

The effect of digital storytelling on nursing students' compliance with isolation precautions and their knowledge levels: A randomized controlled trial

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Abstract

Background: Digital storytelling is a teaching tool that can help nursing students master the curriculum and improve their skills. This study investigated the effect of digital storytelling on nursing students' knowledge levels and compliance with isolation precautions.

Methodology: A pretest-posttest open-label randomized controlled trial. This study was conducted in the nursing department of the faculty of health sciences of a university in Türkiye. The sample consisted of 109 fourth-year nursing students divided into experimental ($n = 66$) and control ($n = 43$) groups. Data were collected using a Demographic Characteristics Questionnaire (DCQ), the Isolation Knowledge Test (IKT), the Questionnaire of Students' Opinions on Digital Storytelling (QSODS) and the Scale of Compliance with Isolation Precautions (SCIP). The experimental group participated a digital storytelling activity, whilst the control group received an education based on the curriculum. The data were analysed using the Mann-Whitney U test, the Wilcoxon test, analysis of variance (ANOVA), and the Spearman correlation test.

Results and Conclusions: The experimental group had significantly higher posttest IKT and SCIP scores than the control group ($p < 0.05$). Both groups had lower IKT and SCIP scores 2 months after the experiment. However, the change was much smaller in the experimental group. Digital storytelling helped the experimental group participants learn about isolation precautions and how to comply with them. Digital storytelling also promotes learning retention. In conclusion, digital tools are effective in distance learning.

KEYWORDS

adult learning, game-based learning, mobile learning, teaching/learning strategies

1 | INTRODUCTION

Whilst healthcare-associated infections are largely preventable, they sometimes result in high morbidity rates and healthcare costs

(Umscheid et al., 2011). The World Health Organization (WHO) declared the novel coronavirus disease (COVID-19) a pandemic in 2019. The coronavirus has spread rapidly since April 2020 and became a global health crisis. The WHO stated that COVID-19

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patients should be isolated for infection control. Isolation is implemented to prevent COVID-19 patients from infecting others (patients, visitors and healthcare personnel). Isolation prevents or slows down the spread of infections (Craven et al., 2013). What is more, most nurses agree that isolation is necessary to avoid hospital infections (Aylaz et al., 2018). As nurses are responsible for monitoring isolated patients, they put their knowledge of isolation precautions into practise to manage the process (Carter et al., 2017; Kim et al., 2021). They use their isolation knowledge, implement standard precautions, and apply the right route of transmission in order to prevent disease transmission from the infected or colonised patients to other patients, healthcare workers, or family members (Craven et al., 2013).

We should identify and address the gaps in nurses' knowledge of isolation precautions because they spend much time with patients. They played a particularly critical role during the pandemic. Fourth-year Turkish nursing students received clinical training to provide care during the pandemic. Nursing students are at high risk of exposure to biological agents during clinical training. Nurses and nursing students should learn about healthcare-associated infections and develop skills to implement preventive measures (Brosio et al., 2017; Kim et al., 2021). Techniques such as demonstration, laboratory studies, simulation and standardised patients use are used to teach nursing students isolation skills during face-to-face teaching (Karataş & Tüzer, 2020). However, distance learning methods have become widespread due to the COVID-19 pandemic. Therefore, students prefer to learn in digital environments (Nabolsi et al., 2021). Distance learning is challenging for nursing students, as they have difficulty filling in the gaps in their knowledge (Morin, 2020; Şanlı et al., 2021). Web 2.0 tools are popular in education because technology is an indispensable part of education for Generation Z. Web 2.0 tools help students build collaboration, communication and participation skills through online tools (Lim & Newby, 2020). Ongor and Uslusoy (2023) determined that multimedia-based education in e-learning positively affected nursing students' academic performance (Ongor & Uslusoy, 2023). They enjoy creativity and innovation and learn whenever and wherever they want. One of the distance teaching techniques is multimedia learning. Multimedia learning theory involves practical applications in designing online learning materials (Cavanagh & Kiersch, 2023; Mayer, 2024). One of those materials is storytelling. According to the principles of multimedia learning, digital storytelling has numerous benefits. Nursing students create pictures by themselves and see them at the same time. This fulfils the temporal cognition principle, which is one of the multimedia principles. It also meets the segmentation principle as users work at their own pace. It also fulfils the signalling principle as it gives clues about isolation. Finally, it fulfils the productivity principle because users produce characters by themselves (Mayer, 2024). Interactive multimedia environments support the learning of Generation Z. Mousavinasab et al. (2020) in their systematic review, emphasised that computers, mobile phones and other multiple technologies should be integrated with traditional education methods to improve nursing process education methods (Mousavinasab et al., 2020).

Students want to learn by playing and storytelling, rather than memorising, and prefer student-oriented and practise-based active learning models instead of conventional lecture-based teaching methods (Chicca & Shellenbarger, 2018). Distance learning also involves digital techniques that promote students' motivation to learn (Yousef & AbuEla, 2019). Therefore, traditional teaching methods should be replaced by innovative ones (Kim et al., 2021; Seo & Jung, 2017). One of these methods is digital storytelling, which can be distance learning (Demirkaya & Ünal, 2019).

2 | BACKGROUND

Storytelling can be traced back to the days before humans could write. It has evolved and taken its place on digital platforms thanks to advances in technology. Digital storytelling may leave a more lasting impression on the target audience than text-based means of communication. Technology provides students with practical learning environments and allows them to enjoy learning and making sense of new information (Balaman, 2016). Digital storytelling is the idea of telling a story, often with strong emotional content, by using a variety of digital multimedia, such as images, audio, music, video and the voice of the narrator (Urstad et al., 2018). Students make digital stories by themselves to promote reflections (Paliadelis & Wood, 2016). Digital storytelling provides student-centred and technology-enriched learning environments (Barrett, 2006). It allows students to create their own stories—it helps them remember important information, reflect on activities, learn deeply and develop critical thinking and problem-solving skills (Tatli et al., 2017). Digital storytelling also promotes creativity and academic performance (Hung et al., 2012; Kirk et al., 2013; Paliadelis & Wood, 2016; Tatli et al., 2017; Xu et al., 2011). It significantly impacts learning success and academic performance and helps students develop 21st-century skills, such as creative thinking, effective communication and research (Talan, 2021). Online resources support face-to-face education and promote teaching performance and learning retention (Terry et al., 2018). Eyuboglu and Gocmen Baykara (2024) stated that digital storytelling is beneficial as it arouses curiosity, attracts attention and helps students focus on the subject and memorise information. Research shows that digital storytelling has many positive effects, such as making health concepts easier to understand, allowing students to build empathy and communication skills, and helping them gain experience on how to provide care (Gazarian et al., 2016; Way & Reed, 2019). Reyhan & Dağlı (2024) stated that digital storytelling encourages creativity, supports learning with fun activities, and improves communication, creativity and problem-solving skills (Reyhan & Dağlı, 2024). Using this innovative technique in combination with other teaching methods in the education system will positively improve students' learning and behavioural changes.

It is more critical to understand isolation since the COVID-19 pandemic began. Nursing students should learn about isolation and comply with isolation precautions. How well nursing students adopt target behaviours determines the quality of care. Nursing education should involve innovative activities and methods to help nurses adopt

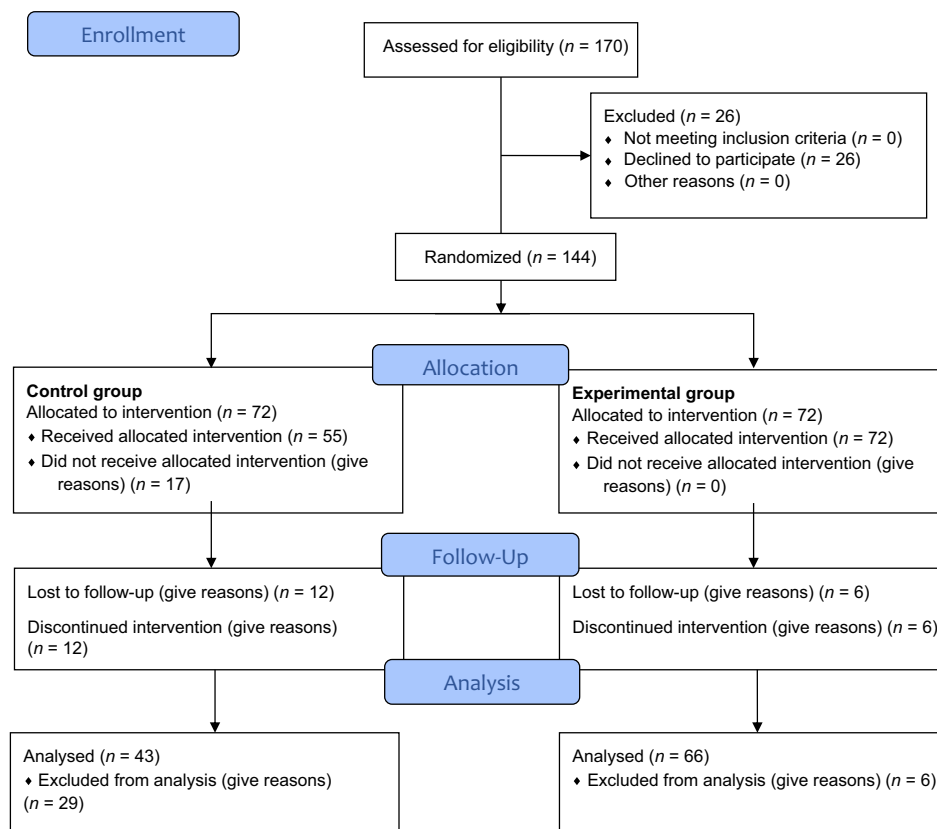


FIGURE 1 CONSORT diagram of this study.

the expected cognitive, psychomotor and adaptive behaviours (Göris et al., 2014). Studies on isolation teaching are generally in the form of traditional (lecture, question-answer) training programmes that evaluate nurses' knowledge and skills (Moreau et al., 2018; Orabi, 2017; Sarier & Kurşun, 2020; Suliman et al., 2018). There is a main theme of research into digital storytelling in nursing education (Beierwaltes et al., 2020; Paliadelis & Wood, 2016; Price et al., 2015; Tatli et al., 2017). Beierwaltes et al. (2020) stated that digital storytelling increased the power of putting family nursing knowledge into practise. Paliadelis and Wood (2016) reported that digital storytelling helped students gain clinical experiences. Price et al. (2015) found that digital stories increased students' knowledge of palliative care (Price et al., 2015). Tatli et al. (2017) stated that digital stories were effective in helping students develop empathy and implement case analysis processes (Tatli et al., 2017). However, no researchers have investigated the effect of digital storytelling on nurses' knowledge of isolation. This study investigated the effect of digital storytelling on nursing students' compliance with isolation precautions and their knowledge levels.

3 | METHODS

3.1 | Design

This study was a pretest-posttest open-label randomised controlled trial. Both participants and researchers in open-label studies know what the procedure is.

3.2 | Participants

The study population comprised 170 final-year students in the spring semester of the 2020–2021 academic year in the nursing department of the faculty of health sciences at a university in Türkiye. The pretest sample consisted of 144 participants, whilst the posttest sample consisted of 109 participants (Figure 1).

The inclusion criteria were as (1) being a 4th-grade nursing student, (2) having an appropriate mobile device, (3) having access to the Internet and (4) volunteering. The exclusion criterion was failing to fill out the data collection tools.

All participants were randomly assigned to control and experimental groups. The study was registered at [ClinicalTrials.gov](https://clinicaltrials.gov) with identifier NCT05022953. A power analysis (G*Power 3.1) was performed based on Tatli et al. (2017). Since fourth-year nursing students learned isolation skills in the first year, that study was taken as a reference to calculate the sample size. The results showed that a sample of 26 participants would be large enough to detect significant differences (effect size 1.49, power of 95%, and significance level of 0.05) (Tatli et al., 2017). The final sample consisted of 109 participants (experimental group = 66 and control group = 43).

3.3 | Data collection

The data were collected using a Demographic Characteristics Questionnaire (DCQ), the Isolation Knowledge Test (IKT), the Scale of

Compliance with Isolation Precautions (SCIP) and the Questionnaire of Students' Opinions on Digital Storytelling (QSODS).

The DCQ was developed by the researchers (Orabi, 2017; Özden & Özveren, 2016; Sarier & Kurşun, 2020). It had nine items. The results showed that the groups had similar characteristics.

The IKT was based developed by the researchers (Doğanay et al., 2013; Erden et al., 2015; Karabay et al., 2018). The researchers consulted three experts to develop the test. The draft test consisted of 40 items. A pilot study was conducted to check the items for intelligibility and relevance and to calculate item difficulty and item discrimination indices. The pilot sample consisted of 85 nurses with bachelor's degrees. The researchers sent all participants a link to the test. Based on the results, 15 items were removed. The final test consisted of 25 items, to which participants replied "True" (one point), "False" (zero points), or "I do not know" (zero points). The total score ranged from 0 to 25. The items had heterogeneous degrees of difficulty, and therefore, reliability was calculated using the KR-20. The results showed that the test was reliable (KR20 = 0.724, Cronbach's alpha = 0.756).

The SCIP was developed by Tayran and Ulupinar (2011). The instrument consists of 18 items rated on a five-point Likert-type scale ("1 = Strongly disagree", "2 = Disagree", "3 = Neither agree nor disagree", "4 = Agree", "5 = Strongly agree"). Five items (1, 8, 11, 13 and 18) are negative items that are reverse scored. The total score ranges from 18 to 90. High scores indicate more compliance with isolation measures. The scale has four subscales: transmission route, employee and patient safety, environmental control and hand washing, and use of gloves. The scale has a Cronbach's alpha score of 0.85 (Tayran & Ulupinar, 2011), which was 0.86 (pretest), 0.78 (post-test) and 0.89 (re-test) in the present study.

The QSODS was developed by the researchers (Doğanay et al., 2013; Erden et al., 2015; Karabay et al., 2018). The questionnaire consisted of three open-ended questions on (1) the contribution of digital storytelling to learning, (2) the effect of digital storytelling on students' compliance with isolation precautions and knowledge levels and (3) students' opinions about digital storytelling.

3.4 | Procedure

Some undergraduate nursing courses (Fundamentals of Nursing, Internal Medicine Nursing, Surgical Nursing and Patient and Staff Safety) offer theoretical and applied training in isolation. The sample consisted of fourth-year nursing students. Participation was voluntary. All participants were sent a link to the DCQ, IKT and SCIP (Google Forms). The sample was divided into two groups (experimental and control) based on their pretest IKT and SCIP scores. The students were randomly assigned to control and experimental groups. First, the students' grades were ranked from highest to lowest. Then they were randomised from top to bottom and divided into groups. Two researchers were involved as instructors in planning, implementing and evaluating digital storytelling. Instructors are experts in the field of fundamentals of nursing. The instructors gave the experimental

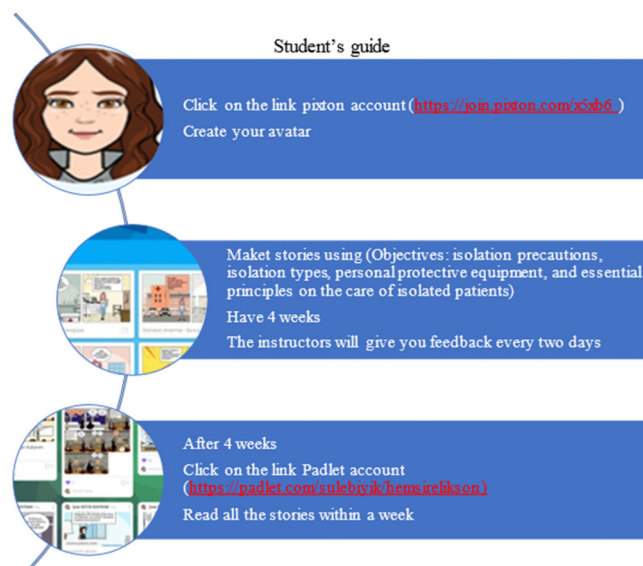


FIGURE 2 Student's guide.

group participants a 15-min briefing about what digital storytelling is, how to perform digital storytelling, sample application demonstration and brief information about isolation. Figure 2 shows the procedures. They also told them not to talk to the control group participants about the content of the briefing. The instructors first created a WhatsApp group with the experimental group participants. They shared the steps to follow for digital storytelling. The instructors created a Pixton account (<https://edu.pixton.com/educators/>) and a class named "Isolation". They sent the link (<https://join.pixton.com/x5xb6>) to the experimental group participants and asked them to click on the link and make stories using their knowledge of isolation over 4 weeks. The instructors checked the participants' stories and gave them feedback every 2 days. The suitability of the story contents for the objectives of isolation (objectives: isolation precautions, isolation types, personal protective equipment and essential principles on the care of isolated patients) was evaluated. The participants were given feedback to prepare the contents outside the objectives by the objectives. Also, the instructors asked the participants to explain their isolation information through digital storytelling. He examined the story visuals and writings. The accuracy of the participants' characters and writings were evaluated. Feedback was provided on WhatsApp. Erroneous information was corrected.

At the end of the 4 weeks, the instructors created a Padlet account (<https://tr.padlet.com/dashboard>) and shared the stories there. The instructors sent the link to the experimental group participants and asked them to read all the stories within a week. Through the Padlet, the participants were able to see each other's stories, write comments and ask questions. Those who did not create stories or read the stories were excluded. The researchers could also see their stories. The stories were checked 3 days a week, and a feedback message was sent to the researcher via WhatsApp. The participants told stories on Pawtoon in their free time when they were available. They did not experience any problems.

The researcher used traditional teaching methods (direct lecture, discussion and Q&A) and made a 60-min PowerPoint presentation to teach the control group participants the subject. After the experiment, all participants filled out the IKT and SCIP as a posttest. At the end of the study, the experimental group participants also filled out the QSODS. All participants filled out the IKT and SCIP (re-test) again 2 months after the experiment. The fact that the participants completed their clinical practise after 2 months was regarded as enough time for the re-test (Wu et al., 2009). After data collection, the stories were also shared with the control group participants. The researchers knew which group the students belonged to, and to avoid bias, the participants filled out the questionnaires by themselves.

3.5 | Data analysis

The data obtained from the study were analysed using the SPSS version 23.0 (Statistical Package for Social Sciences) software package. Number, percentage, mean, median and standard deviation values were used in the descriptive statistical evaluation of the data. A one-sample Kolmogorov–Smirnov test was used to evaluate data with normal or non-normal distribution. Nonparametric tests were used to indicate non-normal distribution. The Mann–Whitney U test was used to compare continuous quantitative data amongst the two independent groups. The Wilcoxon test was used for the matched groups to determine the differences between the first and last scores. Friedman Test in repeated measurements and Spearman correlation analyses were performed to determine the relationship with knowledge and precautions of isolation. If the r value is between 0.01–0.29, it is defined as a weak relationship (Büyükoztürk, 2016). The data were evaluated at a 95% confidence interval and a $p < 0.05$ significance level.

4 | ETHICAL CONSIDERATIONS

This study was approved by the University Ethics Committee (approval no: 24237859-779) on December 21, 2020. All the necessary explanations were offered to the students about the study's aim, content and methodology. Participation was voluntary, and participants were guaranteed that they could leave the study without stating any reasons. An informed consent form was provided by those who agreed to participate. The control group received the educational programme given to the experimental group after data collection.

4.1 | Results

The experimental ($n = 66$) and control ($n = 43$) group participants had a mean age of 22.57 ± 2.28 and 21.79 ± 0.80 , respectively. The experimental group consisted of 56 (84.8%) women and 10 (15.2%) men. The control group consisted of 38 (88.4%) women and 5 (11.6%) men. Most control group participants took the “Fundamentals of

Nursing” course (72.7%). More than half of the experimental group participants took the “Fundamentals of Nursing” course (52.2%). More than half of the experimental group participants stated that the isolation training was adequate (58.1%). Half of the control group participants stated that the isolation training was adequate (50%). Most experimental group participants stated that they applied more than one isolation prevention skill during their clinical practise (71.2%). More than half of the control group participants stated that they applied more than one isolation prevention skill during their clinical practise (58.1%). Half of the experimental group participants stated that they were proficient or partially proficient (50%). More than half of the control group participants stated that they were proficient or partially proficient (55.8%). Less than half of the experimental group participants stated that the reason for inadequate isolation measures was workload (45.5%). Less than half of the control group participants stated that the reason for inadequate isolation measures was workload (44.2%). Most experimental group participants stated that they took contact isolation precautions (78.8%). More than half of the control group participants stated that they took contact isolation precautions (67.4%). All experimental group participants wore gloves as personal protective equipment (100%). Most control group participants wore gloves as personal protective equipment (95.3%) (Table 1). There was no statistically significant difference in pretest scores between the two groups ($p > 0.05$).

There was a significant difference between scores, higher post and re-IKT scores than the pre IKT scores in the experimental group ($p = 0.001$). There was no significant difference in pre KT scores between the experimental and control groups. However, there was a significant difference in post IKT scores between the groups ($p = 0.003$). There was no significant difference between the control groups' pre, post and re-IKT scores (Table 2).

There was a significant difference between the experimental group's pre, post and re-total SCIP scores ($p = 0.019$). The experimental group had significantly higher post SCIP scores than the pre SCIP scores ($p = 0.003$). There was no significant difference in pre SCIP scores between the experimental and control groups. However, there was a significant difference in post SCIP scores between them ($p = 0.027$). There was no significant difference between the control group's pre, post and re-SCIP scores.

There was no significant difference in pretest “Transmission route” and “Environmental control” sub-dimensions scores between the experimental and control groups. However, there was a significant difference in posttest SCIP scores between them ($p = 0.033, 0.008$) (Table 3).

There was a weak correlation between pre and post IKT scores and pre and post SCIP scores in the control group. There was a moderate correlation between pre and post IKT scores and a weak correlation between pre and post SCIP scores in the experimental group. There was a weak of pre and post SCIP scores and post IKT and pre SCIP scores in the experimental group. There was a moderate correlation between re- and post IKT scores and a strong correlation between the control group's re and pre IKT scores. There was a weak correlation between re-IKT and post IKT scores and between re and

TABLE 1 Distribution of students according to descriptive characteristics.

	Groups Control (n = 43)	Experimental (n = 66)	Statistical analyse
Age (Mean ± SD)	21.79 ± 0.80	22.57 ± 2.28	
Min.-Max.	(21–24)	(21–38)	
	n (%)	n (%)	
Gender			
Female	38 (88.4)	56 (84.8)	p = 0.85
Male	5 (11.6)	10 (15.2)	X ² = 0.033
In which class did you take isolation precautions?			
Fundamentals of Nursing	22 (51.2)	48 (72.7)	p = 0.271
Internal Medicine Nursing	6 (14)	8 (12.1)	X ² = 0.727
Patient and Staff Safe	15 (34.9)	10 (15.2)	
Qualification status of isolation training			
Qualification	25 (58.1)	33 (50)	p = 0.09
Unqualification	7 (16.3)	20 (30.3)	X ² = 2.316
Encounter with isolation measures			
I have never met	4 (9.3)	3 (4.5)	p = 0.13
I encountered it once during my clinical practice	14 (32.6)	16 (24.2)	X ² = 2.245
I have encountered this more than once during my clinical practice	25 (58.1)	47 (71.2)	
The situation of finding the isolation applications sufficient			
Not enough at all	-	8 (12.1)	p = 0.79
Partly enough	15 (34.9)	33 (50)	X ² = 10.88
Sufficient	24 (55.8)	20 (30.3)	
Quite enough	3 (7)	4 (6.1)	
Very enough	1 (2.3)	1 (1.5)	
Reasons for inadequate isolation applications			
Employee shortage	11 (25.6)	16 (24.2)	p = 0.92
Workload	19 (44.2)	30 (45.5)	X ² = 0.028
Non-compliance with protocols	13 (30.2)	20 (30.3)	
Type of isolation used in clinical practice			
Standard isolation	22 (51.2)	31 (47)	
Contact isolation	29 (67.4)	52 (78.8)	^a
Respiratory isolation	14 (32.6)	29 (43.9)	
Droplet isolation	16 (37.2)	23 (34.8)	
Personal protective equipment used			
Glove	41 (95.3)	66 (100)	
Disposable mask	28 (65.1)	44 (66.7)	
N95/FFP2 mask	7 (16.3)	12 (18.2)	
Disposable apron	16 (37.2)	28 (42.4)	
Glasses	6 (14)	12 (18.2)	
Face protector	4 (9.3)	7 (10.6)	
Bonnet	6 (14)	25 (37.9)	^a
Foot protector	2 (4.7)	11 (16.7)	
Protective overalls	1 (2.3)	2 (3)	

^aAnalysis was not performed because more than one answer was given.

Knowledge test			Statistical analyse	
	Control (n = 43)	Experimental (n = 66)		
Score	Median (min.–max.)	Median (min.–max.)	p^a	U
Pre	19 (8–22)	17 (1–23)	0.248	1234.0
Post	18 (8–22)	19 (15–23)	0.003^d	942.0
p^b	0.248	0.001^d		
Z	1.155	4.970		
Re	18 (0–25)	18 (6–32)	0.504	1281.0
p^c	0.262	0.001^d		
Z	3.380	0.389		

^aMann Whitney U.

^bWilcoxon Test.

^cFriedman Test.

^dValues in bold are statistically significant ($p < 0.05$).

TABLE 2 The difference between the control and experimental group students' pre, post, and re-test knowledge and SCIP scale scores.

pre, post SCIP scores in the experimental group. There was a weak correlation between re SCIP and pre-post IKT scores in the control group. There was a moderate correlation between re- and pre SCIP scores and an inadequate correlation between pre, post IKT and re-SCIP scores in the control group (Table 4).

4.2 | Students' opinions

The following are quotations from the experimental group participants about digital storytelling. These statements were selected randomly. Only participants were quoted.

"I realized that I had some gaps in my knowledge of isolation methods and protective measures. It [digital storytelling] helped me fill those gaps". [Student (S). 10].

"I think that it's [digital storytelling] fun and instructive. I helped me go over what I already knew and learn new stuff" [S.12].

"We've had distance learning for a long time, so this storytelling thing helped me feel like I was in it" [S.54].

"We had fun dialogues that made me learn things for good" [S.66].

"It was fun, so I got to learn stuff by practice, and I got to keep things in mind" [S.55].

"I think that it affects visual intelligence positively. Visuals and colours make it easier to remember things" [S.56].

"It helped me remember things I forgot, and I learned more" [S.23].

"I can say that I learned more" [S.24].

"It's so much fun to learn this way than just to read texts. It also helped me remember things I forgot and learn more stuff" [S.58].

"I got to go over what I already knew, and it was more permanent. I believe that it'll contribute much to education because it applies to all fields" [S.63].

"It was a different teaching technique. It was so helpful for learning retention; we got to remember the isolation precautions as they are critical during the pandemic". [S.45].

"From now on, I'll be more careful" [S.17].

"As a trainee nurse working during the pandemic, I've realized once again how important the isolation precautions are" [S.52].

"I'm sure I'll remember the dialogues my classmates came up with when I put those methods into practice, and so it'll be much more fun" [S.66].

4.3 | Discussion

The COVID-19 pandemic has clarified how important it is for nursing students to master and comply with isolation precautions. Our results showed that digital storytelling helped the experimental group participants learn more about isolation. Students presented the practises they knew about isolation skills on Pawtoon by storytelling. Thus, they remembered the practises they did in clinics and researched to write accurate information whilst narrating. Students stated that they remembered and updated their knowledge in this way. In this respect, it can be said that storytelling methods are effective in remembering and permanence of information. They also achieved learning retention and showed higher compliance with isolation precautions. Although nurses know about isolation precautions, they have difficulty putting them into practise (Moriceau et al., 2016; Suliman et al., 2018; Tufail et al., 2017). Suliman et al. (2018) found that almost all nurses knew enough about isolation precautions, but only half complied with them. This suggests that nurses have difficulty complying with isolation precautions and putting them into practise. More than half of our participants (both in the experimental and control groups) stated that they learned about isolation in classes. Nursing students learn about isolation in their first year. However, the memorability of the information decreases, and it takes time to gain an attitude. The test results also confirm this.

Both groups had slightly higher pretest IKT scores than average, indicating that undergraduate nursing education does not provide learning retention. Universities should offer regular training that involves teaching methods to ensure learning retention (Moreau

TABLE 3 The difference between the control and experimental group scores according to the sub-dimensions and total of the SCIP scale.

Sub-dimensions of the scale of compliance with isolation measures	Score	Control group Median (min.–max.)	Experimental group Median (min.–max.)	p^a	U
Total score	Pretest	80 (54–90)	81 (54–90)	0.281	1245.5
	Posttest	82 (65–89)	84 (69–90)	0.027	1064.0
	p^b	0.437	0.003		
	Z	0.777	2.925		
	Re-test	80 (34–90)	82 (58–90)	0.037	1055.50
	p^b	0.440	0.019^c		
	Z	2.171	1.926		
Transmission route	Pretest	27 (21–29)	27 (21–29)	0.790	0.267
	Posttest	24 (16–25)	24 (18–25)	0.033^c	2.134
	p^b	0.000^c	0.000^c		
	Z	5.538	6.310		
	Re-test	24 (17–25)	23,5 (5–25)	0.282	1.077
	p^b	0.047^c	0.624		
	Z	1.985	0.491		
Employee and patient safety	Pretest	27 (18–30)	28 (16–30)	0.203	1.272
	Posttest	28 (21–30)	29 (1–30)	0.051	1.953
	p^b	0.173	0.011^c		
	Z	1.364	2.546		
	Retest	23 (16–25)	22 (13–25)	0.072	1.798
	P	0.000^c	0.000^c		
	Z	7.022	5.639		
Environmental control	Pretest	17 (12–20)	18 (12–20)	0.020	2.323
	Posttest	18 (12–20)	19 (15–20)	0.008^c	2.671
	p^b	0.291	0.055		
	Z	1.055	1.919		
	Re-test	18 (13–20)	17 (4–20)	0.046	1.994
	p^b	0.110	0.658		
	Z	1.600	0.443		
Use of hand hygiene gloves	Pretest	13 (9–15)	13 (8–15)	0.481	0.705
	Posttest	13 (10–15)	13 (10–15)	0.942	0.073
	p^b	0.895	0.627		
	Z	0.132	0.486		
	Re-test	13 (9–15)	12 (7–15)	0.223	1.218
	p^b	0.306	0.003^c		
	Z	1.023	2.977		

^aMann Whitney U.^bWilcoxon.^cValues in bold are statistically significant ($p < 0.05$).

et al., 2018). There was no significant difference in pretest IKT scores between the experimental and control groups, suggesting that they were comparable. The experimental group had significantly higher posttest IKT scores than the control group. Sarier and Kurşun (2020) reported that most nurses found their knowledge of isolation precautions adequate. The experimental group developed skills relevant to clinical practise, such as landscaping applications in the clinic. But the

control group was not developed, because there was no expectation that students would remember their knowledge, prompting them to research.

Although both the experimental and control groups had lower re-IKT scores (2 months after the experiment) than posttest scores, the former group had significantly higher re-IKT scores than the latter. Research also shows that digital tools integrated into face-to-face

TABLE 4 Correlation between knowledge of isolation and adaptation to isolation precautions scale scores of students in the control and experimental groups.

Score	Control group					Experimental group				
	Pre IKT	Post IKT	Pre SCIP	Post SCIP	Re-SCIP	Pre IKT	Post IKT	Pre SCIP	Post SCIP	Re-SCIP
Pre IKT										
p^a	-	0.000^b	0.989	0.233	-	-	0.000^b	0.086	0.035	-
r	-	0.434	0.002	0.149	-	-	0.694	0.265	0.323	-
Pre SCIP										
p^a	0.989	0.557	-	0.000^b	-	0.086	0.032^b	-	0.002^b	-
r	0.002	0.074	-	0.462	-	0.265	0.328	-	0.463	-
Re-ICKT										
p^a	0.000^b	0.001^b	0.001^b	0.092	0.394	0.030^b	0.003^b	0.807	0.867	0.394
r	0.727	0.501	0.489	0.561	0.001	0.267	0.360	0.031	0.021	0.001
Re-SCIP										
p^a	0.001	0.037	0.000	0.014	-	0.607	0.054	0.000	0.005	-
r	0.476	0.324	0.654	0.376	-	0.065	0.238	0.451	0.339	-

^aSpearman correlation.^bValues in bold are statistically significant ($p < 0.05$).

education promote learning retention (Padilha et al., 2019; Woolwine et al., 2019). Orabi (2017) found that medical students who attended a health education programme had higher knowledge of aseptic techniques. She also reported a positive correlation between knowledge and compliance (Orabi, 2017).

We also detected a positive correlation between our participants' knowledge of isolation and their compliance with isolation precautions. This result suggests that nursing students who know more about isolation precautions are more likely to comply with them. Our results indicate that digital storytelling helps students learn about isolation and comply with isolation precautions. Digital storytelling is a promising tool that provides distance learning to medical students (Kearns & Kearns, 2020; Price et al., 2015). Our experimental group participants stated that digital storytelling was a fun and informative method that helped them remember and learn more about isolation precautions in a more permanent way.

Research shows that nurses have good SCIP scores (Arli & Bakan, 2017; Doğu & Tiryaki, 2017; Geçit & Özbayır, 2020; Sarier & Kurşun, 2020; Şatır et al., 2019). We found similar results. There was no significant difference in pretest SCIP scores between experimental and control groups, indicating similar levels of compliance with isolation precautions. However, both groups had higher posttest SCIP scores than pretest scores. Moreover, the experimental group participants had significantly higher posttest SCIP scores than the control group, suggesting that digital storytelling promoted learning retention and compliance with isolation precautions. There was a drop in retest-SCIP scores in both groups, but the experimental group had significantly higher retest-SCIP scores than the control group. Sarier and Kurşun (2020) determined that nurses had high isolation scores. Sertçelik et al. (2023) found that healthcare professionals working in the Adult Emergency Department had a moderate knowledge of isolation precautions.

According to these results, nursing students who learn more about isolation and comply with isolation precautions are more likely to achieve learning retention and provide high-quality care. Therefore, our results show that different training and activities are essential for nursing students to acquire knowledge and develop skills. The experimental group participants also stated that they had appreciated isolation precautions more since the pandemic began and that they would pay much more attention to them both in theory and practise.

Research has shown that nurses have SCIP total and subscale scores that are slightly higher than average (Düş Tatlıcılar, 2019; Özden & Özveren, 2016). However, our participants had higher SCIP total and subscale scores than had been reported by earlier studies. Özden and Özveren (2016) reported that nurses were good at complying with isolation precautions. Küçük and Yazar (2021) stated that paediatric nurses had high skills in taking isolation precautions. Our experimental group participants had significantly higher SCIP scores than the control group participants. The experimental group also had higher SCIP subscale scores than the control group. However, the difference was significant only in the "mode of transmission" and "environmental control" subscales. The difference between the two subscales is that the education in the experimental group created the skills they encountered and frequently practised in clinical practise. Students make applications related to landscaping in the clinic more during the maintenance process.

Digital storytelling helps students enjoy distance learning (Kearns & Kearns, 2020). Moreau et al. (2018) report that digital storytelling is used to help students develop clinical skills, teach them the concepts of individual patient- and family-centred care, and provide care for those with chronic health problems. Anand et al. (2018) argue that digital storytelling can be integrated into nursing and medical courses. Tatli et al. (2017) found that nursing students who attended

a digital storytelling activity recognised patients' physical and emotional needs than those who did not participate in the activity. The researchers recommended that digital storytelling be used in education (Tatli et al., 2017). Rodríguez-Almagro et al. (2021) also consider digital storytelling a viable method for improving students' knowledge. Our participants also stated that digital storytelling had helped them enjoy learning and remember their prior knowledge. They concluded that digital storytelling was a promising tool for education.

4.4 | Conclusion

Technological learning methods allow Gen Z to study outside of class whenever and wherever they want. Distance learning offers students different learning opportunities. Our results show that nursing students comply with isolation measures and ensure the permanence of knowledge with digital storytelling, a multimedia method outside of class. It is recommended that these and similar practises be used and disseminated to develop knowledge, skills and attitudes in applied departments, such as nursing education.

4.5 | Limitations of the study

This study has several limitations. The sample included only fourth-year students. The sample size was small. Blinding could not be provided since the researchers knew which group the students belonged to. More research is warranted to better understand the effect of digital storytelling on different subjects in nursing education.

AUTHOR CONTRIBUTIONS

Sule Biyik Bayram: Conceptualization; investigation; funding acquisition; writing – original draft; methodology; writing – review and editing; visualization; software; formal analysis. **Emel Gülnar:** Conceptualization; methodology; writing – review and editing; writing – original draft; investigation. **Nurcan Caliskan:** Conceptualization; methodology; writing – review and editing; software; investigation; writing – original draft. **Çiğdem Torun Kılıç:** Conceptualization; methodology; writing – original draft; writing – review and editing; investigation.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data supporting the results reported in a published article can be found.

ETHICS STATEMENT

This study was approved by the University Ethics Committee (approval no. 24237859-779) on December 21, 2020.

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