Clinical and Experimental Health Sciences

Edpuzzle Application in Improving Nursing Students' Metric and Drug Dose Calculation Skills in a Virtual Learning Environment: Mixed Methods Study

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Received: 13.04.2023 **Accepted:** 15.11.2024

ABSTRACT

Objective: This study aims to determine the effect of Edpuzzle application on nursing students' metric conversion and drug dose calculation skills.

Methods: 84 nursing students participated in parallel groups in the mixed model single-blind randomized controlled study, conducted between April and June 2021.Data were collected using a descriptive features form, metric and drug dose calculation skill test. After all students completed the theoretical lessons, a pre-application of the skill test was made. After the experimental group students watched the interactive videos in the Edpuzzle application for fifteen days, a final skill test was applied to all students. Then, four focus group interviews were conducted with 28 experimental group students.

Results: The last scores of the students in the experimental group, pertaining to metric and drug dose calculation skill test, were higher than those of the students in the control group and were statistically significant ($p<.05$). In the focus group discussions, the students said that the Edpuzzle application is useful, increases the memorability, but they encountered the problem that the videos could not be fast forwarded.

Conclusion: This is the first study on which Edpuzzle application was used to calculate metric conversion and drug dose in nursing students. It was determined that Edpuzzle application in the virtual learning environment increased the metric and drug dose calculation skills of nursing students. Based on the results of the study, it is recommended to integrate Edpuzzle as an innovative teaching technology into the nursing education curriculum and to be used in the courses.

Keywords: Drug dose, edpuzzle, metric conversion, nursing education, virtual learning

1. INTRODUCTION

Drug administration is one of the most basic functions and legal responsibility of nurses. In order for drugs to be administered safely, drug doses must be calculated correctly. Errors in drug dose calculation account for more than 15% of drug errors and may lead to the death of patients (1,2). It is reported that nurses spend approximately 40% of their time on medication administration. Therefore, it is very important to prevent medication errors with accurate dose calculations (3). Nursing students have difficulties in this regard because drug dose calculations require complex skills where the patient's age and weight are taken into consider (4). Many studies show that nurses and nursing students have a low rate of calculating the drug doses correctly (5-10). In a study, the rate of students who solved the questions on drug dose calculation without making any mistakes was determined as 16.7% (5). In another study, it was found that after training on drug dose calculations only 26.8% of the nursing students were sufficient in calculating the drug dose and 33% knew how to calculate the dose (6). These rates show that drug dose calculation teaching methods are not sufficient in nursing education. Another study found that nursing students had poor basic maths calculation skills and therefore students needed support in calculating drug dosage (7). In a study examining the drug dose calculation skills of graduating nursing students, it was determined that the students made simple drug calculations, but a significant number of students had difficulty in calculations that required more than one operation and more conceptual understanding skills (8). In a retrospective study, a total of 285 exam papers and 1034 drug dose calculation questions of 1st, 2nd and 3rd year nursing students were examined, and it was determined that the most common errors were related to more complex operations such as unit conversion and dilution. Other common mistakes were found to be not

DOI: 10.33808/clinexphealthsci.1282606

understanding the question and not using basic units when answering (9). In another study, it was determined that senior nursing students had low drug dose calculation skills (10).

In the emergence of these results; reasons such as the fact that adequate practice in the clinical setting is not possible for every students (5), lack of resources for drug calculations (1,3), students' lack of conceptual understanding, low numerical skills (3,9), anxiety, low self-efficacy (3), insufficient physical conditions of schools, high number of students in classrooms (11), the low number of instructors per student and the inability to solve a sufficient number of sample questions due to the dense curriculum (2,6) are effective. Therefore, students may be prone to medication errors and they need various interventions to increase their drug dose calculation skills (2). Although the approaches to these requirements differ, it is vital that nursing students acquire the skills to calculate adequate medication doses. Because, when they start professional practices, they will be responsible for the administration of medicines.

It is stated that education programs are effective in improving the mathematical and drug dose calculation skills of nursing students (12). In the 21st century digital learning era, Web 2.0 tools such as Edpuzzle, Edmodo, Kahoot have started to be used. In our study, Edpuzzle application was used to improve the metric conversion and drug dose calculation skills of nursing students.

The virtual classroom that provides virtual learning is defined as a computer-based environment. In the virtual classroom, the instructor and students can work together and use multiple communication channels such as audio, video and whiteboard (13). One of the preferred platforms for virtual learning is Edpuzzle. Edpuzzle is a free video sharing program that helps students examine the lesson as a whole and determine whether the subject is understood or not, and provides the opportunity of using interactive videos online in learning (14). Edpuzzle was officially founded in 2013. Before it existed as it is known today, Edpuzzle CEO and math teacher Quim Sabrià began creating his own video lessons to reach all students. Sabrià shared this idea with his friends Jordi Gonzalez, Santi Herrero, Xavi Vergés, and the four friends founded Edpuzzle, which is known today (15).

Edpuzzle enables students to focus their attention throughout the video and interact with the video while watching, with its features such as cutting the video, voice-over, adding voice notes, adding open or closed-ended Questions (16). It also allows sharing interactive videos prepared by instructors in virtual classrooms and accessing student analyses for videos (14). Recent studies show that Edpuzzle application has positive effects on students' knowledge and skills. For example, Kaplan and Tüzer (17) a randomized controlled study with 67 students reported that Edpuzzle increased stoma care knowledge and skill scores of the nursing students.

There are researches used by Edpuzzle in different disciplines. Similarly, although there are studies conducted in the field of nursing, no study has been found in which Edpuzzle was used on nursing students' metric and drug dose calculation skills. Our research is an original study conducted to determine the effects of Edpuzzle application on the development of nursing students' metric and drug dose calculation skills in a virtual learning environment.

The hypotheses of the study are:

H_1-1: Edpuzzle application increases the metric conversion skills of nursing students.

H_1-2: Edpuzzle application increases the drug dose calculation skills of nursing students.

2. METHODS

2.1. Design

It is a mixed model single-blind randomized controlled study in parallel groups.

2.2. Participants

The population of the research consisted of 131 students enrolled in the Fundamentals of Nursing course in the Faculty of Health Sciences, Department of Nursing at a state university in a Turkey April-June 2021. Inclusion criteria for the study: (1) Registered for the first time in the Fundamentals of Nursing course and (2) Students who volunteered to participate in the research. Exclusion criteria: (1) Graduated from a health-related high school or university, (2) Having difficulties in speaking and understanding Turkish and (3) Students who do not have sufficient internet. Since it was planned to reach the entire population in the research, the remaining students after exclusions were included in the sample. In this context, 12 health-related high school and university graduates, 23 students who had difficulty in speaking and understanding Turkish, 7 students who did not have sufficient internet, and 5 students who re-took the Fundamentals of Nursing course were excluded from the study. After exclusions, 84 students were randomly assigned to control (n= 42) and experimental (n= 42) groups using the simple randomization method according to gender. At the qualitative stage, all experimental group students (n= 42) were invited to focus group interviews. A sample of 28 students, who volunteered to participate in the interviews, was created.

Before starting the study, the registration number (ID: NCT04800380) was obtained from "ClinicalTrials.gov". Written approval was obtained from the university ethics board (01.03.2021/19) and from the institution involved (16.03.2021/E-52950036.045.9490). The students were informed about the purpose and method of the research and their consent was obtained. This study was conducted

in accordance with the principles of the Declaration of Helsinki.

2.3. Data collection and measures

The data were collected with the "Descriptive Characteristics Form", "Metric and Drug Dose Calculation Skill Test" and "Semi-structured Focus Group Interview Form" prepared by the researchers through scanning the literatüre (4,18). The descriptive features form consisted of 12 closed-ended questions. The skill test consisted of 20 five-choice and multiple-choice questions. 1st – 4th questions were on metric conversion calculation, 5th – 8th questions on oral drug dose, 9th – 12th questions on local drug dose, 13th – 16th questions on parenteral drug dose and 17th – 20th questions were on liquid drug dose calculation. Wrong answers were evaluated as "0" points and correct answers as "5" points. The lowest score that could be obtained from this test was "0" and the highest score was "100". After the test was prepared, opinions were received from a faculty member who is an expert in the field of Mathematics and two faculty members who are experts in the field of Nursing Fundamentals. Necessary adjustments were made in the knowledge test based on expert opinions. Content Validity Ratio (CVR) and Content Validity Index (CVI) were determined by creating a specification are provided in Table 1.

The interview form consisted of three open-ended questions in order to evaluate the opinions of the experimental group students about the Edpuzzle application. For the interview form, opinions were obtained from three faculty members who are experts in qualitative research. According to expert opinions, necessary adjustments were made to the form.

2.4. Creation process of video lessons and edpuzzle assignment

Five video recordings were made with the OBS Studio 26.1.1 program (Open Broadcaster Software) in order to improve the metric and drug dose calculation skills of the students. OBS is an open source, free video recorder and live broadcast tool. The software is available and can be accessed on its original site (19). Videos consisted of solving 50 sample problems on 1. Metric calculation, 2. Oral drug dose calculation, 3. Local drug dose calculation, 4. Parenteral drug dose calculation, 5. Liquid drug dose calculation. The videos provided answers to the study questions. All of the videos were created by the responsible researcher in order to eliminate interpersonal differences in teaching. The camera angle has been zoomed in to ensure image clarity while video recordings are being taken. The shortest video was 13 minutes and the longest was 31 minutes.

To become a member of Edpuzzle for free, the link https://edpuzzle.com was entered on the web. A new account has been opened from the trainer section and a virtual classroom has been created under the name of "ÇAKÜ-Nursing". "My Content" was selected and the videos were uploaded to the Edpuzzle application in order, after clicking the "Add Content" button. Four multiple-choice questions were added to the uploaded videos for students to answer, using the "Questions" and "Multiple-choice question" options. Answer options for each question were created and the correct answer was marked. In addition, the option of not advancing the video without the answer of the student to the question was selected and the editing process was completed through clicking the "Finish" button. Edited interactive videos were assigned to the "ÇAKÜ-Nursing" virtual class by determining the "Start Date" and "Due Date". After all interactive videos were assigned to the virtual classroom, they appeared in the "My Classes" tab (Fig. 1).

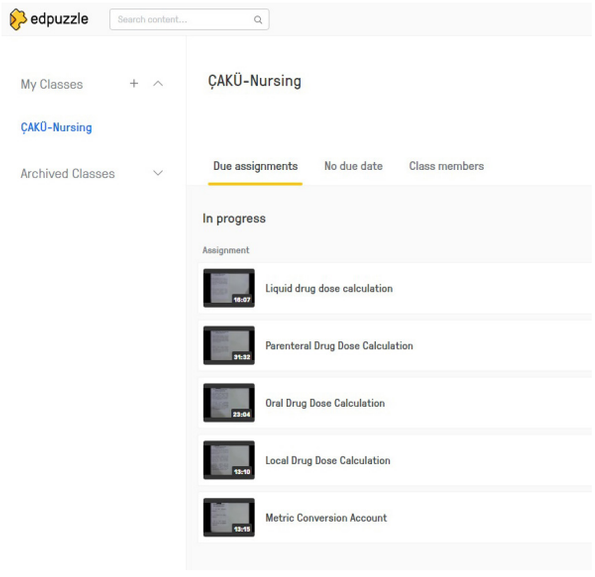

Figure 1. *Interactive videos in the edpuzzle virtual classroom*

Table 1. *Specification table*

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	CVR
Expert 1	√	√	√	√	√	√	√	√	☒	√	√	√	√	√	√	☒	√	√	☒	√	0.7
Expert 2	√	√	√	√	√	√	√	√	☒	√	√	√	☒	√	√	√	√	√	☒	√	0.7
Expert 3	√	√	√	√	√	√	√	√	√	√	√	√	☒	√	√	☒	√	√	√	√	0.8
																				Mean CVI	0.7

CVR= Content Validity Ratio; CVI: Content Validity Index

Then, "class code" was created from "Class members" option. After registering for free to Edpuzzle, students joined the "ÇAKÜ-Nursing" virtual class with the class code given to them. The date of watching the videos and their answers to the questions in the videos appeared in the "Students" tab (Fig. 2). A pilot test was conducted with 10 nursing students who had successfully passed Fundamentals of Nursing course before starting the study. Pilot test data were not included in the study.

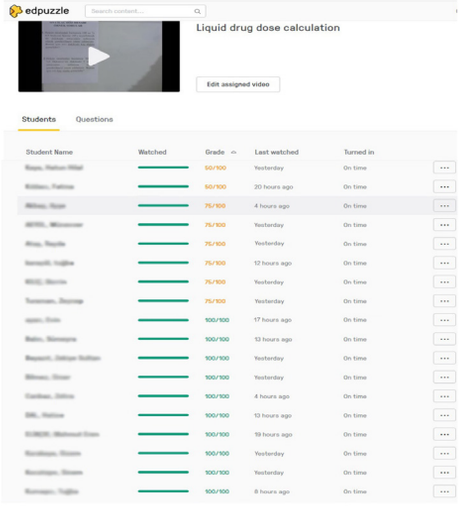

Figure 2. *Monitoring analysis of students' liquid drug dose calculation*

2.5. Application of the study

Web-based theoretical training for metric and drug dose calculation was given to all students via the "Advancity Learning Management System (ALMS)" (https://karatekin.almscloud.com/Account/LoginBefore) of the university where the study was conducted. Then, two separate WhatsApp group was created covering the students in the experimental and control groups. The "Descriptive Characteristics Form" created via Google forms was sent to control and experimental student groups and asked to fill in. On the same day, the students were informed about that they will take the skill test for calculating metric and drug dose, and they were given a week to prepare. The questions in the skill test were added to the ALMS system sequentially, the correct answers were marked, and the virtual exam was created, giving the students 40 minutes. Then, in order to make a score analysis for each subject, the option to "mix the answer choices but not the questions" was selected. One week after the theoretical training, students participated in the virtual exam, which was the pre-test application of the "Metric and Drug Dose Calculation Skill Test". In order to ensure online exam security, each student was given a certain amount of time to answer a question. At the same time, the student did not have the opportunity to go back and re-examine a question he had answered. After the exam, a detailed document on the scores received by the students was obtained from the ALMS system.

After the pre-test application, no intervention was made to the students in the control group. The students in the experimental group were informed about the Edpuzzle application, the class code was sent, and they were given fifteen days to watch the interactive videos in the "ÇAKÜ-Nursing" virtual class. Then, students' access to the Edpuzzle application was automatically closed. The next day, all students were informed about that they were going to undergo the skill test for calculating metric and drug dose, and they were given a week to prepare. The questions in the skill test were added to the ALMS system sequentially, the correct answers were marked, and the virtual exam was created by giving 40 minutes to the students. Three weeks after the pre-test, the students took the virtual exam, which was the last test application of the "Metric and Drug Dose Calculation Skill Test" (Fig. 3). After the exam, a detailed document on the scores received by the students was obtained from the ALMS system. After the study was completed, all other students in the control group and the ones who were excluded from the study were able to access the Edpuzzle application.

At the qualitative stage, four focus group interviews were conducted in groups of seven to evaluate the opinions of the voluntery students in the experimental group about the Edpuzzle application. The time and place of the interviews were planned with the students. Before starting the interviews, students were informed about the purpose, scope and approximate duration of the interview. It was explained that audio recording will be taken during the interviews. After the consent of the students was received, negotiations were started. A total of 28 students and researchers participated in the interviews. Each of the interviews lasted 30-40 minutes. The researchers conducting the interviews are experienced (Fig. 3).

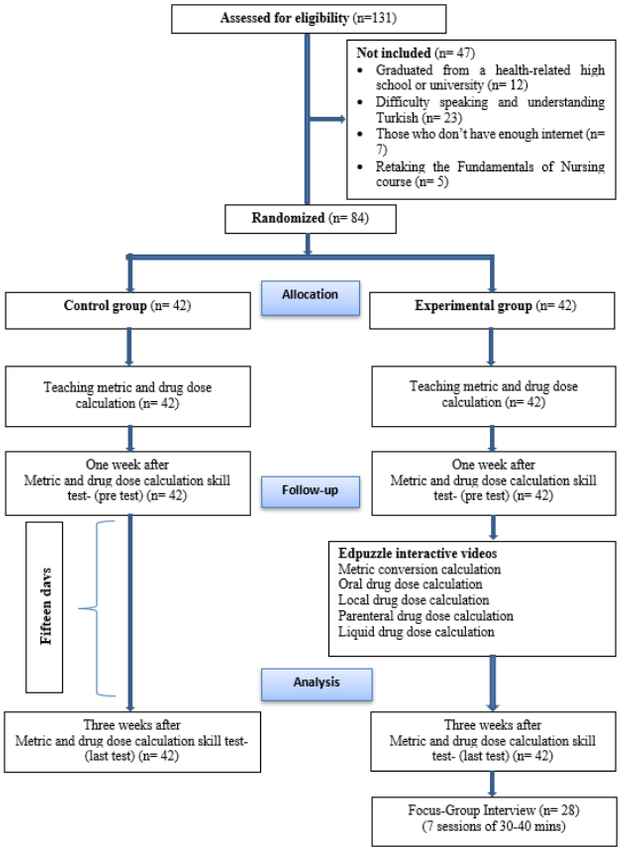

Figure 3. *CONSORT diagram of this study*

2.6. Data analysis

The data were analyzed with the SPSS package program (version 22.0; SPSS, Inc., USA). Number, percentage, mean and standard deviation were used in descriptive statistics. Kolmogorov Smirnov Test was used to determine normal or non-normal distribution. Parametric tests (df=84, p>.05) were used to indicate the normal distribution, and the Independent-Samples T-Test was used to evaluate differences between groups. The relationship between the grouped variants was tested by Chi-Square (χ^2) analysis. Paired-Samples T-Test was used to determine the differences between the initial and post-test scores for the matched groups. The data were evaluated at a significance level of p<.05 at 95% confidence level. The data obtained from the focus group interviews were coded by three independent researchers and thematic content analysis was performed. Themes, sub-themes and codes were created for frequently repeated expressions.

3. RESULTS

3.1. Quantitative findings of the study

66.7% of the students in the control group and 71.4% of the students in the experimental group are women. 73.8% of the students in the control group and 80.9% of the students in the experimental group are between the ages of 19-20. 80.9% of the students in the control group and 83.3% of the students in the experimental group were graduates of anatolian high school. It was determined that 95.2% of the students in the control group and 92.8% of the students in the experimental group liked mathematics. No statistically significant difference was observed between the control and experimental groups in the distribution of their descriptive characteristics (p>.05) and are provided Table 2.

There was no statistically significant difference between the initial scores of control and experimental groups on the metric and drug dose calculation skill test (p>.05). Metric and drug dose calculation skill test final scores (19.52 ± 1.48; 68.45 ± 7.28) of the students in the experimental group were significantly higher than the control group (17.38 ± 2.75; 52.97 ± 11.31) (p=.000) (Table 3).

While there was no significant difference in the initial scores of control and experimental groups regarding oral, local, parenteral and liquid drug dose calculation scores (p>.05), the final scores of the students in the experimental group (19.52 ± 1.85; 15.83 ± 3.96; 17.26 ± 3.16; 16.07 ± 3.03) were found to be significantly higher than the control group (17.61 ± 3.70; 13.80 ± 4.24; 12.02 ± 4.69; 9.04 ± 4.84) (p<.05) (Table 4).

Table 2. *Distribution of control and experimental group students according to their descriptive characteristics (n=84)*

Characteristics	Groups		χ^{2**}	p
	Control n = 42 (%)	Experimental n = 42 (%)		
Gender				
Female	28 (66.7)	30 (71.4)	0.073	.840
Male	14 (33.3)	12 (28.6)		
Age				
17-18	7 (16.7)	5 (11.9)		
19-20	31 (73.8)	34 (80.9)	0.852	.584*
21 and above	4 (9.5)	3 (7.2)		
Graduated high school				
Anatolian High School	34 (80.9)	35 (83.3)		
Science High School	5 (11.9)	4 (9.5)	0.173	.931*
Other[a]	3 (7.2)	3 (7.2)		
Liked Mathematics				
Yes	40 (95.2)	39 (92.8)	0.267	.718*
No	2 (4.8)	3 (7.2)		
Uses calculator in calculations				
Yes	25 (59.5)	27 (64.2)	0.271	.745
No	17 (40.5)	15 (35.8)		
Internet use monthly				
3-4 GB	42 (100)	40 (95.2)	1.016	.552*
5 GB and above	-	2 (4.8)		
Internet Access tool[b]				
Computer	3 (7.2)	2 (4.8)		
Mobile phone	12 (28.6)	9 (21.4)	1.245	.504*
Computer + Mobile phone + Tablet	27 (64.2)	31 (73.8)		
Metric conversion and drug dose resources[b]				
Course notes	10 (23.8)	9 (21.4)		
Course notes + Books	21 (50)	23 (54.8)	0.307	.848
Course notes + Books + Internet	11 (26.2)	10 (23.8)		
Virtual learning experience				
Yes	15 (35.8)	17 (40.5)	0.267	.747
No	27 (64.2)	25 (59.5)		
Problems in metric and drug dose calculations[b]				
Metric conversion	7 (16.7)	8 (19)		
Oral drug dose calculation	2 (4.8)	1 (2.3)	5.358	.600*
Local drug dose calculation	1 (2.3)	-		
Parenteral drug dose calculation	4 (9.5)	4 (9.5)		
Liquid drug dose calculation	1 (2.3)	2 (4.8)		
Metric + drug dose calculation	20 (47.7)	19 (45.4)		
None	7 (16.7)	8 (19)		

[a] *Vocational high school of commerce, open education high school and private high school*

[b] *Since more than one answer was given, they were given as percentage results*

** Fisher's Exact Test,*

*** Chi-Square Test*

Table 3. *Comparison of pre-test and last test scores of control and experimental group students pertaining to the metric and drug dose calculation skill test (n=84)*

	Metric calculation skill test scores				Drug dose calculation skill test scores			
	Skill score (min:0-max:20) Groups				Skill score (min:0-max:80) Groups			
	Control X±SD[d]	Exp[a] X± SD[d]	t[b]	p	Control X± SD[d]	Exp[a] X± SD[d]	t[b]	p
First	16.30 ± 4.28	15.95 ± 3.53	0.417	.678	53.33 ± 13.86	54.04 ± 12.84	-0.245	.807
Last	17.38 ± 2.75	19.52 ± 1.48	-4.433	.000	52.97 ± 11.31	68.45 ± 7.28	-7.452	.000
p[c]	.048	.000			.706	.000		

[a] *Experimental,* [b] *Independent sample t-test ,*[c] *Paired sample t-test,* [d] *X: mean value, SD: standard deviation*

Table 4. *Comparison of the pre-test and the last test scores of the control and experimental group students regarding the sub-data of the drug dose calculation skill test (n=84*

	Oral drug dose calculation scores				Local drug dose calculation scores				Parenteral drug dose calculation scores				Liquid drug dose calculation scores			
	Skill score (min:0-max:20) Groups				Skill score (min:0-max:20) Groups				Skill score (min:0-max:20) Groups				Skill score (min:0-max:20) Groups			
	Control X±SD[d]	Exp[a] X±SD[d]	t[b]	p	Control X±SD[d]	Exp[a] X±SD[d]	t[b]	p	Control X±SD[d]	Exp[a] X±SD[d]	t[b]	p	Control X±SD[d]	Exp[a] X±SD[d]	t[b]	p
First	19.16 ± 2.90	18.45 ± 3.02	1.104	.273	13.69 ± 5.18	12.85 ± 5.31	0.727	.469	13.09 ± 5.51	14.52 ± 5.15	-1.226	.224	7.38 ± 5.97	7.97 ± 5.41	-0.478	.634
Last	17.61 ± 3.70	19.52 ± 1.85	-2.982	.004	13.80 ± 4.24	15.83 ± 3.96	-2.256	.027	12.02 ± 4.69	17.26 ± 3.16	-5.998	.000	9.04 ± 4.84	16.07 ± 3.03	-7.966	.000
p[c]	.011	.037			.812	.001			.071	.005			.021	.000		

[a] *Experimental,* [b] *Independent sample t-test,*[c] *Paired sample t-test,* [d] *X: mean value, SD: standard deviation*

3.2. Qualitative findings of the study

Table 5. *Interviews: Context, themes, and sub-themes (n=28)*

Context	Themes	Sub-themes
Opinions for calculating metric and drug dose	Metric and drug dose calculation	➢ Professional Requirement ➢ It is vital ➢ Difficult topics ➢ Not making mistakes
		➢ Technical problem ➢ Useful on-line content ➢ Usability
Opinions on the Edpuzzle application	Effect on metric and drug dose calculation skills	➢ Inexpensive and available ➢ Persistence in mind ➢ Increasing learning
	Positive opinions about virtual learning with Edpuzzle	➢ Being Instructive ➢ Flexibility in education ➢ Trustable
Opinions on the virtual learning experience	Negative opinions about virtual learning with Edpuzzle	➢ Preference of face-to-face education ➢ Not being able to receive a feedback

3.2.1. Opinions for calculating metric and drug dose

Students, expressed opinions such as professional necessity, vital importance, difficult issues, not making mistakes regarding metric and drug dose calculation. Sample comments:

"Very necessary for our profession, but quite difficult subjects" (S.27).

"Making a small mistake can harm human life. That is why it is very important" (S.5).

3.2.2. Opinions on edpuzzle application

The students stated that Edpuzzle is useful, cheap and accessible, and that the useful online content in the videos increases memorability and learning, but they encountered

technical problems such as the inability to fast forward the videos in the application. Sample comments:

"*The questions in the videos are very useful, but when I wanted to pass some places faster, the application did not allow me to fast forward the videos. The practice is bad in this aspect"* (S.18).

"*The app is very useful. It doesn't charge users either. I could easily log in with my e-mail address and password"* (S.9).

"The questions we came across during the videos were very useful. As we solved the questions, it became instructive and more memorable" (S.23).

3.2.3. Opinions on virtual learning experience

Students stated that Edpuzzle provides flexibility in education through the opportunity to watch it over and over again in the desired place, time and space, it is instructive and increases the sense of confidence. Some students stated that they preferred face-to-face training because of problems such as not being able to receive immediate feedback. Sample comments:

"*Of course, it is more beneficial than face-to-face training. I could open and watch as much as I wanted whenever I wanted*" (S.1).

"At first I couldn't understand, then I watched it over and over. Now I can easily understand what the question is asking of me. My self-confidence has increased in this regard" (S.21).

"If I were in the classroom, I could instantly ask where I couldn't understand and get an answer back. I think face-to-face education is more beneficial" (S.16).

4. DISCUSSION

In our study, it was determined that the Edpuzzle application in the virtual learning environment, increased the metric and drug dose calculation (oral, local, parenteral and liquid drug dose calculation scores) skills of nursing students. In various nursing students studies in the literature, it has been found that analytical thinking, creativity, technological skills of the students have improved and their level of knowledge has increased in lessons where Edpuzzle is used (17, 20-23). Edpuzzle was determined that the flipped classroom using interactive videos increased nursing students' biostatistics knowledge scores (22). In the other study, Edpuzzle was used as one of the digital material preparation tools in flipped learning. As a result of the study, it was determined that nursing students' knowledge of asepsis increased (20). Similarly, Edpuzzle, one of the digital materials, was used in flipped learning. In this study, it was found that nursing students' knowledge of patient safety increased (23). Edpuzzle is stated as an interactive online material that nurse educators can use to enhance learning (24). Edpuzzle, used as a digital material in a flipped learning environment, was found to increase first-year nursing students' blood pressure knowledge (21). Kaplan and Tüzer (17) determined comparing Edpuzzle with web-supported education and peer education that both methods increased the stoma care knowledge of nursing students. The emergence of these results can be attributed to the positive effects of the students' ability to access and rewatch the videos whenever and wherever they want, and the fact that the questions in the videos increase the motivation and interaction of the students. In addition, taking into account individual differences in learning, providing an autonomous learning environment by Edpuzzle may contribute to the increase of student skills.

In the qualitative findings of our study, students stated that metric and drug dose calculations are necessary and vital, and that Edpuzzle application increases memorability, is useful and accessible. In their experiences with virtual learning, some students stated that Edpuzzle application provides flexibility in education, is instructive, but some others prefer face-to-face education due to problems such as not receiving immediate feedback. In nursing education, a study was found in which student (22) and nurse educators' (25) opinions were taken about the Edpuzzle application. In the study where student views were taken about the Edpuzzle, students stated that the Edpuzzle was instructive, fun, made it easier for them to prepare for exams and that they were satisfied (22). Similarly, in the study in which nurse educators' opinions about the Edpuzzle were taken, educators stated that the Edpuzzle increases students' interest in learning with its audio-visual content and positively supports students' learning (25). Since there has not been any other study in which user opinions about Edpuzzle have been obtained in the field of nursing, the data of this study have been discussed with similar research results conducted in the literature. In the qualitative researches, it was determined that the students' views on the Edpuzzle application were positive. The qualitative findings of our study support the previous studies, such as the following: Gómez-García et al (26) examined the effect of Edpuzzle application on healthy habits and diet in primary school sixth grade students and determined that Edpuzzle increased students' motivation and autonomy. Abou Afach et al (16) reported that the use of Edpuzzle in the education of children with special requirements, increased the awareness of the students. Su and Chiu (27) examined the experiences of primary school students on using Edpuzzle interactive video and reported that 76.4% of the students had a positive attitude towards Edpuzzle. The fact that Edpuzzle increases visual and auditory interaction, contributes to learning, is fun, helps prepare for exams and increases the desire to learn may have contributed to the positive student opinions in this study.

In our research, students encountered technical problems in the Edpuzzle application and stated that the videos could not be fast forwarded. In a study, nursing students expressed negative opinions that an extra internet package was needed to watch Edpuzzle interactive videos and that watching the videos was a waste of time (22). The nursing students who participated in this study are Generation Z. Regarding the lack of function of fast forwarding in the Edpuzzle videos as a problem by the Z generation students, can be attributed to the fact of active

use of technology by this generation. Additionally, the fact that Edpuzzle requires the use of the internet and that time must be spared to watch may have caused negative student opinions. The positive and negative opinions of the students on the virtual learning experience may be due to individual learning differences. The results of our study show us that supporting nursing students with Edpuzzle application has a positive effect on their learning levels.

5. CONCLUSION

The rapid development of technology has necessitated the use of information technologies as an important tool in education. In this direction, nurse educators tend to include instructional technologies that will stimulate the students' affective domains into the nursing education curriculum. The results of this study showed that Edpuzzle application in virtual learning environment increased the metric and drug dose calculation skills of nursing students. Based on the results of the study, we suggest Edpuzzle to be integrated and used as an innovative teaching technology in the nursing education curriculum.

The study is limited to first-year students in the faculty of nursing at a state university in a Turkey and agreed to participate in the research.

Acknowledgement: *We wish to thank the students who gave up their time to be involved in this study*
Funding: *This study was not funded*
Conflicts of interest: *The authors declare that they have no conflict of interest.*
Ethics Committee Approval: *This study was approved by Ethics Committee of Cankiri Karatekin University Health Sciences, (approval date 1.3.2021 and number 19).*
Peer-review: *Externally peer-reviewed.*
Author Contributions:
Research idea: YO
Design of the study: YO
Acquisition of data for the study: YO
Analysis of data for the study: YO
Interpretation of data for the study: YO, SY, GÖÖ
Drafting the manuscript: YO, SY, GÖÖ
Revising it critically for important intellectual content: YO, SY, GÖÖ
Final approval of the version to be published: YO, SY, GÖÖ

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How to cite this article: Ordu Y, Yılmaz S, Özaras Öz G. Edpuzzle Application in Improving Nursing Students' Metric and Drug Dose Calculation Skills in a Virtual Learning Environment: Mixed Methods Study. Clin Exp Health Sci 2024; 14: 943-951. DOI: 10.33808/clinexphealthsci.1282606