ORIGINAL ARTICLE

The Effect of Padlet on Nursing Students' Drug Dose Calculation Skills

Hemşirelik Öğrencilerinin İlaç Doz Hesaplama Becerilerinde Padlet'in Etkisi

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Abstract

Objective: Nursing students attended distance learning due to the pandemic, which made it more difficult for them to learn how to calculate the right dose because drug dose calculation requires constant practice. This study investigated whether Padlet helped nursing students to learn how to calculate the right dose.

Method: This study adopted a single-group pretest-posttest experimental research design. This study was conducted in the nursing department of a university in Turkey. The sample consisted of 42 first-year nursing students. Students participating in the research answered the "form for promotional features" and "drug dose calculation knowledge test" sent via Google Forms. Then, the researcher and participants shared and discussed the questions, pictures, and videos they prepared for drug dose calculation on Padlet for three weeks. At the end of three weeks, all participants filled out the knowledge test again. Number, percentage, and Wilcoxon test were used for data analysis.

Results: It was determined that the students' test score average regarding drug dose calculation skills increased at a statistically significant level (p<0.05). It was determined that the students' knowledge level in calculating milligrams of drugs, converting drug units, and preparing scale and tablet type drugs increased significantly.

Conclusion: At the end of the study, it was determined that different web 2.0 tools used in distance education enabled students to actively provide continuous education and increase their drug dose calculation skills. It is suggested that such applications are effective in extracurricular learning and can be used in applied subjects.

Keywords: Distance learning, drug, nursing students, dose

Öz

Amaç: Pandemi nedeniyle uzaktan eğitime devam eden hemşirelik öğrencileri, ilaç dozu hesabı sürekli pratik gerektirdiğinden doğru dozun nasıl hesaplanacağını öğrenmelerini zorlaştırdı. Bu çalışma, Padlet'in hemşirelik öğrencilerinin doğru dozu nasıl hesaplayacaklarını öğrenmelerine yardımcı olup olmadığını araştırdı.

Yöntem: Çalışma, tek gruplu ön-son testli müdahale çalışmasıdır. Araştırma Türkiye'de bir üniversitenin hemşirelik bölümünde okuyan öğrenciler ile yapılmıştır. Araştırmaya birinci sınıfta öğrenim gören 42 hemşirelik öğrencisi katılmıştır. Araştırmaya katılan öğrenciler, Google Formlar ile gönderilen "tanıtıcı özelliklerine yönelik form" ve "ilaç doz hesabı bilgi testi"ni cevaplamıştır. Daha sonra araştırmacı ve öğrenciler üç hafta boyunca doz hesabına yönelik hazırladıkları soru, resim ve videoları Padlet üzerinden paylaşmış ve tartışmışlardır. Üç hafta sonunda öğrenciler tekrar bilgi testini doldurmuştur. Verilerin değerlendirilmesinde; sayı, yüzdelik ve Wilcoxon testi kullanılmıştır.

Bulgular: Öğrencilerin ilaç doz hesaplama becerilerine ilişkin test puan ortalamasının istatistiksel açıdan anlamlı düzeyde arttığı belirlenmiştir (p<0,05). Öğrencilerin ilaçları miligram hesabı yapabilme, ilaç birimlerini dönüştürme, ölçek ve tablet türü ilaçların hazırlanmasında bilgi düzeylerinin anlamlı derecede arttığı belirlenmiştir.

Sonuç: Çalışma sonunda uzaktan eğitimde kullanılan farklı web 2,0 araçlarının öğrencileri aktif kılarak sürekli öğretimi sağladığı ve ilaç doz hesaplama becerilerini artırdığı belirlenmiştir. Bu tür uygulamaların ders dışı öğrenmede etkili olduğu ve uygulamalı konularda kullanılabileceği önerilmektedir.

Anahtar Kelimeler: Uzaktan öğretim, ilaç, hemşirelik öğrencileri, doz

Introduction

Nurses are responsible for preparing and administering drugs in accordance with physicians' orders. There are ten principles of medication administration (right patient, right medication, right dose, right time, right route, right documentation, proper patient education, right to refuse, rejection verification, and correct assessment) that must be followed to ensure patients safety (1). Academicians teach these rights theoretically and practically in the nursing principles course. Therefore, nurses are expected to adhere to them in their professional life. However, the most challenging principle for nursing students is "calculating the right dose" (2-6). They experience anxiety when calculating the right dose requires mathematical knowledge and skills. Calculating the right dose require students to think, formulate, and calculate (2). In the fundamentals of nursing course, academics teach first-year students how to calculate oral and parenteral medications and administer them to patients. They teach students how to use calculation methods and formulas and present them with examples. However, research has shown that students experience anxiety because they cannot use those calculation methods and formulas (7). This shows that students have difficulty putting theory into practice (8). Academics should present theoretical knowledge with cases to help students use that knowledge in clinical practice. But, nursing students could not perform clinical clerkships because Turkey shifted to distance learning due to the Coronavirus disease-2019 (COVID-19) pandemic. Therefore, they did not have the chance to put theoretical knowledge into practice. In other words, they could not practice calculating the right drug dose, convert different types of medical units, and diluting medications with solutions. Nursing students experience stress and cause medication errors in real-life clinical settings when they cannot calculate the right drug dose threatens patients safety, disrupts treatments, and negatively impacts nursing care outcomes (7).

According to the Joint Commission on Accreditation of Healthcare Organizations, 354 (5.4%) of the 6.554 medical errors between 2004 and 2012 were medication errors (9). Nursing students and nurses make medication administration errors (10-12). Zaybak et al. (12) reported that nursing students believed that they knew little about medication administration practices. They also found that only one in ten nursing students knew enough about drugs and drug applications (12.7%), while only three in ten knew enough about drug dose calculation (29.5%) (12). Çoban et

al. (13) also determined that nurses had difficulty following the ten rights. Wrong dose administration accounts for 6.9% of all medical errors (14). Research shows that nurses administer medications without calculating their doses correctly (15,16). Çevik et al. (17) reported that nine in ten first-year nursing students administered the wrong dose of medication (89.7%). On the other hand, Özyazıcıoğlu et al. (18) found that nine in ten nursing students (n=148) answered the drug dose correctly. Taşkiran et al. (19) documented that only three in ten nursing students had adequate drug dose calculation skills (26.8%), whereas two in five answered all drug dose calculation problems correctly (41.8%). Cebeci et al. (14) found that two in five nursing students (n=324) made medication errors during practice. Unver et al. (20) claim that newly graduated nurses are inexperienced, which is one of the main reasons for medication errors.

Web 2.0 tools offer innovative learning opportunities in distance education today (21). Researchers maintain that academics can use Web 2.0 tools to teach nursing students how to calculate the right dose (22-24). Web 2.0 tools allow nursing students to meet on a single platform, go over study topics, use visuals and videos to anchor key points, and put their knowledge into practice. Digital environments allow distance learners to interact. Padlet helps students interact with each other and instructors outside the classroom (25). Padlet is a digital clipboard application. Instructors can add texts, videos, visual presentations, animations, and games to the clipboard, allowing students to see all resources digitally, listen to lectures at any time, and enjoy learning. Padlet motivates teachers and students to discuss and brainstorm about things outside the classroom (26). It provides opportunities for cooperative learning, peer learning, and self-assessment (27).

Interactive applications motivate students, allow them to grasp subjects quickly, and positively affect their attitudes toward courses (28). Technological tools allow nursing students to take theoretical lessons and perform procedures by watching interactive videos and animations outside the laboratory. Thus, students make fewer mistakes in real-life clinical settings (29). Karabağ Aydin and Dinç (22) and Öztürk (30) also reported that nursing students who received web-based training were better at calculating drug doses. Kim and Suh (31) maintain that interactive mobile training is effective. Based on these results, Web 2.0 tools may help nursing students learn how to prepare and administer medications. Therefore, this study investigated whether Padlet helped nursing students learn how to prepare and administer medications.

Research Hypotheses

H_0: Padlet does not help nursing students learn how to prepare and administer medications.

H_1: Padlet helps nursing students learn how to prepare and administer medications.

Main Points

- Drug dose calculation skills require nursing students' ability to calculate.
- Preparing drugs in appropriate doses is an important practice in the clinic where students are stressed and may pose a risk in terms of patient safety.
- Today's Generation Z students enjoy working from digital resources outside of the classroom.
- Padlet provides students with an interactive learning environment with the instructor and each other outside of the classroom.

Material and Method

Aim of the Research

This study investigated whether Padlet helped nursing students learn how to calculate the right drug dose.

Design

This study adopted a single-group pre-post test quasi-experimental research design.

Participants

The study population consisted of 182 first-year students enrolled in the fundamentals of nursing II course in the spring semester of the 2020-2021 academic years in the nursing department of the faculty of health sciences of a university in Turkey. Students who accepted to participate in the study and met the inclusion criteria were included in the study. The sample consisted of 42 participants. A power analysis (G*Power 3.1) was performed based on the results at the end of the study. The results showed that the sample was large enough to detect significant differences (effect size=0.894, df=41, and power=99%).

Inclusion criteria

• Taking Fundamentals of Nursing II course for the first time

• Having a mobile phone or computer

• Having internet access,

Exclusion criteria:

• Having used Padlet before

• Have been trained in drug dose calculation

Data Collection Techniques and Tools

The data were collected online (Google Forms) using a Descriptive Characteristics Questionnaire (DCQ) and a Drug Dose Calculation Knowledge Test (DDCKT).

DCQ

The DCQ was based on a literature review conducted by the researcher (19,22,30,32). The questionnaire consisted of eight items on age, gender, grade level, degree, digital apps used, the contribution of digital tools to learning, adequacy of drug dose calculation knowledge, and demand for training.

DDCKT

The DDCKT was based on a literature review conducted by the researcher (19,22,30,32). The test consisted of 15 items. Three experts were consulted to prepare the test. A pilot study was conducted with 82 nursing students to check for intelligibility and relevance and to establish item difficulty and item discrimination indices. The item difficulty and discrimination indices were analyzed according to the evaluation criteria (33). The results showed that the two items were difficult and indiscriminative (p<0.60, r<0.20). Therefore, they were removed from the test, with 13 items remaining (KR20=0.70). The test had a Cronbach's Alpha of 0.70. The items were scored as 0 (wrong answers) or 1 (correct answers). The total score ranged from 0 to 13.

Creating a Class on the Padlet

The researcher signed into Padlet (https://tr.padlet.com/dashboard) and created a wall titled "drug dose calculations" (Figure 1).

Question content included mg of medicine by age, unit calculation, unit conversion, and dilution of tablets, suspensions, or dry powdered medicines. The researcher shared the wall only with the participants. The wall allowed participants to ask questions to the researcher and to see each other's posts.

Conducting the Research

The study was conducted in April 2021 during the pandemic. Within the scope of the nursing principles course, the researcher delivered a two-hour theoretical lecture online on drug dose calculation. After the class, the researcher briefed the students about the research purpose and procedure and received informed consent from those who agreed to participate. Afterward, the researcher sent the students the DCQ and DDCKT and gave them one day to fill them out. The researcher shared a link to the Padlet class after participants filled out the DCQ and DDCKT (pre-test). The researcher uploaded a new question to Padlet daily and discussed participants' solutions with them. Discussion periods were approximately 15 minutes long and were held 4 times a day. The researcher uploaded various questions about drug dose calculation to Padlet and asked them to solve the questions and upload their solutions to Padlet. Participants prepared pictures or videos of their solutions and shared them on Padlet. Participants could see each other's posts, ask each other written questions, and get answers. The researcher monitored all participants' posts and approved those who answered the questions appropriately, while she guided those who did not and helped them reach the correct answer. This activity continued online for three weeks. At the
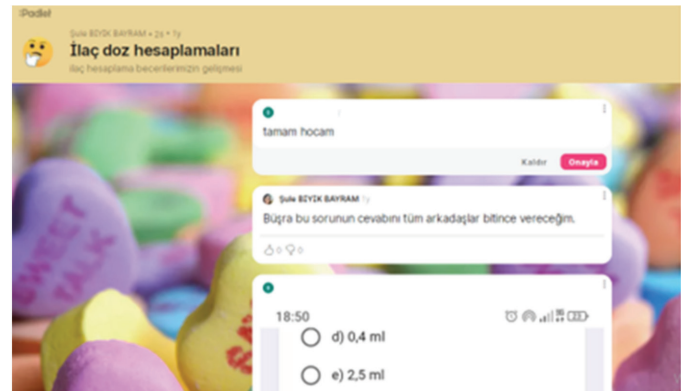

Figure 1.
Padlet platform

end of three weeks, participants filled out the DDCKT again (post-test) (Figure 2).

Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS, v. 23.0) at a significance level of 0.05. Percentage, median, and standard deviation values were used for analysis. The Kolmogorov-Smirnov test was used for normality testing. Wilcoxon signed-rank test was used because the data were not normally distributed. Wilcoxon test was used to determine the difference between the pre-test and post-test scores.

Ethical Considerations

The study was approved by the Karadeniz Technical University Medical Faculty Scientific Research Ethics Committee (2021/199, no: 24237859-535, date: 17.06.2021). Institution permission was obtained from the university faculty of health sciences, nursing department. All students were informed about the research purpose and procedure and those who agreed to participate in the study signed the informed consent form. In the Google Form, informed consent form was first given and they were asked to mark the text "I confirm to participate in the study". The students who made the mark were able to fill out the questionnaire.

Results

Participants had a mean age of 19.04±0.96. Most participants were women (76.2%) with Anatolian high school degrees (73.8%). The majority of the participants used digital sources (71.4%), such as videos (83.3%), edpuzzle (52.4%), quizizz (54.8%) pixton (19%), videos we made at home (40.5%), and articles (14.3%). More than half of the participants believed that digital sources were useful (66.7%). More than half of the participants stated that they had moderate drug dose calculation skills (57.1%). Most participants wanted to receive drug dose calculation training (88.1%) (Table 1).

Participants had a significantly higher mean score posttest DDCKT than the pre-test score (p<0.001) (Table 2).

When compared according to the question content, there was an increase in the number of correct answers for each question. There was a statistically significant increase in the number of correct questions in the preparation of liquid- and suspension-type drugs and unit conversion calculations (p=0.01, p<0.001, p=0.02, p<0.001) (Table 3).

Discussion

Calculating the right dose is one of the six principles of drug administration. Nursing students learn how to administer medications theoretically and put them into practice in clinics until graduation (34). They must first calculate the right drug dose in laboratories and administer the drugs on models until they get it right because medication safety is one of the principles of patient safety. Many universities have adopted the distance mode of learning during the COVID-19 pandemic. Therefore, educational methods, such as e-learning and mobile learning, have become increasingly popular (29). Today, academics use virtual environments to interact with students and to enable them to study, ask questions, and interact with each other at any time and place (28). Taşkiran et al. (19) recommend that nursing curricula should address drug dose calculation more often in order to help students develop those skills.

Our participants had a significantly higher mean post-test score DDCKT than the pre-test score (p<0.001) (Table 2). Research also shows that various techniques help nursing students learn how to calculate the right drug dose (22,35-38). Mariani et al. (35) reported that nursing students who received simulation training learned more about drug safety and became more competent. Basak et al. (36) also found that nursing students who attended low-level environmental fidelity simulation developed drug dose calculation skills. Pol-Castañeda et al. (37) determined that simulation-based training increased the correct dose preparation skills of nurses from 60.3% to 100%.
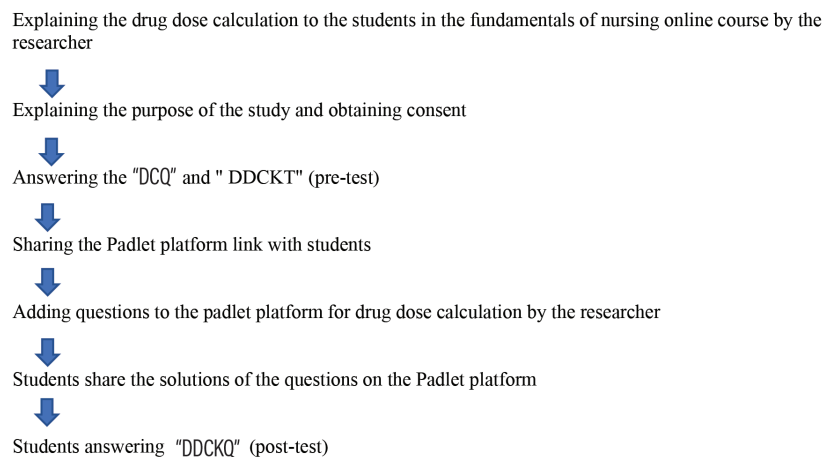
Explaining the drug dose calculation to the students in the fundamentals of nursing online course by the researcher

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Explaining the purpose of the study and obtaining consent

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Answering the "DCQ" and " DDCKT" (pre-test)

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Sharing the Padlet platform link with students

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Adding questions to the padlet platform for drug dose calculation by the researcher

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Students share the solutions of the questions on the Padlet platform

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Students answering "DDCKQ" (post-test)

Figure 2.
Flow chart of the research

Table 1.
Descriptive Characteristics Questionnaire (n=42)

Descriptive characteristics	n (%)
Age Mean ± SD=19.04±0.96	
Gender	
Woman Man	32 (76.2) 10 (23.8)
The school you last graduated from	
High school Anatolian high school Health vocational high school	7 (16.7) 31 (73.8) 4 (9.5)
Digital resource usage status	
I use Partially	30 (71.4) 12 (28.6)
Resources useful for learning*	
Video Edpuzzle Guizz Pixton Videos we made ourselves at home Articles	35 (31.53) 22 (19.81) 23 (20.72) 8 (7.20) 17 (15.31) 6 (5.40)
Advantage of digital resources in learning	
Advantageous Disadvantageous Partially	28 (66.7) 1 (2.4) 13 (31)
How good is your drug dose calculation information?	
Very good Good Middle Bad Too bad	2 (4.8) 9 (21.4) 24 (57.1) 4 (9.5) 3 (7.1)
Desire to receive training on drug calculations	
Yes No	37 (88.1) 5 (11.9)

*=More than one answer is marked, SD=standard deviation

Table 2.
Comparison of Students' Knowledge Levels About Drug Dose Calculations Before and After Padlet

Score	Knowledge		Statistical evaluation *	
	Mean ± SD	Median (min-max)	Z	p
Pre-test	9.64±2.65	10 (2-12)	3.610	<0.001
Post-test	11.11±1.04	11 (9-13)		

*=Wilcoxon test, SD=standard deviation

Grugnetti et al. (38) also documented that nursing students who attended a clinical skills workshop developed more drug dose calculation skills. Karabağ Aydin and Dinç (22) reported that students who performed web-based medication dose calculation had improved their skill levels. Hitam (39) investigated the utilization of web-based instruction among 122 second-year students. Students' skills improved based on mathematics diagnostic test results (39). McMullan et al. (40) compared traditional "handout" learning support with an interactive e-drug calculation package, including drug calculation skills, self-efficacy, and satisfaction with the support material. Stake-Nilsson et al. (41) state that articles draw on digital technologies such as web-based platforms, e-learning modules, calculators, simulation, and personal digital assistants, such as hand-held computers. These results indicate that academics should use teaching

Table 3.
Comparison of Students' Pre and Post Padlet Drug Dose Calculation Question Types

Question types	Pre-test n (%)	Post-test n (%)	Statistical evaluation *	
			Z	p
Calculating liquid medicine in mg	29 (69)	38 (90.5)	2.496	0.01
Calculating the unit of medication to be given according to weight	37 (88.1)	41 (97.6)	1.633	0.10
Reconstitution of powdered medicine	34 (81)	38 (90.5)	1.265	0.20
Unit conversion	33 (78.6)	36 (85.7)	0.905	0.36
Calculating the scale of the drug in suspension	28 (66.7)	40 (95.2)	3.207	<0.001
Make a daily tablet account	37 (88.1)	40 (95.2)	1.134	0.25
Unit calculation	38 (90.5)	40 (95.2)	0.816	0.41
Calculate units by unit conversion	39 (92.9)	39 (92.9)	0.000	1.00
Diluting the drug and taking the appropriate dose of the drug	39 (92.9)	38 (90.5)	0.378	0.70
Drug withdrawal to the insulin injector according to the dose calculation	33 (78.6)	35 (83.3)	0.577	0.56
Dilute the powdered drug in the desired mL and take the appropriate dose	30 (71.4)	33 (78.6)	0.775	0.43
Calculate gr from mg	26 (61.9)	33 (78.6)	2.333	0.02
Calculate tablet by unit conversion	2 (4.8)	15 (35.7)	3.464	<0.001
*=Wilcoxon test				

techniques and offer web-based systems to help students develop dose calculation skills. Online digital tools (web pages or Web 2.0 tools) make students active and enable them to learn by revision at any time and place. Therefore, it is recommended to include these tools in the curriculum to encourage students to study outside the classroom to support face-to-face education.

After the intervention, more participants answered some questions correctly, such as preparing liquid and suspension drugs and converting units. Our participants answered the question "tablet calculation by unit conversion" (4.8%) correctly the least. Taşkiran et al. (19) found that two out of every five nursing students (n=194) incorrectly converted unit doses (37.1%). Karabağ Aydin and Dinç (22) reported that 55.6% of the students were able to answer questions about ratio-proportion concepts, whereas 4.8% were able to convert measurement units. Özyazıcıoğlu et al. (18) found that most students taking pediatrics courses were correct in dose calculations according to the age of the child (87.1%), 9.5% were incorrect, and 3.4% left blank. More than half of the students (69.6%) found the safe dose range, and 79.1% found the correct rate. Özyazıcıoğlu et al. (18) also determined that students might make ten times more errors when miscalculating decimal values in dose calculations. Therefore, nursing students should perform drug dose calculations carefully and repeatedly until they are sure of the results. These results suggest that students have difficulty converting units because they do not have sufficient math calculation skills. Therefore, teaching students math skills before drug dose calculation applications is important. Academics should overcome the deficiencies in students'

mathematical knowledge of ratio-proportion and unit conversion, frequently used in pharmaceutical applications.

In distance education, web 2.0 tools such as kahoot, quizizz, edpuzzle, and crossword can be used to increase the learning skills of students wherever and whenever they want. In this study, the padlet was used as a digital resource to increase students' drug dose calculation skills (42). In this study, seven in ten participants stated that they used digital resources (71.4%). More than half of the participants noted that digital resources were beneficial for learning and that these resources were programs such as videos (83.3%), edpuzzle (52.4%), and quizizz (54.8%). Kahoot, Mentimeter, Quizizz, Pictochart, and Padlet, known as Web 2.0 tools in nursing education, provide learner-centered teaching strategies. After the pandemic, nursing educators use web-based tools more widely (43). Using such tools as course materials and revealing their importance will guide educators. The web and social media help Generation Z students to realize their learning goals because they use them frequently outside the classroom.

After the intervention, student opinions were taken. More than half of our participants believed they had moderate drug dose calculation skills (57.1%). Most participants noted that they would like to receive training in drug dose calculation (88.1%). Çelik and Şendir (32) also found that nursing students had average dose calculation skill scores. Different programs have been developed to increase nursing students' knowledge about drug dose calculation. For example, Bagnasco et al. (44) developed the safe Medicate and eDose™ (Authentic World Ltd.) tool. The tools

should include lectures and tests that will enable students to improve their math skills. After developing their math skills, they should learn how to calculate the right drug dose (44). Mackie and Bruce (45) reported that lessons and online resources designed as an intervention to target mathematical concepts and skills led to improved results and increases in overall pass rates for second-year students for medication dosage calculation tests. Stake-Nilsson et al. (41) suggest that digital technologies are increasingly important in promoting nursing students' knowledge and medication dosage calculation skills (36). The results also show that nursing students need more lessons for drug dose calculations that require math skills. During the pandemic, academics could not monitor students' progress, so target learning remained limited. However, Padlet enabled the researcher to follow and communicate with all participants. In addition, all participants could learn by watching each other's solutions.

Study Limitations

Several limitations of this study must be acknowledged. The study was conducted only with first-year nursing students who took the Fundamentals of Nursing course at a university. The post intervention assessment was done immediately after the intervention happened for a period of three weeks. It is seen that the use of the Padlet application used in this study in different subjects will support nursing education. Since Padlet is a non-compulsory environment that students can actively use outside of the classroom, only some of the students participate. Another limitation is that the study was conducted with a single group.

Conclusion

Padlet is a Web 2.0 tool that offers an innovative learning environment in nursing. Although Padlet is not very popular, we think it will allow students to spend their free time outside the classroom efficiently as a bridge between distance and face-to-face learning. In this respect, Padlet helps nursing students develop mathematical skills, making calculating the right drug dose easier. Padlet and similar web tools should be included in nursing curricula. When Generation Z students cannot always learn in class or want to reinforce the information they have learned, applications such as Padlet will improve their knowledge and skills. Researchers should conduct further studies on web tools, and nurse educators should use web tools more often.

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