the Faculty of Health Sciences of a state university who were enrolled in the Operating Room Nursing course. "Student Information Form", "Instructional Materials Motivation Survey (IMMS)," and "Study Process Questionnaire (SPQ)" were used to collect the data. The puzzles were distributed to the students at the end of each lesson throughout the semester, and they were expected to solve them. Percentages, averages, and dependent sample t-tests were utilized to analyze the data.

Results: The mean age of the students was 19.9±1.38 years, and 84.5% were female. 73.1% of the students stated that they liked solving puzzles, and 67% of them recommended using puzzles in nursing education. It was found that the mean total scores of the students of the IMMS were significantly higher after the puzzle application than before ($t=-12.931$, $p<0.001$). The student's main score in the deep strategy sub-dimension of the SPQ was found to be significantly higher after the puzzle application than before ($t=-9.282$, $p<0.001$).

Conclusions: It was found that the puzzle as a teaching method positively affected the motivation and study process of the students taking the operating room nursing course.

Implications for nursing practice/management or policy: Using student-centered teaching methods, such as puzzles, can contribute to the training of qualified professional members by ensuring the active participation of nursing students in the study process. Puzzles can support the strengthening of students' professional knowledge and skills, therefore, it is recommended that they be used more frequently in the nursing curriculum.

Keywords: Motivation, Operating room nursing, Puzzle, Study process

[1] Assist. Prof., Gazi University Nursing Faculty Surgical Nursing Department, Ankara, Türkiye, E-mail: nevra.demir@gazi.edu.tr, Phone Number: 03122162681, ORCID: 0000-0003-4536-7933

[2] Student, Gazi University Faculty of Health Sciences Nursing Department, Ankara, Türkiye, E-mail: seda28189@gmail.com, Phone Number: 05539053379, ORCID: 0009-0002-1247-9488

[3] Student, Gazi University Faculty of Health Sciences Nursing Department, Ankara, Türkiye, E-mail: zahidegulerezer0@gmail.com, Phone Number: 05312556581, ORCID: 0009-0000-8764-0921

[4] Student, Gazi University Faculty of Health Sciences Nursing Department, Ankara, Türkiye, E-mail: cansudalgic35@gmail.com , Phone Number: 05393239128, ORCID: 0009-0000-2013-0142

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INTRODUCTION

The main purpose of nursing education is to prepare students for their professional lives by ensuring the development of their professional knowledge and skills (Köse et al., 2021). In nursing education, to provide students with the behaviors required by the profession, it is emphasized that the importance of focusing on student-centered teaching methods and using different teaching methods to ensure the retention of information is emphasized (Çonoğlu et al., 2020). For this reason, it is essential that students participate in the learning process and perform active learning, and carry out activities that increase their learning motivation (Hung et al., 2020; Mshayisa, 2020; Nurhayati et al., 2019).

Puzzles, which are one of these activities and are frequently used in education, appeal to students with different learning styles, provide easier learning of information, and entertain while thinking (Bilgin & Bekiroğlu, 2021). Today, gamification or the use of game elements for learning is becoming increasingly widespread due to its benefits, such as increasing student participation, providing motivation, and improving learning skills (Gomez-Urquiza et al., 2019; Shannon & Erik, 2021). Puzzles used in education provide a review of the concepts learned in the course, help students evaluate their knowledge, and facilitate learning (Kaynak et al., 2023; Shawahna & Jaber, 2020). Studies have found that puzzles, which can be used as educational games, increase students' motivation by enabling them to achieve, complete, and reach the result while learning (Cardozo et al., 2016; Çoban & Polatcan, 2020). In addition, puzzles as a teaching method will increase the retention of information and academic success in students, thus contributing to the development of positive attitudes towards the profession (Kalkan et al., 2022; Messineo et al., 2019; Sanaie et al., 2019).

In randomized controlled studies conducted in our country on the use of puzzles in nursing education, it was reported that puzzles had positive effects on learning concepts related to the course (Acun, 2024; Tosunöz & Doğan, 2023) and improved students' problem solving and clinical decision-making skills (Kaynak et al., 2023).

Although there are many studies in the international literature on the use of puzzles in education, studies examining their use in the education of nursing students are limited. In a randomized controlled study (2020) conducted to determine the effect of puzzles on nursing students' learning of epilepsy pharmacology and correct prescribing of drugs, it was reported that students' knowledge levels increased (Shawahna & Jaber, 2020). In another study, it was found that the use of puzzles made positive contributions to learning the course (Yousof, 2024).

Operating Room Nursing course is included in the nursing education curriculum within the scope of surgical diseases nursing and/or as a separate course. Operating rooms are generally expressed by nursing students as environments full of curiosity, excitement, and unknowns. Operating room nurses are specialty nurses who determine the care needs of patients in the perioperative process and are responsible for early diagnosis of complications that may occur during surgery, ensuring patient safety and coordination of quality nursing care (Arslanoğlu & Köser, 2019; Eyi et al., 2016; Kızıl et al., 2016). The ability of operating room nurses to fulfill their roles and responsibilities professionally depends on having sufficient knowledge and skills specific to the field (Ciğerci & Yılmaz, 2022). Therefore, it is recommended to develop educational strategies to increase the knowledge of operating room nursing in order for students to gain a more effective learning experience during their undergraduate education (Salman & Canbulat, 2023). It is thought that conducting the operating room nursing course, which has intensive and comprehensive content, with student-centered teaching methods, will have positive effects on learning, and presenting the puzzle teaching method, which provides game-based learning, as an example, may contribute to the literature.

Aim

The aim of this study was to determine the effect of the puzzles applied to the students taking the operating room nursing course within the scope of the course on the course study process and motivation of the students.

Hypotheses

$H_{0\text{-}1}$: Puzzles applied in the operating room nursing course do not affect students' motivation.
$H_{1\text{-}1}$: Puzzles applied in the operating room nursing course affect students' motivation.
$H_{0\text{-}2}$: Puzzles applied in the operating room nursing course do not affect students' study process.
$H_{1\text{-}2}$: Puzzles applied in the operating room nursing course affect students' study process.

MATERIAL and METHODS

Study Design

The study was conducted as a quasi-experimental study with a one-group pretest-posttest design.

Study Sample

The population of the study consisted of 113 students studying in the 2nd grade of the Department of Nursing, Faculty of Health Sciences, in the fall semester of the 2022-2023 academic year of a state university and taking the elective course of Operating Room Nursing. No sample selection was made in the study, and 97 students who agreed to participate and solved at least 10 of the prepared puzzles were included in the study (Participation rate: 85.8%).

Data Collection Tools

The data were collected through face-to-face interviews using the Student Information Form, Instructional Materials Motivation Survey, and Study Process Questionnaire.

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Student Information Form: The form, which was created by the researchers in line with the literature (Agarwal et al., 2020; Kalkan et al., 2020; Mshayisa, 2020), includes a total of eight questions, including age, gender, school of graduation, and five questions about puzzle solving activity.

Instructional Materials Motivation Survey (IMMS): The survey was developed by J.M.Keller in 1987 to measure the effect of instructional materials on students' motivation. The five-point Likert-type questionnaire consists of a total of 36 items in a four-factor structure. As a result of the factor analysis conducted by Kutu and Sözbilir (2011) in the Turkish validity and reliability study, two sub-dimensions, namely attention-relevance (items 1-11) and confidence-satisfaction (items 12-24), were obtained, and the final version consisting of 24 items was formed. The 3rd, 12th, 14th, 16th, and 18th items in the questionnaire are coded as negative statements. The motivation level of the students regarding the teaching material increases as the score obtained from the questionnaire increases. The Cronbach's alpha internal consistency coefficient of the questionnaire was found to be 0.83 for the total questionnaire, 0.79 for attention-relevance, and 0.69 for confidence-satisfaction for sub-factors (Kutu & Sözbilir, 2011). In this study, Cronbach's alpha internal consistency coefficient was found to be 0.78 for the total questionnaire, 0.78 for attention-relevance, and 0.72 for confidence-satisfaction for sub-factors. The application of the IMMS took approximately 10 minutes.

Study Process Questionnaire (SPQ): The Questionnaire was developed by Biggs in 1987 to determine whether university students' processes of studying and learning are deep or surface. The five-point Likert-type scale, whose validity and reliability study was conducted by Yılmaz and Orhan (2011) in Turkey, has 20 items. Ten items in the scale measure the deep strategy, and 10 items measure the surface strategy. In the reliability study, Cronbach's alpha coefficient was calculated and found to be 0.79 for the deep strategy dimension and 0.73 for the surface strategy dimension. The range of points that can be obtained for each of the deep and surface strategies is between 10-50. The student's process of studying is determined based on which process the student scores higher. In the study, Cronbach's alpha coefficient was found to be 0.78 for the deep strategy dimension and 0.69 for the surface strategy dimension (Yılmaz & Orhan, 2011). The application of the questionnaire was completed in approximately 10 minutes.

Data Collection

The data of the study were collected by face-to-face interview technique using the data collection tools at the beginning of the semester before the first week of the operating room nursing course (pre-test) and at the end of the last week of the 14-week training program (post-test).

Application of the study

Operating Room Nursing Course

In the nursing department where the study was conducted, the Operating Room Nursing course is included in the fall semester curriculum of 2nd-year students who have not yet taken the Surgical Diseases Nursing course. As an elective course, it is taught theoretically for 2 hours a week. This course; organization and management in the operating room, duties, roles and responsibilities of the operating room nurses, registration and documentation in the operating room, operating room cleaning and disinfection; disinfection and sterilization methods, prevention of operating room surgical site infections, types of anesthesia and complications, temperature control in the operating room, hypothermia and malignant hyperthermia, bleeding control in the operating room, preparation of the mayo table, patient positions in the operating room and nurses' responsibilities in preventing complications, patient safety and responsibilities of the nurse in the operating room, nurses safety in the operating room, safe surgery checklist, and ethical and legal issues in the operating room. In the study, puzzles were prepared for all of these topics within the scope of the course.

Preparation of Puzzles

The puzzles used in the study were developed by 3rd year nursing students who were part of the research team and who had previously completed the operating room nursing course. In the preparation of the puzzles, the researchers used free online tools (Eclipse Crossword, Crossword Puzzle Maker) and prepared the word search puzzles directly by editing them themselves. The prepared crossword puzzles contained the answers to the basic knowledge and concepts to be learned about the course topics. In crossword puzzles, the questions that students were expected to answer were indicated in left-to-right or top-to-bottom columns, and students were expected to place the answers in the puzzle (Figure 1).

In the word search puzzles, students were instructed to identify key concepts (answers to the questions) hidden in horizontal, vertical, diagonal, or reverse orientations (Figure 2). The puzzles were completed individually at the end of the lesson. Although no time limit was imposed, students were asked to record their start and end times on the puzzle sheet. Additionally, answer keys were provided in an inverted format at the bottom of each puzzle page. All puzzles prepared by the student researchers were reviewed by the academic advisor for both formal structure and content accuracy.

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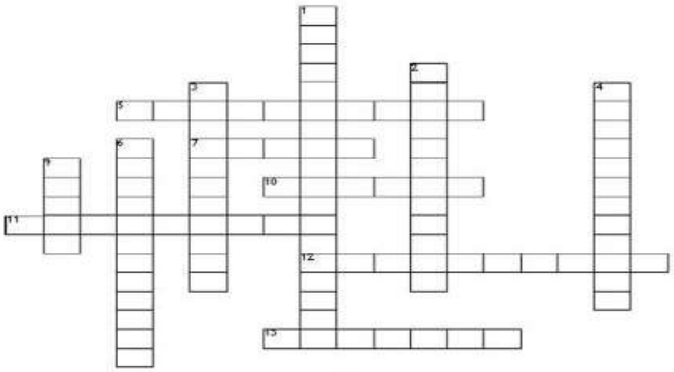
Ameliyathane Ekibinin Görev Yetki ve Sorumlulukları



SATIR

5. Anestetik ajanların yönetiminden ve ağrının azaltılmasından sorumlu kimse

7. Birimin çalışma koşulları, ekip iletişimi gibi konuları içeren oryantasyon program çeşidi

10. Ameliyat öncesi tanıdan ve cerrahi girişimin gerçekleştirilmesinden sorumlu kişi

11. Sterilizasyon ve fırçalama ünitelerin bulunduğu , galoş, maske ve başlık gerektiren ameliyathane bölümü

12. Ameliyathane sırasında gerekli olan steril araçların bulunduğu alanları içeren ameliyathane bölümü

13. Hastadan alınan örnekleri etiketleyip patolojiye gönderen, hastanın hemşirelik bakımdan sorumlu kimse

SÜTUN

1. Gün sonunda anestezi cihazlarının bakım ve temizliğine yardım eden kimse

2. Birimde çalışan tüm personelin görev yetki ve sorumluluklarının belirlenmesinden sorumlu ameliyathane yönetim birimi

3. Günlük kıyafetler ile giyilmesine izin verilen, preoperatif ve postoperatif alanların bulunduğu ameliyathane bölümü.

4. Hem teorik hem pratik eğitimin sorumlu hemşire ve eğitim hemşiresi tarafından verildiği oryantasyon programı 6. Hastane içinde cerrahi işlemlerin asteptik bir ortamda yapıldığı bir oda

8. Hastanın örtülmesi ve cerrahın steril giyinmesine yardım eden ameliyathane ekip üyesi

9.Çalışan güvenliği ve yasal hakları konularını içeren oryantasyon program çeşidi

Figure 1. An example of a crossword puzzle (in Turkish).

Ameliyathanede Isı Kontrolü

N	P	A	S	İ	F	I	S	I	T	M	A	N	L	H	A	T
A	S	O	L	U	N	U	M	A	S	İ	D	O	Z	U	H	İ
R	K	A	K	T	İ	F	I	S	I	T	M	A	K	F	İ	N
T	E	G	Ş	Y	Y	Z	D	F	D	O	D	Ş	R	Y	P	T
I	A	U	K	I	P	Ü	U	D	Z	Ş	S	S	D	A	E	E
Ş	Ü	Ş	Ü	M	E	O	F	C	İ	G	Z	İ	R	Ş	R	R
R	I	S	I	T	I	C	I	F	A	N	L	A	R	L	K	N
H	Z	N	Ü	C	Ü	Ü	R	T	İ	N	O	M	K	I	A	A
İ	F	U	R	Ü	L	Ü	C	C	N	O	P	C	F	L	L	L
P	D	U	Y	N	L	Ş	G	Ş	O	R	E	Ü	G	I	E	I
O	P	U	K	Z	C	G	E	K	Ş	M	T	H	Z	K	M	S
T	İ	M	K	I	A	İ	F	D	I	O	Z	P	F	Z	İ	I
E	A	Ş	I	N	Ş	H	F	K	T	T	F	P	G	M	Ş	T
R	Z	A	M	K	O	M	D	K	N	E	İ	Z	İ	M	C	M
M	A	L	İ	G	N	H	İ	P	E	R	T	E	R	M	İ	A
İ	L	Y	N	S	R	T	İ	C	C	M	Ş	E	S	S	H	M
D	E	R	L	E	N	M	E	Ü	N	İ	T	E	S	İ	L	G

DİKEY:

1- Hipotermiin kardiyovasküler sistemde kan basıncına yaptığı etki.

2- Beden sıcaklığının 36 C altında olmasıdır.

3- Beden sıcaklığının 36 37,5 C aralığında olmasına denir.

4- Ameliyat öncesi dönemde hipotermiin nedenlerinden biri olan yaş dönemi

5- Malign hipertermi tedavisi için %30'lik 50 gr Dekstroz ve 10 ünite insülin kullanılan elektrolit dengesizliği

6- Aktif ısıtma yöntemlerinden biri olan ve hastaya ameliyat sırası ve sonrası dönemde intravenöz ve/veya yıkama yoluyla uygulanacak sıvıların, kan ve kan ürünlerinin vücut sıcaklığına kadar ısıtılması işlemi olan ısıtma yöntemi.

YATAY:

7- Isı kaybını önleyerek ve hastanın mevcut ısısını koruyarak hipotermiyi kontrol etmeyi amaçlayan ısıtma yöntemi

8- Malign hiperterminı de artmış CO2 üretimi ve artmış O2 tüketimi mevcuttur. Bu durumun asit baz bozukluğuna yol açtığı durum

9- Dışarıdan hastaya ısı verilmesi esasına dayanan ısıtma yöntemi.

10- Hafif hipotermiinin ilk belirtisidir.

11- Eksternal ısıtma yöntemlerinden biri

12- Habis yüksek ateş de denilen, uçucu anesteziklere, nöromüsküler bloke edilen ilaçlar ve diğer ilaçların neden olduğu akut hipermetabolik bir kriz

13- Ameliyathaneye gelen hastaların, ameliyatdan en az 20 dakika önce, sıcaklığı 22-24 C olan alındığı ünite

Figure 2. An example of a word search puzzle (in Turkish).

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Application of Puzzles

The puzzles were prepared every week throughout the semester (14 weeks in total) at the end of the lesson in relation to the subject of the related lesson, distributed to the students in printed form at the end of the lesson, and applied. Students were expected to solve the puzzles individually, and no time limit was set. In addition, the answers to each puzzle were indicated on the reverse side at the end of the page containing the puzzle. During the implementation of the puzzles, the researchers guided the students in the classroom when necessary, observed the students, and did not intervene in solving the puzzles. At the end of the puzzle application, the unsolved parts were explained to the students who requested them, or the puzzles they wanted to repeat were delivered again. The puzzles were completed in approximately 10-15 minutes.

Data Analysis

The research data were transferred to the SPSS 21.0 program. In the study, mean and standard deviation values for numerical variables and frequency distributions (number, percentage) for categorical variables were given. The kurtosis and skewness coefficients were examined to determine the compatibility of the variables with the normal distribution. The kurtosis and skewness values obtained from the variables between +1.5 and -1.5 are considered sufficient for normal distribution (Tabachnick & Fidell, 2013). Since the skewness and kurtosis values obtained from the scale scores were found to show normality, parametric tests were used. In the analysis of the data, a dependent sample t-test was used for pairwise comparisons within the same group. In addition, the reliability of the scales was examined using Cronbach's alpha value. The significance level was accepted as $p<0.05$.

Ethical Considerations

Written permission from the institution where the research was conducted and approval from the ethics commission was obtained for the implementation of the research (Date and Number: 14.09.2022-E.453614). Before the data collection tools were applied, it was explained to the students that the purpose of the research, the results of the research would be used only for scientific purposes, and individual identity information would be kept confidential. Only students who volunteered to participate were included in the study.

Limitations

The study was conducted in a pretest-posttest quasi-experimental research design with 2nd year nursing students taking the Operating Room Nursing course at a university. The limitation of the research is that time limitations could not be made for the solution of the puzzles due to the individual differences of the students, and in cases where the puzzles could not be solved, the solutions were explained only to the students who requested them.

RESULTS

The mean age of the students was 19.9±1.38 years, 84.5% were female students, and 70.1% were graduates of Anatolian/Science High School. It was determined that 43.3% of the students solved puzzles in their daily lives, 82.5% had not participated in puzzle activities before, 73.1% liked solving puzzles, 78.3% wanted to participate again, and 67% recommended the use of puzzles in nursing education (Table 1).

Table 1: Descriptive Characteristics of Students (n=97)

	n	%
Age (year) (Mean±SD)	19.9 ± 1.38	
Gender		
Female	82	84.5
Male	15	15.5
Type of secondary education		
Regular High School	19	19.6
Health Vocational High School	10	10.3
Anatolian/Science High School	68	70.1
Solving puzzles in daily life		
Yes	42	43.3
No	55	56.7
Previous participation in a puzzle activity		
Yes	17	17.5
No	80	82.5
Liking to solve puzzles		
Yes	71	73.1
No	26	24.9
Willingness to participate in puzzle activities again		
Yes	76	78.3
No	21	21.7
Recommendation to apply the puzzle in nursing education		
Yes	65	67.0
No	32	33.0

n: Number of participants, SD: Standart deviation

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The IMMS Attention-Relevance subscale mean scores of the students were found to be 33.30±4.52 before and 39.78±6.45 after the puzzle intervention. This difference between the mean scores was statistically significant (t=11.879, p<0.001). The IMMS Confidence-Satisfaction sub-dimension mean scores of the students were significantly higher at 38.25±5.91 before and 46.16±4.45 after the puzzle (t=15.938, p<0.001). The mean total IMMS scores of the students were found to be 73.20±9.81 before and 84.58±8.74 after the puzzle (t=-12.931, p<0.001).

The SPQ Deep Strategy subscale mean scores of the students were found to be significantly higher at 29.85±6.60 before the puzzle and 35.04±6.27 after the puzzle (t=-9.282, p<0.001). The SPQ Surface Strategy sub-dimension mean scores of the students were 28.43±6.10 before the puzzle and 31.01±5.87 after the puzzle application, and the difference between the mean scores was statistically significant (t=6.065, p<0.001) (Table 2).

Table 2. Comparison of the Mean Scores of the Students in the Instructional Materials Motivation Questionnaire and Study Process Questionnaire Before and After the Puzzle (n=97)

Scales and sub-dimensions	Pre-test Mean±SD	Post-test Mean±SD	t value*	p
IMMS				
Attention-Relevance	33.30±4.52	39.78±6.45	11.879	**<0.001**
Confidence-Satisfaction	38.25±5.91	46.16±4.45	15.938	**<0.001**
Total	73.20±9.81	84.58±8.74	-12.931	**<0.001**
SPQ				
Deep Strategy	29.85±6.60	35.04±6.27	-9.282	**<0.001**
Surface Strategy	31.01±5.87	28.43±6.10	6.065	**<0.001**

n: Number of participants; SD: Standard deviation, * Dependent sample t-test
IMMS: Instructional Materials Motivation Survey, SPQ: Study Process Questionnaire

DISCUSSION

It is known that puzzles, which are one of the active learning methods, have many benefits, such as learning new subjects, helping students better understand the subjects, increasing the retention of information, and reinforcing the subjects (Agarwall et al., 2020; Gomez-Urquiza et al., 2019). In the literature, it is stated that completing puzzles, placing the concepts correctly, and reaching the result increase students' motivation by creating a sense of achievement (Khorammakan et al., 2023). In addition, remembering the information learned while solving puzzles encourages learning and has a positive effect on students' motivation (Fontes et al., 2024; Kalkan et al., 2022; Khorammakan et al., 2023).

In this study, which was conducted to determine the effect of puzzles applied to students taking operating room nursing courses within the scope of the course on students' study process and motivation, it was found that the majority of students wanted to participate in puzzle activities again and recommended their use in nursing education. In a mixed-method study by Kalkan et al. (2022), in which students' views on the use of puzzles in nursing education were determined, students stated that they wanted to do the puzzle activity more and recommended it in nursing education (Kalkan et al., 2022).

In order to increase the retention of the education given to nursing students and to create an efficient learning process, it is important to better understand the motivation of the students (Messineo et al., 2019). In the study, it was determined that the motivation of the students regarding the teaching materials increased after the puzzle application. In a quasi-experimental study comparing the effect of lecture and puzzle teaching strategies on self-regulated learning and academic motivation of nursing students, it was found that self-regulated learning and academic motivation scores increased significantly in the puzzle group (Sanaie et al., 2019). In a qualitative study in which students' experiences and perceptions regarding the use of puzzles in disaster and trauma nursing courses were determined, it was found that students' motivation and participation in the course increased (Hung et al., 2020). Similarly, there are studies in the literature indicating that the puzzle-solving method increases students' course motivation (Mohan et al., 2018; Nurhayati et al., 2019; Tosunöz & Doğan, 2023).

In the study, the effect of puzzle application on students' process of studying was evaluated. It was determined that students' deep process of studying scores increased after the puzzle application. In a study conducted by Agarwal et al. (2020), students evaluated the puzzle-solving method as a valuable tool in learning the lesson and stated that puzzles facilitated remembering the concepts in the lessons, increased the retention of the information learned in the lesson, and increased their academic achievement.

In the study by Gomez-Urquiza et al. (2019), in which puzzles were used by teamwork in a planned game in nursing students, students stated that puzzles helped them learn the subject and prepare for exams. Similarly, in the study by Kalkan et al. (2022), students stated that solving puzzles provided an advantage in studying and preparing for the exam. In a randomized controlled study conducted in our country to evaluate the effect of puzzles on nursing students' learning of concepts related to the pain

management course (2023), it was found that the use of puzzles had positive effects on the success of learning concepts related to the pain management course and the retention of information (Tosunöz & Doğan, 2023).

CONCLUSION

As a result, it was found that the puzzle teaching method positively affected the motivation and study process of the students taking the operating room nursing course. It is thought that using student-centered teaching techniques, such as puzzles, may have positive effects on the nursing profession and contribute to the training of qualified professional members. Considering that freely accessible programs for designing and creating puzzles help instructors to prepare puzzles easily and have positive effects on students' education as a learning activity, puzzles are recommended to be used more frequently in the nursing curriculum.

Ethics Committee Approval: Gazi University Ethics Commission, Date and No: 14.09.2022-E.453614.
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Author contributions
Study design: NK, SD, ZGE, CD
Data collection: NK, SD, ZGE, CD
Literature search: NK
Drafting manuscript: NK
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