The Effect of a Virtual Simulation Game on the Development of Nursing Students' Knowledge and Skills: A Protocol for a Parallel-Group Randomized Controlled Trial*

Hemşirelik Öğrencilerinin Bilgi ve Becerilerinin Geliştirilmesinde Sanal Simülasyon Oyununun Etkisi: Paralel Grup Randomize Kontrollü Çalışma İçin Çalışma Protokolü*

Inci Mercan Annak[1] (iD), **Hulya Bulut[2]** (iD)

Öz: Araştırmanın amacı hemşirelik öğrencilerinin kateter ilişkili üriner sistem enfeksiyonunu (KİÜSE) önlemeye ilişkin bilgi ve beceri geliştirilmesinde sanal simülasyon oyununun (SSO) etkisini değerlendirmektir. Bu araştırma paralel grup, randomize kontrollü çalışma protokolü olarak tasarlanmıştır. Araştırma Nisan 2022 tarihinde ClinicalTrials.gov adresine kayıt edilmiştir (NCT05309317). Araştırma Hemşirelikte Meslek Dersleri Uygulaması II dersine kayıtlı 82 hemşirelik öğrencisi ile Nisan-Mayıs 2022 tarihleri arasında yapılacaktır. Araştırmanın uygulanması üç aşamada gerçekleştirilecektir. Araştırmanın birinci aşamasında KİÜSE'yi önlemeye ilişkin sanal simülasyon oyun uygulaması geliştirilmiştir. İkinci aşamasında veri toplama araçlarının ön uygulaması yapılacaktır. Üçüncü aşamasında ise, hemşirelik öğrencilerinin KİÜSE'yi önlemeye ilişkin bilgi ve becerilerinin geliştirilmesinde sanal simülasyon oyununun etkisi belirlenecektir. Tüm öğrencilere ön test ile bilgi ve beceri değerlendirmesi yapıldıktan sonra "KİÜSE'nin Önlenmesi" konulu bir eğitim verilecektir. Eğitim sonrasında öğrenciler deney (n=41) ve kontrol (n=41) gruplarına random ataması yapılacaktır. Kontrol grubu sadece eğitim alırken, deney grubu araştırmacı tarafından geliştirilen sanal simülasyon oyununu oynayabilecektir. Eğitimden yedi gün sonra son test ile bilgi ve beceri değerlendirmesi yapılacaktır. Böylelikle ön test ve son test arasında farklılık değerlendirilecektir. SSO yeni nesil öğrencilerin öğrenme yaklaşımlarına uygundur. Sanal simülasyon oyununun kullanılması öğrencilere KİÜSE'nin önlenmesi için yapılacak uygulamaları eğlenerek, istediği kadar tekrar edebilmesine, zaman ve mekan farketmeden oynayabilmesine olanak sağlayacaktır. Öğrencilerin oyunda vereceği kararlar gerçek hayata etkisi olmayacağı için hasta güvenliğini koruyacaktır. Sonuç olarak çalışmamızın literatüre katkı sağlayacağına ve SSO'nun psikomotor becerileri geliştirmek için kullanılacağını düşünüyoruz.

Anahtar Kelimeler: Sanal Simülasyon Oyunu, Kateter İlişkili Üriner Sistem Enfeksiyonu, Hemşirelik Eğitimi, Hemşirelik Öğrencileri, Çalışma Protokolü.

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Abstract: The aim of the study is to evaluate the effect of virtual simulation game (SSO) on nursing students' knowledge and skills in preventing catheter-associated urinary tract infections (CAUTI). This study is parallel-group randomized controlled trial. It was registered at ClinicalTrials.gov in April 2022 (NCT05309317). The sample will consist of 82 nursing students. The study will be conducted between April and May 2022. The study will consist of three stages. In the first stage, we developed a virtual simulation game on preventing CAUTI. In the second stage, a pretest will be administered. In the third stage, the effect of the virtual simulation game on participants' knowledge and skills for the prevention of CAUTI will be evaluated (a posttest). All participants will take the pretest and then receive training on preventing CAUTI. After the training, participants will be randomly assigned to experimental (n=41) and control (n=41) groups. The control group will only receive the training, while the experimental group will receive the training and play the VSG. Seven days after the training, participants will take the posttest. VSG are appropriate for new generation students' learning approaches. The virtual simulation game will help the experimental group participants have fun learning the interventions to prevent CAUTI. The game will allow them to go over the topics whenever and wherever they like. The game will ensure patient safety because players' decisions will not affect real life. As a result, we believe that our study will add to the literature, and that this game will be used to improve psychomotor skills.

Keywords: Virtual Simulation Game, Catheter-Associated Urinary Tract Infection, Nursing Education, Nursing Students, Study Protocol.

[1] Inci Mercan Annak, MSc., PhD Candidate, Faculty of Health Sciences, Department of Nursing, incimercan@gazi.edu.tr (Sorumlu yazar.)

[2] Professor Hulya Bulut, PhD., Gazi University, Faculty of Health Sciences, Department of Nursing, bhulya@gazi.edu.tr

* This study is doctoral thesis's study protocol for a parallel-group randomized controlled trial.

Introduction

Catheter-associated urinary tract infection (CAUTI) are the most common healthcare-associated infections. Catheter-associated urinary tract infections are seen in patients with urinary catheters inserted at least 48 hours before their appearance (1). They increase morbidity and mortality, prolong hospital stay, increase hospital costs, and cause complications, such as cystitis and sepsis (2-4). The recommended infection control measures prevent 17% and 69% of CAUTI (2). The main targets of preventive interventions are unnecessary catheter use and duration of urinary catheter use because they are the most critical risk factors for CAUTI (5-8).

Surgical patients undergo urinary catheterization more than other patients (9, 10). Routinely using urinary catheterization in surgery and keeping it longer than 48 hours after surgery put the patient more at risk for CAUTI (10-12).

Evidence-based interventions reduce the risk of CAUTI (13, 14). Nurses play a crucial role in reducing the incidence of CAUTI because they spend much time with patients and are responsible for catheter care (2). Nurses should have up-to-date and evidence-based information on CAUTI and use prevention protocols to ensure effective patient care (10, 13, 15).

Both clinical nurses and nursing students should know how to prevent CAUTI. Although nursing students work safely and effectively in complex and ever-changing healthcare settings, they have limited opportunities to perform interventions (16). The faculty member-student ratio in Turkey is skewed. Therefore, not every student gets the chance to develop skills and put them into practice. In addition, limited time and lab facilities reduce the effectiveness of teaching(17, 18). All these problems make it hard for students to care for clinical patients. In recent years, there have been significant advances in technology, on which Generation Z relies for everything. These phenomena affect education methods (18, 19). The measures as a response to the COVID-19 pandemic have also prevented nursing students from receiving face-to-face education and interacting with patients in real-life clinical settings. All these significant changes have transformed the education systems of many countries (20-22).

Nursing students need safe and stimulating learning environments to prepare for professional practice (23). Nursing students need to be involved in different training methods and strategies (real clinical scenarios, role-playing, simulation, virtual reality, video demonstration, standard patient, etc.) to learn how to implement nursing interventions correctly (23-26). Although simulation labs are an excellent non-clinical approach to providing nursing students with experiences, they require many resources regarding time, facilities, cost, and equipment (23). In addition, the number of labs and faculty members is not enough to run scenarios with large numbers of students. Therefore, not every student has an equal chance to participate in them. Each student has only one opportunity to take part in one scenario. However, virtual simulations allow students to participate in scenarios repeatedly whenever and wherever they want as long as they have access to the Internet (18, 23, 27). Having become even more important thanks to the COVID-19 pandemic and the ease of access to technology, virtual simulations are used to support simulation labs and clinical practices in nursing education (16, 23, 28-30).

In recent years, there has been a growing body of research on virtual simulations, including screen-based simulators (31), game-based virtual reality (18), web-based simulations (32) and serious gaming (33). These applications explain the concepts of "simulation" and "virtual." Video games are used more and more in education these days. We used a "virtual simulation game" (VSG) to highlight the educational aspects of games and integrate them with virtual simulations (29, 34).

Virtual simulation games (VSGs) are engaging and interactive technological tools that help users develop skills and acquire knowledge.Virtual simulation games set objectives and include some scoring systems(34). They are accessed via phones, tablets, and computers for education or training rather than entertainment.Users take roles in real clinical scenarios in virtual settings in VSGs. They act as avatars to achieve the goals set by the games (29).

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Virtual simulation games are engaging and innovative games that make students more attentive and creative and ensure active participation and learning retention(26, 29, 30). Virtual worlds are safe settings where students can develop practical skills (23, 28). In other words, virtual environments provide real-life interaction that allows students to develop communication and clinical skills and put them into practice (23-26). In addition, virtual environments help students develop technical and critical thinking skills before they start caring for actual patients in real-life clinical settings (26, 29, 30, 35).

This randomized controlled trial aims to determine whether a VSG helps nursing students develop the skills and acquire the knowledge necessary to prevent CAUTI. The research hypotheses are:

H0-1:There is no significant difference in Knowledge Test for Preventing Catheter-Associated Urinary Tract Infections (KT-PCAUTI) scores between the experimental and control groups.

H1-1: There is a significant difference in KT-PCAUTI scores between the experimental and control groups

H0-2: There is no significant difference in Skills Assessment Checklist for Preventing Catheter-Associated Urinary Tract Infection (SAC-PCAUTI) scores between the experimental and control groups.

H1-2: There is a significant difference in SAC-PCAUTI scores between the experimental and control groups.

Methods

Research type

This study protocol has adopted a parallel-group, randomized controlled trial design. The study will be conducted under the guidance of Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) (36). This randomized controlled trial (RCT) has been reported based on the Consolidated Standards of Reporting Trials (CONSORT) (37). Table 1 shows the participatory timeline of registration, interventions, and evaluation (36). The study is registered on clinicalTrials.gov (Date: 04.04.2022 & No: NCT05309317).

Table 1. Participant timeline of registration, interventions, and evaluations.*

	STAGES					
	Registration	Intervention (Training on "CAUTI Prevention")	Allocation	Intervention (Virtual Simulation Game)	Post-Allocation	Close-Out
TIMEPOINT	T-1		T0	T1 (Applying the virtual simulation game for seven days after the training on "the prevention of CAUTI")	T2 (Seven days after the training on "the prevention of CAUTI")	T2 (Seven days after the virtual simulation game)
REGISTRATION						
Eligibility screening	X					
Informed consent	X					
Randomization			X			
INTERVENTIONS						
Experimental		X		X		X
Control		X			X	
EVALUATIONS						
Demographic characteristics	X					
Knowledge test	X				X	X
Skill assessment	X				X	X

*Eligibility will be evaluated according to the inclusion criteria. After the eligibility assessment, informed consent will be obtained from all participants. All participants will fill out the questionnaire. After training on CAUTI, participants will be stratified into experimental and control groups. Evaluations will be made at T-1 and T2 times.

Research setting and time

The study will be carried out between April and May 2022 in the spring semester of the 2021-2022 academic year in the Nursing Department of the Faculty of Health Sciences of Gazi University.

Population and sample

The study population will consist of all third-year nursing students from the Nursing Department of the Faculty of Health Sciences of Gazi University in the spring semester of the 2021-2022 academic year.

The sample size was calculated using GPower 3.1. The results showed that a sample of 68 would be large enough to detect significant differences between the experimental and control groups (95% confidence and 95% power) according to the broad-level effect size (f=0.80 Cohen, J) (38). Similar studies have reported a drop-out rate of 20%. Therefore, the target sample size is 82 (18,28,30) (Figure 1).

The sample will consist of 82 nursing students who agree to participate in the study.

Inclusion criteria:

•To successfully complete the Surgical Diseases Nursing course

•Volunteering to participate in the study
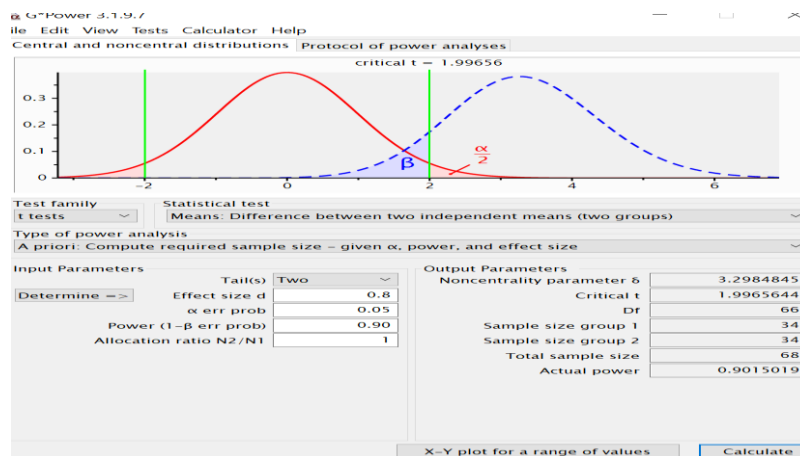
•Having a smartphone or computer and Internet access

Figure 1. Sample Size Calculation Screenshot.

Exclusion criteria

•Failing to fill out the data collection forms at any stage

•Failing to complete the data collection forms

•Not participating in the skill evaluation at any stage

•Not participating in the training

•Not playing or completing the VSG

Randomization

The experimental group participants will play the VSG for seven days after the training. They will be informed that they are expected not to share any information regarding the VSG with the control group participants. The control group participants will be told not to receive any information from the experimental group participants about the VSG. Informed consent will be received from all participants prior to the study.

Randomization will be performed to avoid selection bias, control for temporal effects, and provide a basis for statistical differences. A list will be created according to student numbers after obtaining informed consent. Eighty-two participants will be randomly selected among the students who agree to participate in the study and meet the inclusion criteria. Random selection will be made using the simple randomization method over the Microsoft Excel program.

Participants will be randomized into experimental (VSG) and control (current training) groups. Random allocation will be carried out after all participants fill out the KT-PCAUTI and SAC-PCAUTI (pretest) and receive training on the prevention of CAUTI. Random allocation will be performed using the stratified randomization method according to the overall weighted grade point averages (GPAs). An independent statistician will randomize the participants without the intervention of the researcher. Participants randomly assigned to both groups will be shared only with the researcher.

Blinding

Three academics will evaluate the skills of the participants. The academics will be trained by SAC-PCAUTI and blinded to the groups. A possible bias will be eliminated by this evaluation blind design. In addition, the researcher will enter the data into the Statistical Package for Social Sciences (SPSS) with the experimental and control groups assigned the numbers 1 and 2. A statistician blinded to the groups will analyze the data independently. The CONSORT flow chart is shown in Figure 2.
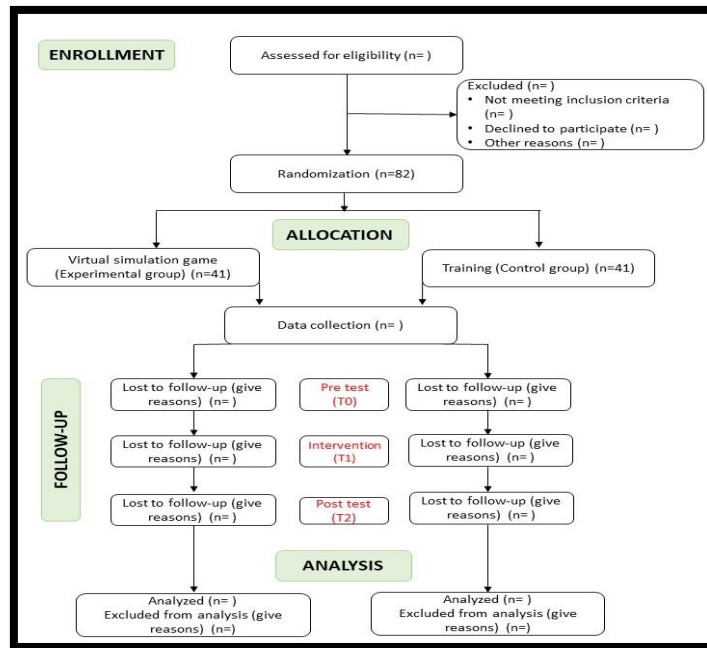

Figure 2. CONSORT flow diagram.

Ethical considerations

The study has been approved by the ethics commission of Gazi University (Date: 24.03.2021 & No: 14574941-199- 57440). Permission has been obtained from the Department of Nursing of the Faculty of Health Sciences of Gazi University. Informed consent is required for the Declaration of Helsinki

(39).Informed consent will be obtained from nursing students prior to the study. After the study, the control group participants will be allowed to play the VSG. Written permission was also obtained from the instructors who took part in the video and those who recorded it.

Data analysis

The data will be analyzed using the Statistical Package for Social Sciences (IBM, SPSS, v 23.0) at a significance level of 0.05. Descriptive statistics (mean, standard deviation, median, percentage, etc.) will be calculated. Normality will be tested using the Shapiro-Wilk test, box-line chart, and histogram. The mean scores will be compared using the significance test for the normally distributed data. The Mann-Whitney U test will be used for the nonnormally distributed data. In categorical variables, the relationship between the two groups will be examined using the chi-square (χ^2) test. The mean KT-PCAUTI and SAC-PCAUTI scores will be compared using the analysis of covariance (ANCOVA). Spearman Correlation will be used to calculate continuous variables.

Primary and secondary outcomes

Outcome measures will consist of evaluations of the experimental and control groups. The primary outcome is the KT-PCAUTI and SAC-PCAUTI scores, while the secondary outcome is the experimental group participants' views of the VSG.

Data collection tools

The data will be collected using the data collection tools below.

Sociodemographic Characteristics Questionnaire

The sociodemographic characteristics questionnaire consists of 11 items on age, gender, high school type, choosing the nursing profession willingly, being happy studying nursing, GPA as of last semester, having played a VSG before, having participated in a course/training on the prevention of CAUTI before, caring for patients with urinary catheters in clinics, and playing virtual games on computers, tablets, or smartphones (16, 18, 19, 23, 24).

Knowledge Test for Preventing Catheter-Associated Urinary Tract Infections (KT-PCAUTI)

The Knowledge Test for Preventing Catheter-Associated Urinary Tract Infections (KT-PCAUTI) was based on a literature review conducted by the researcher to determine students' knowledge of the prevention of CAUTI (1-3,5-8,40-43). The test consists of 25 multiple-choice questions rated on a four-point scale. The total score ranges from 25 to 100.

Skills Assessment Checklist for Preventing Catheter-Associated Urinary Tract Infection (SAC-PCAUTI)

The Skills Assessment Checklist for Preventing Catheter-Associated Urinary Tract Infection (SAC-PCAUTI) was based on a literature review conducted by the researcher to determine students' skills regarding the prevention of CAUTI (1-3,5-8,40-43). The checklist consists of four procedural stages: (1) urinary excretion of a patient with a urinary catheter, (2) mobilization, (3) collecting a sterile urine sample, and (4) removing the urinary catheter. The stages will be evaluated on a scale of 3 to 1: "Performed" (three points), "Partly Performed (Incorrect)" (two points), "Partly Performed (Missing)" (two points), and "Failed to Perform" (one point). The first stage consists of 13 steps (min=13, max=39). The second stage consists of nine steps (min=9, max=27). The third stage consists of 22 steps (min=22, max=66). The fourth stage consists of 13 steps (min=13, max=39). Participants will be asked to perform the interventions on mannequins and standard patients to prevent CAUTI based on the case developed according to the Objective Structured Clinical Examination (OSCE).

The Virtual Simulation Game Evaluation Form (VSGEF)

The Virtual Simulation Game Evaluation Form (VSGEF) consists of two parts. The first part consists of three open-ended questions (What are your positive thoughts about the VSG?, What are your negative thoughts about the VSG?, and What are your recommendations about the VSG?).

The second part is The Virtual Simulation Game Technology Acceptance Survey (VSG-TAS), developed based on the Technology Acceptance Model (44). The survey consists of 21 items on the ease of use (applicability-15 items) and perceived usefulness (usability-6 items) of the game. The items will be rated on a five-point Likert-type scale (1: Strongly disagree, 2: Disagree, 3: Undecided, 4: Agree, 5: Strongly Agree). This survey will be filled out by the experimental group participants after the final skill assessment.

Content Validity and Index

Nine experts in surgical nursing and nursing principles were consulted to determine the content validity of the KT-PCAUTI and SAC-PCAUTI. The experts checked the forms for comprehensibility and relevance. Afterward, the content validity ratio (CVR) and the content validity index (CVI) were calculated using Lawshe's technique (45,46). In Lawshe's technique, the CVR is used to include or exclude items. After determining the CVR, the content validity index is calculated for the entire test.

The KT-PCAUTI questions and the SAC-PCAUTI procedural stages had a CVR of 0.778 and 1, respectively. Since these values were greater than 0, no questions and procedural stages were removed from the scales. The KT-PCAUTI and SAC-PCAUTI had a CVI of 0.96 and 0.99, respectively. According to Lawshe's table, the scales should have a content validity criterion (CVC) of 0.778 from the expert scoring (minimum/critical values of CVRs-CVC). A CVI>CVC indicates that the content validity of the scale items is statistically significant. These results show that the scales have content validity and that expert opinions are statistically consistent (45,46).

We did not make any changes in the scales in terms of content, but we revised them in terms of wording and expression.

Procedure

The study will be performed in three stages. In the first stage, a VSG was developed. In the second stage, a pilot study will be conducted. In the third stage, the effect of the VSG will be determined.

Stage 1: Developing a visual simulation game

A virtual simulation game was designed based on the 11-item Healthcare Simulation Standards of Best Practice published by the International Nursing Association for Clinical Simulation and Learning (47). The game was developed in five stages: analysis, design, development, implementation, and evaluation (Table 2).

•Analysis: Simulation experts were consulted for the content and design of the VSG. A needs assessment was conducted to present evidence of implementation. All procedures were guided by the Healthcare Simulationist Code of Ethics (48). These rules include honesty, transparency, mutual respect, professionalism, accountability, and outcome orientation. In addition, measurable goals based on students' basic knowledge were established.

•Design: Three-dimensional (3D) VSG will be used based on the simulation method. The researcher wrote a script for the VSG. According to the script, each participant will act as a nurse. The participant will care for a 35-year-old male patient who is being followed up for four days after a kidney transplant surgery. The participant is expected to accurately perform and record the four stages of the SAC-PCAUTI (urinary drainage, mobilization, sterile urine sampling, and urinary catheter removal) to avoid CAUTI. The VSG steps have been prepared according to the evidence-based interventions, objectives, and levels of the students. During the VSG, scenario-based questions appear on the screen before the participant performs an intervention. The participant will not be allowed to proceed to the next stage until she answers correctly.

She will be allowed to answer each question more than once. The game consists of seven questions included in the scenario content.

Table 2. The development of a virtual simulation game according to the healthcare simulation standards of best practice.

The development stages of the virtual simulation game	Healthcare simulation standards of best practice
Analysis	1. Simulation-based experiences (SBE) were designed in consultation with content and simulation experts knowledgeable in simulation training, pedagogy, and best practices. 2. A needs assessment was conducted to provide key evidence of a well-designed simulation. 3. Measurable goals based on fundamental knowledge were established.
Design	4. A simulation method was created. 5. A scenario content was designed.
Development	6. Different realistic methods were used to create a perception of reality. 7. Facilitating approaches were planned based on participants' learning objectives, knowledge, experience, and expected learning outcomes.
Implementation	8. Preparation materials and a preliminary information plan were created.
Evaluation	9. Simulation practices will be followed with an evaluation and/or feedback. 10. A plan will be developed to evaluate participants and their simulated experiences. 11. The simulation will be tested before the application.

•Development: The virtual simulation game was designed in three dimensions to create a sense of reality (Picture 1). The game consists of the steps of the SAC-PCAUTI.A video of the steps was taken to help the developer visualize the game. All materials and equipment were photographed so that the developer could design them realistically (Picture 2).

Picture 1. Virtual simulation game screenshots.

Picture 2. Video screenshots.

Based on the participants' learning objectives, knowledge, experience, and learning outcomes, student-centered facilitation approaches were planned before, during, and after the VSG.This will provide an engaging learning environment, guide the participants, and encourage them to think clinically.This will motivate the participants to learn, help them build self-confidence, and make them sensitive to possible infection risks during simulation.

•Implementation: A preparation material and preliminary information plan will be made to guide the participants. A PowerPoint presentation will be given about "the Prevention of CAUTI" as the preparation material. The experimental group participants will be provided with preliminary information to adapt to the VSG.

•Evaluation:The visual simulation game will be evaluated by experts, the researcher, and the software experts for its content and technical evaluations. A pilot study will be conducted with ten third-year nursing students. After the pilot study, a debriefing session will be held with the participants. The PEARLS (Promoting Excellence and Reflective Learning in Simulation) method will be used during the session. PEARLS consists of reaction, definition, analysis, and summary stages (49). The participants will be able to communicate openly, share their experiences, and conduct self-assessments during the session. The session setting will be safe and private. The Virtual Simulation Game Evaluation Form (VSGEF) will be used to evaluate the applicability and usability of the VSG. After the pilot study, modifications will be made, and the final version will be created.

Stage 2: A pilot study for the data collection tools

A pilot study will be conducted with third-year nursing students to assess the KT-PCAUTI for comprehensibility and relevance. The pilot study participants will be told not to share the KT-PCAUTI questions with other people. During the pilot study, the KT-PCAUTI collection duration will be determined, and the questions will be revised based on the feedback from the participants.The item discrimination and difficulty indices of the KT-PCAUTI will be calculated.

Participants who have taken the KT-PCAUTI will attend OSCE to determine the applicability of the steps and the application time of the final version of the SAC-PCAUTI. Three experts in surgical diseases nursing will evaluate the application steps of the form. The researcher prepared the OSCE evaluator and student guidelines. The OSCE guidelines include rules that the evaluators and participants must follow. The comprehensibility of the guidelines will be evaluated, and the final OSCE guideline will be created. During OSCE, participants will perform the stages of the SAC-PCAUTI: (1) urinary excretion of a patient with a urinary catheter, (2) mobilization, (3) collecting a sterile urine sample, and (4) removing the urinary catheter. The evaluators will complete and score the checklist for each stage. The evaluators will also record how long it took participants to complete the stages.Thus, the average times at each station will be determined.

After the pilot study, the data collection tools, and the VSG will be revised and finalized.

Stage 3: Application of research

At this stage of the study, participants will take the KT-PCAUTI and SAC-PCAUTI to determine their knowledge and skill levels regarding preventing CAUTI. The steps of the application phase of the research are as follows:

◎Participants will be recruited from among students who agree to participate in the study and meet the inclusion criteria (n=82).

◎All participants will fill out the KT-PCAUTI (as a pretest) to determine their knowledge levels regarding the prevention of CAUTI.

◎Three academics will use the SAC-PCAUTI to evaluate all participants' skill levels regarding the prevention of CAUTI. Participants will be asked to perform interventions to prevent CAUTI on standardized patients and mannequins based on a case prepared according to OSCE guidelines.

◎All participants will attend the training on the "Prevention of CAUTI." The training will be held with a PowerPoint presentation, which is the current training method in the curriculum. The presentation will also include videos of the application processes. The training will take place at all participants' convenience.

◎Participants will be stratified into experimental and control groups based on their GPAs.

◎The experimental group participants will be informed about the VSG. They will be able to play the game for seven days after the training.

◎The control group participants will have received training on the prevention of CAUTI.

◎The experimental and control groups will take the KT-PCAUTI and SAC-PCAUTI (as a posttest) seven days after the training. Afterward, the control group participants will be allowed to play the VSG.

◎The Virtual Simulation Game Evaluation Form (VSGEF) will be used to determine what the experimental group participants thought about the VSG.

◎The pretest and posttest scores will be compared.

Discussion

There is a large body of research on VSGs in nursing education (28,16,29,30).However, there is only one study conducted on VSGs in nursing education in Turkey (18).Virtual simulation games make learning exciting and motivating, make knowledge permanent through active learning, and help participants develop critical thinking skills (34,26,29,23). Virtual simulation games are compatible with the learning styles of new generation students. More research is warranted to determine the contribution of VSGs to education (28,16,18,33).Therefore, we think that this study will contribute to the literature.

Conclusion

The virtual simulation game will help the experimental group participants have fun learning the interventions to prevent CAUTI. The game will allow them to go over the topics whenever and wherever they like. The game will ensure patient safety because players' decisions will not affect real life. During clinical practice in their post-graduate careers, students will be able to provide correct care to patients with urinary catheters and reduce the risk of CAUTI.

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