Research article

User experiences of patients' relatives with a computer game about pressure ulcer prevention: a descriptive qualitative study

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ABSTRACT

Background Patients' relatives are members of the care team. Obtaining their cooperation and empowering them by providing education is crucial for pressure ulcer (PU) prevention practices to be successful. Accordingly, innovative educational methods and continuous evaluation are needed.

Aim This study aimed to evaluate the user experiences of patients' relatives regarding a three dimensional web-based computer game developed for PU prevention training.

Methods The descriptive qualitative study was conducted between November 2021 and February 2022. PreSore: Pressure Ulcer Prevention Game (PPUPG) was developed, and participants (n = 55) were asked to play the game. An interview was performed at the end of the gameplay through the Gaming Experience Interview Questionnaire. Data were analysed using descriptive statistics and qualitative inductive content analysis.

Results The main categories regarding user experience were: learning motivation; responsibility; empathy; authenticity knowledge and learning; awareness; care components; and appropriateness. The most prominent sub-categories were: happy to be informed; desire to care for the virtual patient properly on time; feeling the difficulty of patient care; recognising the patient with PU risk; learning the bedridden patient care; an effective method and enjoyable.

Conclusion The data showed that PPUPG helped to create awareness about a virtual game-based approach for PU training, and users accepted the game as an educational method.

Implications for clinical practice This study lays the groundwork for the future education of individuals and communities through digital platform games about prominent health issues.

Keywords Digital games, pressure ulcers, prevention, serious games, virtual games, user experience

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KEY MESSAGES

- Games on digital platforms are one of the global pedagogical approaches.
- Educational games on digital platforms should be evaluated continuously by obtaining user experiences.
- The data obtained in the study can be used to develop tools and evaluation criteria for understanding the user experience and continuous development of educational games.

INTRODUCTION

Digital education has gained popularity due to the increased opportunities to access various digital devices in recent years.[1,2] Digital education, whether used as a blended or standalone teaching method, is defined as the act of learning and teaching through digital technologies.[3,4] According to the features of the technology and teaching techniques used, digital education is classified as online and offline digital education, electronic learning, digital game-based learning, digital gamification, psycho-motor skills trainers, virtual reality environments, virtual patient simulations, and mobile learning tools.[5,6,7]

Games on digital platforms, in which the gamification method is integrated with educational technologies, are accepted among one of the global pedagogical approaches for today's learners.[8,9] These games aim to promote knowledge acquisition through competitive activities aligned with determined learning objectives. They are usually designed as simulations in a virtual environment and are closely related to game-based learning.[3] Game-based learning means achieving defined learning outcomes through game content and

enhancing learning by incorporating problem-solving areas and challenges that provide learners or players with a sense of achievement.[10,11]

Contrary to the perception that games are generally preferred as an educational method for children and young people, it has been reported that individuals of all ages can learn through games.[9] Players aim to reach specific goals in games used for educational purposes by interacting with the game mechanics in a virtual world. In addition, due to the desire to win triggered by the game elements presented in the games, players discover and actively participate in the game flow while solving problems in the virtual environment. Thus, players have an enjoyable gaming experience, and an increased interest in the subject is created. If desired, the player or learner can replay the game and repeatedly experience the entire process and in-game elements. Repetitive game-playing experiences provide a flexible learning environment by enabling trial and error.[9,12,13]

Educational games on digital platforms should be evaluated continuously. This evaluation is critical in planning the ongoing improvement of games by determining their quality and functional features and their effect on users.[14,15,16] User experience is among the main components in the evaluation of games.[9] In the systematic review study by Calderon and Ruiz (2015)[17], 119 studies using games developed for a specific purpose from different disciplines were examined. In the study, the methods used in the evaluation of games were determined mainly by questionnaire (n=92), interview (n=21), observation (n=8), and the evaluation criteria were learning outcomes (n=47), usability (n= 7), user experience (n=23).[17]

In the context of educational games on digital platforms, user experience is the determinant of the acceptability of the game.[18] During the development process of traditional entertainment games, various methods and tools for game mechanics, game systems, and software are used to evaluate user experience.[19] On the other hand, it is essential to perform a game-specific evaluation due to various factors, such as the development purposes of educational games, the technology used, the expectations from the game, and the characteristics of the user group (as single or multiplayer, educational level, gaming experience, etc.).[16,20]

Patients and their informal caregiver relatives must be included in the care processes to ensure the success of disease management and improving health. This practice forms the basis of the person-centered care philosophy and is a community-based approach. In this context, there is a need to educate and strengthen the relatives who care for patients as informal caregivers and to increase their health literacy.[21,22] Pressure ulcers (PUs) are a worldwide health problem, and prevention has always been the focus of clinical practices. Educating healthcare professionals, patients, and their relatives is recommended within the scope of attempts to prevent PUs.[23] On the other hand, prevention and care of PUs, especially in the home care setting, is a complex process and requires patients' relatives to have special knowledge and skills.[24] It has been reported that the incidence of these wounds could be significantly reduced by educating caregiver relatives.[25]

Cooperation between healthcare professionals and the relatives of the individuals receiving care for various health needs in and outside hospitals supports positive patient care outcomes. It can also contribute to the prevention of PUs. The skills of patients' relatives can be strengthened using new educational approaches in line with current scientific knowledge to support person-centered care and create social awareness about PUs.[22,26] Moreover, the development of technology-based innovative approaches to educating relatives, who are key care team members, illustrates the importance of education for preventing PUs in the care process. It is crucial to continuously update educational approaches based on the experiences and feedback of the target education group to increase their effectiveness.[17] In this context, this study aimed to evaluate the user experiences of patients' relatives regarding a web-based computer game, explicitly designed to educate them on PU prevention. Examination of relevant literature found that studies on evaluating educational games developed for patients' relatives and community education on health issues were very limited. The game developed within the scope of the study is the first game aimed at educating people other than health professionals on wound issues. In this regard, it is expected that the game and evaluation results of this study, developed especially for PUs, will guide the games to be developed in this field in the future.

METHODS

Aim and study design

The study was conducted as a descriptive qualitative study to evaluate the user experiences of a three-dimensional (3D) web-based computer game called PreSore: Pressure Ulcer Prevention Game (PPUPG). The game was developed to educate patients' caregiver relatives about PU prevention.

The following research questions were addressed in the study;

1. Which components are included in the user experience of the patients' relatives regarding PPUPG?
2. What are the opinions of the patients' relatives regarding PPUPG?

The Standards for Reporting Qualitative Research (SRQR) checklist was used in reporting the study.[27]

Study material

The PPUPG, a web-based computer game, was used in the study. This game was deveopled to educate patients' caregiver relatives on PU prevention. The game incorporates gamification, 3D modeling, and animation. Unity 3D simulation development platform and c# programming language were used to develop the PPUPG. A specialised game development team comprised one computer engineer academic specialising in modeling and simulation, one graphic design specialist, and one software development specialist who worked with researchers while creating the simulation software of the PPUPG. The researchers consisted of nurse academics working in wound care.

A patient profile (virtual patient) was integrated into the game world (virtual game simulation environment). The virtual patient had a risk of PU and care practices within the scope of PU prevention practices that should be included in a patient's daily care routine. The virtual game world reflects the experience of the virtual patient receiving care at home and

consists of the care environment. A player's main task in the PPUPG is to complete the preventive care practices in the daily home care routine of the virtual patient within a 12-minute game cycle in the game simulation environment. The main purpose of performing tasks in a certain period of time is to encourage immersion and in-game motivation by exposing the player to a challenge or a compelling factor. In this context, all instructions, materials and tools required to guide and enable the player to perform these tasks are integrated into the game world. These include instructions, a task list, task tools, materials and clues.

In-game tasks related to the care of the virtual patient were designed by taking into account the recommendations of international guidelines addressing PUs.[23,28] In this regard, three main task categories were defined as follows: a) Being organised, b) Hygiene and care and c) Patient status. Subtasks of each main task category were formed. The being organised tasks, include actions for planning care, such as reading the PU Information Booklet, establishing the virtual patient's care routine and reporting to the stoma and wound care nurse. Hygiene and care tasks include a head-to-toe skin check, skin care, selecting proper skin care products and other hygienic care activities, including incontinence care, body cleaning, checking and care of the medical equipment and other devices in the patient bed. The patient status tasks include care activities related to the physical needs of the virtual patient, such as changing position, correcting the patient's position in the bed, mobilising the patient.

The subtasks interact with the player through an artificial intelligence-based algorithm according to the player's reactions and preferences in the game flow. Thus, all tasks integrated into the game are ensured to be completed by player. The game flow is built around the player navigating freely, exploring the tasks, making decisions while performing these tasks, and completing the tasks in the game world within a specified time period. The player can see the realisation status of the tasks and the performance scores report and self-evaluate when the game time is over. The players can replay the entire game as often as they want, whenever they want, and repeatedly experience all the tasks. The game is available in both Turkish and English languages.

Study participants

A purposive sampling method was used to recruit participants.[29] Accordingly, it was aimed to reach the patients' relatives who can use computers and who have a patient at risk of PU development in acute care institutions or at home in Turkey. The patients' relatives who participated in the study were reached through wound care nurses and physicians who work in chronic wound care. For this purpose, the study was announced via social media platforms (e-mail, WhatsApp, Facebook and LinkedIn) by asking wound care professionals to refer patients' relatives to the researchers. The inclusion criteria were as follows: being 18 years of age or older, being literate, being a relative of a patient with any PU risk level, not having any cognitive and physical disability, being able to use a computer, and being willing to participate in the study. Accordingly, 55 eligible volunteer participants were included in the study. An identifier number was given to each participant to ensure the confidentiality of their personal descriptive information.

Data collection tools

The Participants' Descriptive Characteristics Form and the Gaming Experience Interview Questionnaire were used to collect the data. The questionnaire consisted of sociodemographic information about the patients' relatives, their status of receiving any training on PUs, their experience with computer games, and their training experiences with games.

The researchers created the semi-structured Gaming Experience Interview Questionnaire to evaluate the participants' game experience and obtain their opinions regarding the PPUPG. Accordingly, the form consisted of three open-ended questions to obtain participants' feelings during the game implementation, their achievements, and views on the educational approach from the user perspective and one question that allows scoring from 1–10 (1: Very low, 10: Very high) to evaluate the level of satisfaction from the game. The questions in this form were designed based on the relevant literature.[16,30,31,32] The questions in the form were asked in the interview session carried out with the participants at the end of the gameplay and included the following questions:

1. What did you feel during the training activity with the game?
2. What achievements do you think you gained with the game?
3. Please state your opinions about the game.
4. Please rate your level of satisfaction with the game between 1–10 (1: Very low, 10: Very high).

Ethical considerations

The ethical approval of the Koç University Biomedical Research Ethics Committee was obtained before the study (Decision Number: 2020.164.IRB2.054). Each participant was informed about the study, and accordingly, the researchers obtained their verbal and written informed consent.

Study procedure

The study was conducted between 1 November 2021, and 28 February 2022 (Figure 1). The PPUPG game was made available to the participants, enabling them to experience the computer game. The patients' relatives who met the inclusion criteria participated in the study face-to-face (n=5) or via the online Zoom platform (n=50), depending on the COVID-19 precautions and the participant's preference. The way participants engaged in the study was decided together with the participants. Appointments were made based on the participants' availability. Before the game application, the participants were given detailed information about the research process, their questions were answered, and verbal and written consents were obtained. The consent was obtained either by them signing the consent form or marking the relevant section via a link sent electronically.

The participant's access to PPUPG was provided via the game's web link. Each participant was registered to the game system by the researcher. Following the registration to the game system, the researcher briefly informed the participant about the purpose of PPUPG and the use of the game system. In addition, the participants examined the Learn the Game section, which contains detailed playing information about the game. While the participant was playing PPUPG, a researcher was present as an observer to provide guidance.

If the participant had technical problems while playing the game, the researcher offered help. When the participants said they had played the game as much as they wanted and experienced enough, the game session ended.

At the end of the game application, a one-to-one interview was performed with the participants using the Gaming Experience Interview Questionnaire. Within the scope of these questions, the participants' feelings during the gaming experience, gains that they thought they achieved, and their opinions about this educational approach were taken. This reflection interview did not involve an in-depth interview technique. The participants were asked to answer open-ended questions about their experiences during the PPUPG application in their own words. The interview lasted approximately 30 minutes with each participant. Participants' responses were recorded according to their type of participation. The interviews with online participants were recorded on Zoom, and the interviews with face-to-face participants were recorded on a form by the researcher who conducted the interview.

Data analysis

Descriptive statistics were used to identify the participants' descriptive characteristics. Participants' responses to the open-ended questions in the Gaming Experience Interview Questionnaire were evaluated through qualitative inductive content analysis. For this purpose, all participants' responses in text format (meaning units) were initially listed in Microsoft Office Excel. Condensed meaning units were identified by reading the meaning units in each listed response. Focused meaning units that could be used interchangeably were coded under more inclusive concepts and divided into sub-categories (Figure 1). Main categories or domains were formed by combining sub-categories. These sub-categories were matched with the main categories by determining the number of responses.[33] Two researchers performed this process, and the analysis included the agreed-upon results. The data obtained through this inductive content analysis process were analysed using Microsoft Office Excel, which was used to calculate frequency and percentages.[34]

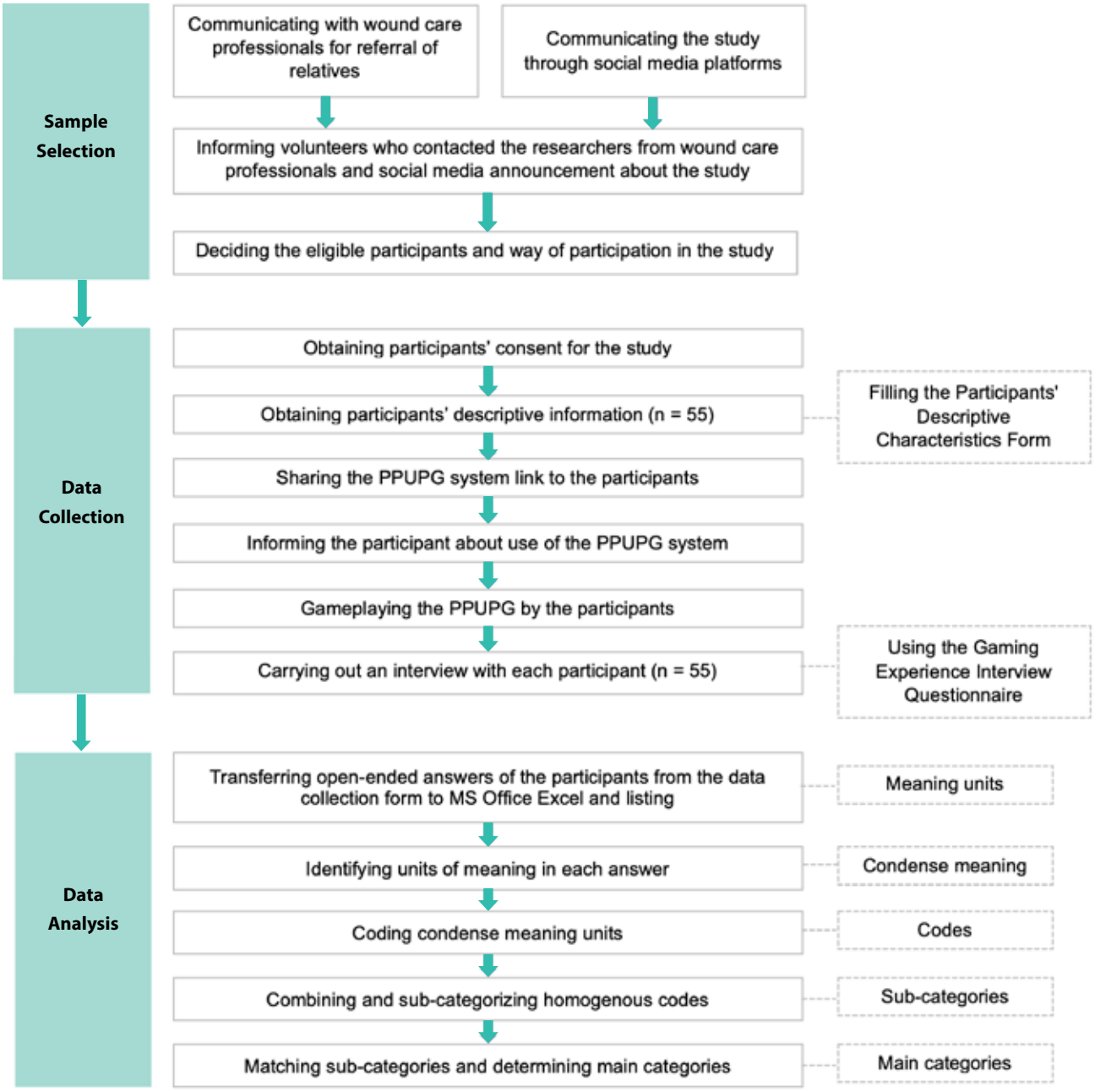

Figure 1. Study flow for the overall study process

RESULTS

Descriptive characteristics of the participants

The mean age of participants was $\bar{x}$=44.55±12.32 years. 65.5% (n=36) of the participants were women, and 69.1% (n=38) were university graduates. Of the participants, 56.4% (n=31) stated they had no experience playing computer games, and 98.2% (n=54) had not previously received any training with the game method. The mean time spent by the participants in the game was $\bar{x}$=55.71±20.71 minutes, and their overall satisfaction score with the game was 9.13±0.84 out of 10 (Table 1).

Gaming experience of the participants

Responses (110 sub-categories) about participants' feelings during the gaming experience were grouped into four main categories: Learning Motivation (50), Responsibility (32), Empathy (24) and Authenticity (4). The most prominent sub-categories of the main categories were determined as happy to be informed (15), desire to care for the virtual patient properly on time (16), feeling the difficulty of patient care (12), and feeling as if giving care to a real patient (4) (Table 2).

Responses (136 sub-categories) about achievements from the educational game were grouped into three main categories: Knowledge and Learning (33), Awareness (25), and Care Components (78). The most prominent sub-categories of the main categories were determined as learning about bedridden patient care (26), recognising patients with PU risk (8), and understanding the effect of PUs on the patients and their relatives (6) (Table 3).

Responses (135 sub-categories) regarding general opinions about the game were grouped into three main categories: Method (69), Learning Motivation (43), and Appropriateness (23). The most prominent sub-categories were an effective method (53), enjoyable (23), and memorable due to its visuality (4) (Table 4).

Selected responses to the open-ended questions

"I felt a sense of responsibility. I did not want to ... hurt the patient in the game. I wanted to make the necessary and correct care applications and give good care as soon as possible." (Participant ID: 021101).

"I put myself in the position of a patient relative. I needed to help the patient as soon as possible, and I discovered how to help". (Participant ID: 171106)

"I was very excited to care for a patient. Trying to care properly has stressed me out". (Participant ID: 140145)

"I was worried about the negative consequences that would occur when I delayed the care of the patient." (Participant ID: 301114)

"I figured out my wrong knowledge on the subject." (Participant ID: 011216)

"I learned how important it is to keep the patient clean and mobilise the patient under appropriate conditions." (Participant ID: 060136)

"I learned the lying positions and repositioning. I learned the consequences of being immobilised." (Participant ID: 140148)

"In general, I found it good. I think it contains all the details about how to care for a patient comprehensively." (Participant ID: 081226)

"The stages of care were given correctly. Its repetition reflects the care environment we encounter in our daily life. " (Participant ID: 271230)

"Positioning and revealing the patient's needs, establishing the connection between needs and patient care and its guiding step by step was helpful." (Participant ID: 060136)

"I think it was developed for the people who have no idea about the subject, and the relevant information was conveyed correctly." (Participant ID: 061103)

Table 1. Participants' descriptive characteristics

Descriptive information		**n**	**%**		
Sex	Female	36	65.5		
	Male	19	34.5		
Educational level	Primary education	9	16.4		
	University graduate	38	69.1		
	Postgraduate	8	14.5		
Previous experience of receiving training on PUs	Yes	3	5.5		
	No	52	94.5		
Previous experience playing computer games	Yes	24	43.6		
	No	31	56.4		
Previous experience of training with games	Yes	1	1.8		
	No	54	98.2		
		Mean	**SD**	**Min**	**Max**
Mean age (years)		44.55	12.32	20	73
Mean number of gameplay		2.18	0.58	1	3
Mean time spent in the game (minutes)		55.71	20.71	17	110
Overall satisfaction score from the game		9.13	0.84	7	10

n: Number of participants, **SD:** Standard deviation, **Min:** Minimum, **Max:** Maximum, **PUs:** Pressure Ulcers

"As someone who likes to play games, competition can be added to the game, and this can make learning more different. You can compete with different people at the same time." (Participant ID: 271230)

"Since it was a subject I did not know, it gave me things I could learn. I enjoyed it because it was in a game style. I think it is an effective learning method. I had the chance of trial and error." (Participant ID: 120141)

"I think it is an effective training method. It was different and interesting. Being able to play instead of reading it over and over is more enjoyable and interesting, less boring." (Participant ID: 130143)

DISCUSSION

This study, which evaluated the user experience of a 3D web-based educational game designed to educate patients' relatives on PU prevention provided important data on this educational approach. In the study, the main categories regarding user experience were: learning motivation, responsibility, empathy, authenticity, knowledge and learning, awareness, care components, and appropriateness. The most frequent statements about the game were groups into the following sub-categories: being happy to be informed; desire to care for the virtual patient properly on time; feeling the difficulty of patient care; feeling as if giving care to the real patient recognising patients with PU risk; understanding the effect of PUs on the patients and their relatives; learning the bedridden patient care; an effective method, enjoyable, and memorable due to its visuality. Participants' satisfaction score with the game was found to be high. It was thought that the feedback mentioned above from the participants showed similarities regarding game evaluation domains described by Moizer et al (2019)[35] with the dimensions (gaming experience, learning experience, adaptivity, usability, and fidelity) and sub-dimensions (such as competence, flow, affect, verisimilitude, identification, visual appeal, content appropriateness, integration),[35] and provided a comprehensive evaluation about the game method. The statements above indicate that the study participants achieved gains regarding the essential practices for preventing PUs. Moreover, within the framework of the main categories, comments were made on the method's effectiveness, the content's adequacy, the fiction and design elements, its accessibility, and motivational elements. Comprehensive suggestions were made, including comments about the features that an educational game should have. This means that although the participants had no training experience with games, the target group, the community, is open to experimenting with technological and innovative educational methods. This situation may increase the acceptability of the method and be a guide for future studies in this field. In addition, the participants' statements are an important data set in terms of drawing attention to the fact that the scope of the evaluation elements identified in the literature[16, 35] may vary according to the characteristics and needs of the target group in the development of games to be used in community education.

Table 2. Participants' responses about their feelings during the gaming experience

Main categories	Sub-categories	n
Learning motivation	Being happy to be informed	15
	Enjoying the activity	14
	Learning without getting bored	6
	Understanding the need for training about the problem	4
	Getting excited about experiencing the training method	4
	Feeling under stress and pressure	4
	Learning by discovery	1
	Being motivated	1
	Feeling open to learning	1
	Total number of responses within Learning Motivation	**50**
Responsibility	Desire to care for the virtual patient properly on time	16
	Feeling responsible for the virtual patient	7
	Questioning care approach to their own patient	7
	Feeling hesitant about harming the virtual patient	2
	Total number of responses within Responsibility	**32**
Empathy	Feeling the difficulty of patient care	12
	Feeling the difficulty of being a patient	7
	Feeling the difficulty of being a patient relative	5
	Total number of responses within Empathy	**24**
Authenticity	Feeling as if giving care to the real patient	4
	Total number of responses within Authenticity	**4**
	Total number of responses within all sub-categories	**110**

n: Number of sub-categories derived within the meaning units obtained from participants' responses

In a randomised controlled study (total n=46; control group, n=23; intervention group, n=23) conducted by Chee et al (2019),[36] an inhaler treatment training game (Play and Learn with Patients) was used. It was for nurses and accessible from a computer and a mobile platform. The game experience of the participants was evaluated with a game perception questionnaire created by the researchers specifically for the game, consisting of 14 questions and 7-point Likert-scale. The general scoring of the intervention group participants towards the game was determined as $\bar{x}$=6.05±0.19 out of seven, and it was concluded that the participants' opinions towards the serious game (SG) were positive. In the study, it was determined that the statements above six points were: "I think SG helps me remember the steps of the inhaler technique better"; "The system can improve my knowledge management skills"; "Using SGs for the learning purposes is impressive"; and "SG has a learning environment that looks realistic".[36] A study by Donovan et al (2021)[37] used a 30-minute web-based simulation game (Ready Patient One) for medical students (n=66) on critical care patient assessment and care planning. It used six game-specific evaluation questions with 5-point Likert-scale options and an open-ended question to evaluate the game. It found that the majority of participants stated that they thought the game improved their understanding of critical care concepts (93.9%–97%), that they enjoyed the game (92.4%), and that they were interested in spending more time in the game (90.9%).[37] A study by Stapinski et al (2018)[38] with an intervention (n=148) and control group (n=133), involved a 20-minute game developed to train the 11–17 age group about narcotic drug usage. The evaluation was made with 5-point Likert-scale questions. The majority of participants in the intervention group stated they enjoyed the game (91%), the game was more interesting than the information booklet (88%), and it increased their compliance with the lesson (92%).[38]

Table 3. Participants' responses on their achievements from the game

Main Categories	Sub-categories	n
Knowledge and Learning	Recognising the patient with Pressure Ulcer (PU) risk	8
	Learning the wrongs that they know right	8
	Getting all the relevant information about the problem	7
	Learning new information	4
	Learning about an unknown subject	2
	Learning the formation of PU	2
	Being able to recognise PU	2
	Total number of responses within Knowledge and Learning	**33**
Awareness	Understanding the effect of PUs on the patients and their relatives	6
	Understanding the need for collaboration with healthcare team	5
	Creating awareness	4
	Understanding the importance of details in care	3
	Understanding the importance of PU	2
	Understanding the importance of education	2
	Developing empathy	1
	Understanding the reason for their care	1
	Recognising deficiencies in their care	1
	Total number of responses within Awareness	**25**
Care Components	Learning to care for bedridden patients	26
	Understanding the necessity of programmed care	12
	Understanding the necessity of cleaning, care and regular control of the skin	8
	Understanding the importance of re-positioning and movement	7
	Understanding the necessity of hygienic care	5
	Learning about care supplies	5
	Understanding the importance of knowledgeable care	4
	Understanding the importance of timely care	4
	Understanding the importance of nutrition	2
	Ability to direct care	2
	Understanding the importance of the care environment	2
	Understanding the continuity of care	1
	Total number of responses within Care Components	**78**
	Total number of responses within all sub-categories	**136**

n: Number of sub-categories derived within the meaning units obtained from participants' responses

Results of these studies with different methodological approaches and containing different study samples[36, 37, 38] align with this study's finding that participants positively evaluated education with the game method. In addition, in studies where digital games developed explicitly for educational purposes are used, it is seen that among the priority evaluation subjects are the quality and adequacy of the educational content of the game, its compatibility with real-life situations, its contribution to learning, and recommending the method due to its positive effect. This prioritisation also aligns with the aim of educational games to teach by adapting game elements to real-life situations.[8,39] In this context, determining the educational objectives of games in line with the characteristics of the target user group and structuring its design in this direction constitutes an essential stage in terms of the quality of the learning process. Although the primary purpose of educational games is not entertainment, the enjoyment from education and the quality of information and content can be considered supportive elements that increase learning motivation and ensure the participant's adaptation and participation.[3,10,11,17]

Educational games developed for a specific purpose provide for their players with challenging tasks or game conditions in a certain period, which motivates learning.[40] In this study, it was interpreted that the educational aspect of the PPUPG was found appropriate and accepted as a training method by the participants, who parised the game's conformity to reality, made statements about knowledge acquisition, and gave the game high satisfaction scores. Considering the participants' mean time spent in the game was $\bar{x}$=55.7±20.7(minutes), it is clear that they can experience more trial and error in exploring the tasks in the game while playing continuously. When PPUPG is widely used, the target group of the game will have the opportunity to play it whenever and as often as they want so that users of the game will have the playing and exploring time they desire. Thus, the player who gains experience with repetitive games can discover the game tasks, game elements, and learning process by playing the game more comfortably. All these above-mentioned enumerated elements may contribute to the knowledge acquisition. In the pretest-posttest design study in which the effect of PPUPG on the knowledge level was evaluated. The knowledge scores of the participants was monitored before and after the game implementation (immediately and one-month after the gameplay). A statistically significant increase ($p<0.001$) in the post-test knowledge scores was found compared to the pretest scores.[41]

Limitations of the study

The participant's access to the game only via computer and internet was experienced as a technical limiting factor in the study. The reflection interview was based on open-ended questions and participants' statements without using an in-depth interview technique, which may have limited the external validity of the data obtained from this interview. Since the study's data collection process coincided with the COVID-19 pandemic, the participants' concerns about transmitting the infection to their patients caused some interviews to be held in an online communication environment. Since this

Table 4. Participants' general opinions about the game

Main Categories	Sub-Categories	n
Method	An effective method	53
	An educational material	9
	An useful method	3
	A different method	2
	A nice method	2
	Total number of responses within Method	**69**
Learning Motivation	Enjoyable	23
	Visually interesting	10
	Not funny because of the topic's nature	8
	Immersive	2
	Total number of responses within Learning Motivation	**43**
Appropriateness	Memorable due to its visuality	4
	Information is clear and understandable	3
	Suitable for today's teaching and learning conditions	3
	Being practical and repetitive is reinforcing	3
	Easy to use	3
	Accessible material	2
	Like a kind of guide	2
	Authentic	2
	Allows trial and error	1
	Total number of responses within Appropriateness	**23**
	Total number of responses within all sub-categories	**135**

n: Number of sub-categories derived within the meaning units obtained from participants' responses

situation limited face-to-face interaction, it made it difficult to obtain objective observation data about the game experiences of the participants.

CONCLUSION

The information obtained in the study showed that PPUPG helped to create awareness about a virtual game-based approach for PU training, and the game was accepted by its users as an educational method. Using the PPUPG, a 3D web-based game, may be helpful as a novel educational method to educate patients' relatives and the community about preventing PUs and improving health literacy. This educational activity could be supported by making the PPUPG available on all media platforms, continuously evaluating the user experience of the target group, and making knowledge and design updates based on these evaluations. Moreover, shaping the design of the PPUPG with user opinions may play a role in increasing adaptation to the method and motivation to learn. The main categories identified in this study can be used as a guide in evaluating user experiences of educational games to be developed in health sciences and other disciplines in the future.

IMPLICATIONS FOR CLINICAL PRACTICE AND FURTHER RESEARCH

Patients' relatives are considered an essential part of the care team. It is critical to obtain their cooperation and to empower them by providing education. For PU prevention practices to be successful patients' informal caregiver relatives need to be involved and informed. On the other hand, studies on the education of patients' relatives on this subject and the variety of educational methods used are limited. This study evaluated the experiences of palients' relatives who used a 3D web-based game developed to educate them about a health issue. In addition, the study provided a data set that could be used in developing and evaluating digital platform games that will be used for community education in the future. The results of this study lay the groundwork for educating individuals, and communities other than healthcare professionals, using digital platform games.

In light of the data from this study, it is considered beneficial to carry out the following studies:

- In educating patients' relatives, innovative education methods need to be evaluated by the target group and improved in line with their inputs.
- There is a need for developing comprehensive but also compact tools and evaluation criteria to understand user experience and continuous development of educational games via an objective process evaluation.
- Well-structured prospective studies on knowledge, skills, and attitudes are recommended by using and continuously improving the PPUPG.

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AUTHOR CONTRIBUTIONS

All authors contributed substantially to the study in the following details: conception and design (Vildan Çakar, Ayişe Karadağ), data analysis and interpretation (Vildan Çakar, Ayişe Karadağ), manuscript draft (Vildan Çakar), critical revision of the manuscript (Vildan Çakar, Ayişe Karadağ), final approval of the manuscript (Vildan Çakar, Ayişe Karadağ).

CONFLICT OF INTEREST

The authors declare no conflicts of interest for this study.

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