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Kan Verme Sırasında Sanal Gerçeklik Uygulaması Kullanılarak Kaygı Duyarlılık Düzeylerinin Araştırılması

Investigating Anxiety Sensitivity Levels Using Virtual Reality Application During Blood Giving

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Abstract: Technologies and medical devices in healthcare are generally used to maintain health status and prevent disease symptoms. This study explored the use of virtual reality (VR) to reduce anxiety in children undergoing blood draws. The anxiety levels of children (experimental group) who used VR glasses that explained the blood collection process in a simple way were compared with the anxiety levels of children who did not use these glasses (control group). The study was conducted as a randomized controlled trial, involving 30 children in each group, at a pediatric outpatient clinic between February 15 and May 15, 2019. The VR group watched an educational video explaining the blood drawing procedure before the blood draw, and then watched 3 to 10 minutes of their own choice of videos (dance, water park, zoo, documentary, etc.) through VR goggles. Children's anxiety levels were measured using the Anxiety Sensitivity İndex for Children. The results showed that children in the VR group had significantly lower scores (physical, psychological, and social anxiety) compared to the control group ($p<0.001$). These findings suggest that VR applications can be a valuable tool for reducing anxiety in children during medical procedures such as blood draws.

Keywords: Anxiety, Child Health, Virtual Reality

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Öz: Sağlık hizmetlerinde teknolojiler ve tıbbi araçlar genel olarak sağlık durumunun korunması ve hastalık semptomlarının önlenmesi için kullanılmaktadır. Bu çalışmada, sanal gerçeklik (VR) teknolojisinin kan alma işlemi geçiren çocukların kaygısını azaltmada kullanımı incelenmiştir. Kan alma işlemini basit bir şekilde anlatan VR gözlüklerini kullanan çocukların (deney grubu) kaygı düzeyleri, bu gözlükleri kullanmayan çocukların (kontrol grubu) kaygı düzeyleri ile karşılaştırılmıştır. Çalışma, 15 Şubat - 15 Mayıs 2019 tarihleri arasında çocuk hastalıkları polikliniğinde her grupta 30 çocuğun yer aldığı randomize kontrollü bir çalışma olarak gerçekleştirilmiştir. VR grubu, kan alımı öncesinde kan alma işlemini anlatan bir eğitim videosu izledikten sonra, 3 ila 10 dakika arasında kendi seçtikleri videoları (dans, su parkı, hayvanat bahçesi, belgesel vb.) VR gözlükleri aracılığıyla izlemiştir. Çocukların kaygı düzeyleri, "Çocuklar için Anksiyete Duyarlılık Ölçeği" kullanılarak ölçülmüştür. Sonuçlar, VR grubundaki çocukların kontrol grubuna kıyasla önemli ölçüde daha düşük puanlara (fiziksel, psikolojik ve sosyal kaygı) sahip olduğunu göstermiştir ($p<0,001$). Bu bulgular, sanal gerçeklik uygulamalarının kan alma gibi tıbbi işlemler sırasında çocukların kaygısını azaltmada kullanılabileceğini düşündürmektedir.

Anahtar Kelimeler: Anksiyete, Çocuk Sağlığı, Sanal Gerçeklik

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Introduction

Virtual reality (VR) glasses are devices designed to provide users with an immersive and interactive experience. These glasses are used to view computer-generated virtual environments and, on some models, allow you to view VR content using your phone. This can be realistic or fantastical, depending on the application. It has the potential to be used for entertainment, education, healthcare, and many other applications. VR aims to immerse users in the virtual environment, making them feel like they are physically present within it (1,2).

In the provision of health services, technologies are generally used to maintain the state of health, to delay or prevent the onset of diseases, and to provide solutions to health problems (3). Among these technologies, Virtual Reality technologies are thought to be significantly effective in health services in the future (4).

Virtual Reality studies have become widespread in the field of clinical psychology in recent years. Virtual reality-based therapies have a wide range of applications, especially in anxiety disorders (5). For example, virtual reality technology is used, which is an effective method to reduce anxiety during vascular access in children. Because, for the child, the relevant procedures in the hospital are a frightening, disturbing and unpleasant experience. Medical procedures such as blood donation and injection are one of the biggest sources of pain and fear for children (6,7). Pain-related anxiety may cause children to be afraid of syringes, and unwillingness for some medical procedures such as vaccination, injection and blood collection, and even negligence or delay in treatment (4,5). VR can help reduce the fear and anxiety that children experience during medical procedures. It allows children to relax and calm down by distracting them from the process (8).

This article focuses on helping children feel less anxious during blood draws. Blood draws can be scary for kids because they involve needles, so this article explores a way to distract them and make the experience less stressful (9,10,11). This study compared the anxiety levels of two groups of children aged 6-15. The trial group wore virtual reality glasses that showed short and simple animated videos about the blood draw process, as well as entertaining videos suitable for the 6-15 age group. The other group (control group) did not wear glasses. The study aimed to see if the videos helped the children in the trial group feel less anxious during their blood draws.

Research Hypotheses

H0: There is no difference in physical, psychological, and social anxiety levels between pediatric patients who experience blood draws with virtual reality and those who do not.

H1: Virtual reality during blood draws reduces physical anxiety in pediatric patients.

H2: Virtual reality during blood draws reduces psychological anxiety in pediatric patients.

H3: Virtual reality during blood draws reduces social anxiety in pediatric patients.

Materials and Methods

Research Type

This randomized controlled trial at Cukurova University Hospital's pediatric outpatient clinics investigated the effects of VR glasses on children's physical, psychological and social anxiety during blood draws.

Research Setting and Time

The study was conducted between February 15 and May 15, 2019 in Cukurova University, Faculty of Medicine, Balcali Hospital Pediatric Polyclinics. The Children's Blood Collection Unit consists of five compartments with a total of 5 seats. There are a total of 6 nurses in the unit with a service supervisor working in a single shift (8 a.m.- 4 p.m.). Children giving blood are met by experienced pediatric nurses that working pediatric blood unite in the compartments reserved for them receiving the queue number at the entrance.

Population and Sample

The number children who gave blood in children's outpatient clinics of Balcali Hospital, Faculty of Medicine, Cukurova University between February 15 and May 15, 2019 was 960. A total of 590 of the children were between the ages of 6-15. The study used the Anxiety Sensitivity İndex for Children and power analysis to determine a sample size of 30 children per group, assuming a medium effect size (Cohen's d = 0,5)

Initially, 62 patients agreed to participate in the study. However, two decided not to wear VR glasses and withdrew. This left a final group of 60 participants for analysis, with 30 assigned to each group. To ensure fairness, participants were randomly assigned to either the experimental (VR) group or the control group. This randomization was done using a computer program that generated a random sequence of "1" and "2". Participants were then assigned to their respective group based on the order they appeared in this sequence. In this sequence, "1" represented the VR group and "2" represented the control group (Figure 1).

Inclusion criteria: The study included pediatric patients aged 6 to 15 who met the following criteria;

Cognitive and communication abilities: No significant visual, hearing, or perception problems; Participants should have normal or corrected vision and hearing to participate in the VR intervention and data collection procedures. They should also have no diagnosed cognitive impairments that could hinder their understanding of the study procedures or communication with researchers.

Mental alert: Participants must be alert and aware of their surroundings. For this reason, patients with whom we could communicate were included.

Open to communication: Participants should be receptive to verbal and non-verbal communication with researchers and able to express their needs and concerns throughout the study.

Exclusion criteria: The following criteria excluded patients from participating in the study.

Refusal to participate: Any patient or parent/legal guardian who refused to participate in the study was excluded.

Lack of assent or permission: Patients who did not provide written assent or whose parents/legal guardians did not provide written informed consent were excluded.

Age limitations: Patients younger than 6 years old or older than 15 years old were excluded due to the targeted age range for the study.

Communication and cognitive impairments: Patients with significant visual, hearing, or perception problems, diagnosed cognitive impairments that would hinder their participation, or limited Turkish language skills were excluded.

Frequent blood draws: Patients who frequently underwent blood draws (defined as a specific timeframe based on your study design) were excluded as their experience with the procedure might influence the study results.

Unconsciousness or disorientation: Patients who were unconscious or not fully oriented to time, place, and person were excluded.

Limited cooperation: Patients with a known history of limited cooperation or inability to follow instructions were excluded to ensure the validity of the study data.

Ethical Considerations

Prior to the study, the Ethics Committee Approval dated 01.02.2019 and numbered 33 of the Ethics Committee of Cukurova University Clinical Researches and the Official Institution Permit of Balcali Hospital was obtained. The patients who participated in the study were informed about the aim of the study; and verbal and written informed consent was obtained from them. Permission was obtained from the developers of the scale to use the anxiety sensitivity scale in children.

Obtaining consent from the child/parents: In the study, written consent was obtained from the children indicating their willingness to participate. The consent form was age appropriate and explained the study in a way the child could understand. Additionally, written informed consent was obtained from the parents or legal guardians of all participants. The informed consent form provided detailed information about the study procedures, potential risks and benefits, and the child's right to withdraw from the study at any time.

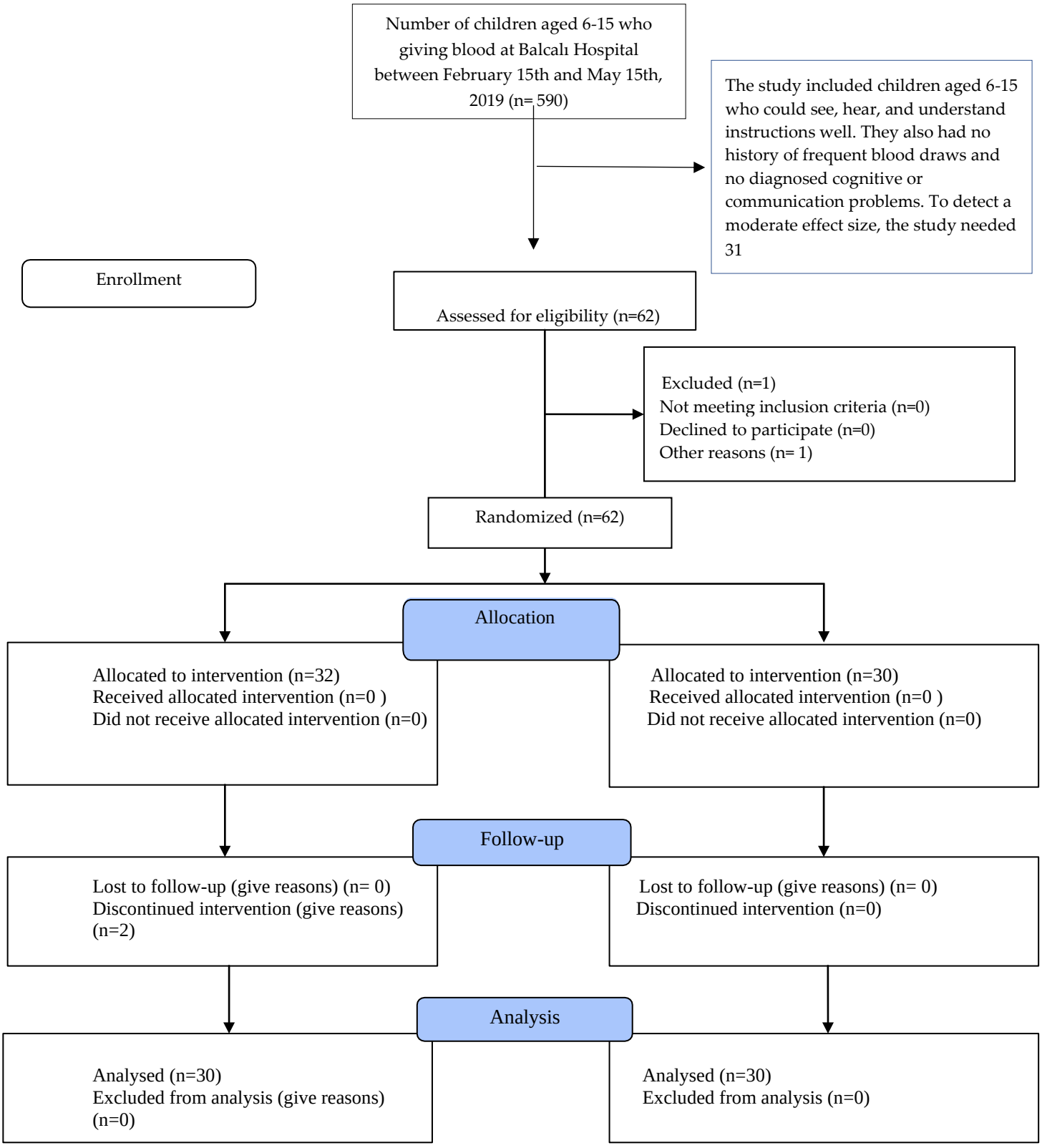

Figure 1. Consort Flow Chart

Data Collection

Preparation of Data Collection Tools

Virtual reality glasses: Within the scope of the study, children who would give blood for medical and/or diagnosis purposes watched 3-minute 2D and 3D videos with virtual reality glasses, which informed them about the blood giving procedure and the tools to be used during this procedure in a simple way. During the blood giving process, the pediatric patients watched a video from a selection of 3-10 minute videos of dance, water park, animal documentary, exploration trips and space documentary content with a pair of virtual reality glasses.

Selection of videos shown to children during the procedure: When the children wore the VR glasses, they first watched a video prepared by the researcher that introduced them to the blood donation process. Afterwards, among the following options; He watched by making choices and transitions among options such as dancing, fun water park, and exciting train riding. The videos were selected as options that would attract children's attention according to their age groups. The selection of the videos was determined by expert researchers and expert child development support. The 3D videos that the children watched were selected by an expert researcher in the field of child health and diseases by considering the developmental age periods and examining the information and content arrangements.

Everest VR-0022 VR BOX virtual reality glasses, smartphones and Sony MDR-EX650AP headsets were used in the study. The introductory video content was prepared by an expert researcher in the field considering the developmental age periods using Powtoon application, a Web 2.0 tool.

Data Collection Forms

Personal Information Form: Personal information form included a total of 10 questions specifying the characteristics of the children (age, gender, education, social security and blood giving status) prepared by the researcher in accordance with the literature (4,7,8,12).

Anxiety Sensitivity İndex for Children: The 'Anxiety Sensitivity Scale in Children', developed by Silverman, Fleisig, Rabian and Peterson, was adapted to Turkish in 2013 by Secer and Gulbahce. The scale is originally a 18-item, five-point Likert-type instrument with three dimensions. For construct validity, exploratory and confirmatory factor analysis studies were conducted. These tests showed the scale explains over half of the variation in anxiety sensitivity and has a good structure. A s a result of the reliability analysis of the scale, the internal consistency coefficient was found to be α=0,87 and the test-retest reliability was found to be r=0,86. It can be said that the scale in its current form, as in its original form, is a reliable and valid measurement tool in a three-dimensional structure consisting of physical sensitivity, psychological sensitivity and social anxiety (12). In this study, the Cronbach's alpha total score of the anxiety sensitivity scale in children was found to be 0,880.

Preliminary Application of Data Collection Tools: In order to evaluate the functioning of the data collection forms, after obtaining the approval of the ethics committee, 10 children who gave blood in the children's outpatient clinics of Cukurova University, Faculty of Medicine, Balcali Hospital were given preliminary application, and no changes or corrections were required in the questionnaire. Ten patients for whom preliminary application was given were not included in the sampling.

Implementation of Data Collection Tools

Experimental Group: During the blood giving process, the pediatric patients watched an informative video and a video from a selection of 3-10 minute videos of dance, water park, animal documentary, exploration trips and space documentary content with a pair of virtual reality glasses. Personal information form and Anxiety Sensitivity İndex for Children were administered immediately after virtual reality glasses application was completed.

Control Group: After the blood giving procedure, personal information form and Anxiety Sensitivity İndex for Children were administered without any other application.

Data Analysis

The study employed various statistical tests to analyze the data and answer research questions. Descriptive statistics (mean and standard deviation) summarized continuous data like anxiety scores. Chi-Square tests analyzed categorical variables such as demographics (gender, age). Hypothesis testing compared mean anxiety scores: t-tests were used for two groups (VR vs. control), and ANOVA compared scores across more than two groups (e.g., different VR types) with post-hoc tests for specific group differences. Additionally, Shapiro-Wilk tests assessed data normality, and Cronbach's Alpha ensured the Anxiety Sensitivity Scale's reliability. A significance level of alpha (α) = 0,05 was set, meaning a result is significant if the chance of observing it by chance is less than 5%.

Results

Table 1. Investigation of the distribution of the children in the groups according to their descriptive characteristics.

	Experimental Group n=30		**Control Group n=30**		p*
	n	%	n	%	
Age					
6-10	11	36,6	13	53,3	0,771
11-15	19	63,3	17	56,7	
Gender					
Female	14	46,7	14	46,7	1,00
Male	16	53,3	16	53,3	
Educational Status					
Illiterate	1	3,3	1	3,3	0,919
Primary School	7	23,3	9	30,0	
Secondary School	13	43,3	13	43,3	
High schools and their equivalents	9	30,0	7	23,3	
Father's profession					
Unemployed	9	30,0	7	23,3	0,392
Civil servant	14	46,7	9	30,0	
Worker	4	13,3	10	33,3	
Self-employed	1	3,3	1	3,3	
Other	2	6,7	3	10,0	
Mother's profession					
Unemployed	9	30,0	8	26,7	0,950
Civil servant	7	23,3	6	20,0	
Worker	4	13,3	3	10,0	
Self-employed	1	3,3	1	3,3	
Other	9	30,0	12	40,0	
Mother's educational status					
Illiterate	9	30,0	8	26,7	0,968
Primary School	4	13,3	6	20,0	
Secondary School	7	23,3	7	23,3	
High schools and their equivalents	6	20,0	5	16,7	
University/Academy	4	13,3	4	13,3	
Father's educational status					
Illiterate	0	0,0	1	3,3	0,811
Primary School	9	30,0	8	26,7	
Secondary School	4	13,3	6	20,0	
High schools and their equivalents	10	33,3	9	30,0	
University/Academy	7	23,3	6	20,0	
Social Security					
Retirement Fund	8	26,7	7	23,3	0,984
Social Insurance Institution	9	30,0	9	30,0	
Green Card (for the uninsured in Turkey)	5	16,7	6	20,0	
None	8	26,7	8	26,7	
Previous Blood Giving Status					
Yes	15	50,0	16	53,3	0,796
No	15	50,0	14	46,7	

*p: Chi-Square test

Table 1 shows the distribution of the descriptive characteristics of the children between the ages of 6-15 of the experimental and control groups. There was no statistically significant difference between the groups

in terms of age, gender, educational status, parental profession, parental education status, social security and previous blood giving status (p>0,05).

According to the anxiety sensitivity finally total scale by groups, there was a statistically significant difference between the groups participating (experimental group) and not participating (control group) in the virtual reality application, in terms of physical, psychological, and social sensitivity subscales (p<0,001). The mean anxiety sensitivity total score of the experimental group (34,43±13,03) was higher than the mean total score of the comparison group (47,93±12,729); and the difference between the groups was statistically significant (p<0,001) (Table 2).

Table 2. Investigation of sub-score means of anxiety sensitivity finally total scale by groups.

Anxiety Sensitivity Index for Children subdimension	**Cronbach's Alpha**	**Experimental Group n=30**		**Control Group n=30**		**p***
		Mean± SD	**Min-Max**	**Mean± SD**	**Min-Max**	
Physical sensitivity	0,911	15,5±5,18	7-27	21,87±6,56	11-35	<0,001
Psychological sensitivity	0,508	11,77±7,26	5-45	16,00±4,35	9-25	0,008
Social sensitivity	0,873	7,17±2,60	3-15	10,07±2,85	5-15	<0,001
Scale Total	0,880	34,43±13,03	15-75	47,93±12,72	30-75	<0,001

*p: Student's t test

The distribution of anxiety sensitivity scale scores according to participants' age and education status within each group was investigated. There was no statistically significant difference by age groups between the experimental and control groups in terms of physical sensitivity, psychological sensitivity and social sensitivity sub-dimension means (p>0,05). However, the total score of the scale in the experimental group varied according to age groups (p=0,046). Accordingly, this difference was between the age group of 11-13 years (43,00±15,10) and the age group of 14-15 years (27,20±10,50) in the experimental group (p=0,035) (Table 3).

In the experimental group, the mean physical sensitivity score varied according to the educational status (p=0,046). Accordingly, this difference was between the secondary school group (18,08±4,80) and high school group and their equivalents group (12,56±4,95) in the experimental group (p= 0,031) (Table 4). In the study group, the mean total score of the scale varied according to the educational status (p=0,037). Accordingly, this difference was between the secondary school and the high school and their equivalent groups (p=0,021) (Table 3).

There was no statistically significant difference by parental profession groups between the two groups in terms of physical sensitivity, psychological sensitivity and social sensitivity sub-dimension means and scale total score (p>0,05) (Table 3). In both groups, there was no statistically significant difference by income, parental education status, social security and previous blood giving status, in terms of physical sensitivity, psychological sensitivity and social sensitivity sub-dimension means and scale total scores of the groups (p>0,05) (Table 3).

Discussion

Blood draws can be nerve-wracking for children, especially if they worry about the physical sensations of anxiety like a racing heart or rapid breathing. This study explored how virtual reality (VR) could help. Children who used VR during blood draws reported significantly lower anxiety sensitivity (fear of anxiety symptoms) across all three categories; physical, psychological, and social compared to those who didn't use VR ($p < 0.001$). This suggests VR may be a promising tool for reducing children's anxiety during medical procedures. As research on VR for distraction and coping in children continues to grow, it could become a valuable tool for healthcare professionals (13-17).

Table 3. Investigation of distribution of anxiety sensitivity scale scores by age and education status of groups.

Variables	**Experimental Group n=30**			**Control Group n=30**		
Age	**Mean± SD**	**Min-Max**	**p**	**Mean± SD**	**Min-Max**	**p***
Physical sensitivity						
6-10	18,50±4,31	7-27	0,077	26,50±3,92	13-33	0,079
11-15	18,00±4,39	7-24		23,44±6,99	11-35	
Psychological sensitivity						
6-10	11,50±2,38	5-15	0,184	18,17±3,09	9-23	0,176
11-15	16,56±3,62	5-45		17,44±3,64	9-25	
Social sensitivity						
6-10	8,00±1,41	3-9	0,147	8,57±1,81	6-14	0,418
11-15	8,44±2,53	3-15		10,88±2,80	5-15	
Scale Total						
6-10	38,00±9,30	15-49	0,044	55,50±7,43	30-68	0,129
11-15	43,00±10,50	15-75		46,00±13,12	30-75	
Educational Status	**Mean± SD**	**Min-Max**	**p**	**Mean± SD**	**Min-Max**	**p***
Physical sensitivity						
Illiterate and Primary School	13,88±4,36	7-21	0,048	21,81±5,63	14-33	0,517
Secondary School	18,08±4,80	12-27		22,46±6,90	11-33	
High schools and their equivalents	12,56±4,95	7-20		19,71±7,50	13-35	
Psychological sensitivity						
Illiterate and Primary School	9,32±2,64	5-15	0,136	15,11±3,67	10-23	0,244
Secondary School	15,08±9,50	9-45		16,85±3,91	9-23	
High schools and their equivalents	8,56±3,81	5-15		14,57±5,47	9-25	
Social sensitivity						
Illiterate and Primary School	6,86±1,95	3-9	0,158	8,60±2,14	6-14	0,167
Secondary School	8,31±2,59	4-15		10,62±3,12	5-14	
High schools and their equivalents	5,78±2,68	3-9		10,43±2,70	7-15	
Scale Total						
Illiterate and Primary School	30,07±8,43	15-44	0,037	45,44±10,21	30-68	0,353
Secondary School	41,46±13,44	27-75		49,92±12,67	30-68	
High schools and their equivalents	26,89±11,08	15-43		44,71±15,21	30-75	

*p: One Way Analysis of Variance (ANOVA)

Studies like Özdemir's (2019) on kids aged 6-12 show VR glasses and distraction cards can effectively manage pain, anxiety, and fear during medical procedures (17). Bergomi et al. (2018) conducted a study on 150 children during intravenous intervention and found that pain and anxiety levels were measured less in the group that was divided into 4 groups and watched animated cartoons (18). A recent study by Yılmaz (2021) explored the potential of virtual reality (VR) to ease anxiety during colonoscopies. The study used a randomized controlled design, where participants were randomly assigned either to a VR group (22 people) or a control group. They found that patients in the VR group experienced a decrease in anxiety compared to the control group. This suggests VR could be a valuable tool for managing anxiety during medical procedures.

In the methodological and experimental study conducted by Caner (2020), the effect of virtual reality glasses and smartphone game application on preoperative anxiety was examined in 100 children between the ages of 7-13 and was found to be effective in reducing anxiety (19,20). Kaya et al. (2020) used the Anxiety Sensitivity İndex for Children to examine the effect of virtual reality glasses applied during the splint procedure on children's pain and anxiety due to the procedure. It was concluded that the virtual reality

glasses used during the splint procedure were effective in reducing the pain and anxiety that developed due to the procedure (21). The study results are parallel to our study.

The study's results pave the way for VR as a potential therapy tool, empowering children aged 11-15 to manage their anxiety. By creating a safe and controlled environment, VR allows children to confront their fears in a virtual world. This exposure can be a powerful tool for therapists, helping children develop coping mechanisms that translate to real-life situations. VR's potential to address anxiety disorders in children warrants further exploration and integration into therapeutic approaches (8). Our study found VR reduced physical anxiety symptoms (dizziness, nausea) in high school students. This aligns with other research showing VR's effectiveness in reducing general anxiety (22) and social anxiety (ages 8-13) in younger children (9).

This study takes virtual reality (VR) research a step further. Previous randomized controlled trials have shown VR's success in reducing pain anxiety during injections. This study explores whether VR can be effective in managing a different aspect of anxiety the fear of anxiety symptoms themselves (21,23-27).

While previous research using VR glasses in children has focused on pain reduction (28-30), this study breaks new ground by examining anxiety sensitivity. We delved deeper, using physical, psychological, and social anxiety scales to understand how VR impacts children's emotional responses during procedures. This shift in focus from pain to anxiety sensitivity offers valuable insights. VR's ability to address not just pain, but also the fear of anxiety symptoms itself, holds promise for treating childhood anxiety disorders. As research progresses, VR has the potential to become a powerful tool in clinical practice, empowering children to manage their anxiety and improve their overall well-being.

Conclusion and Suggestions

As a result of this study, the physical, psychological and social anxiety sensitivity scale scores and total scale scores of children participating in the virtual reality application were found to be lower than those who did not participate in the application, and the difference between groups was found to be significant in support of the experiment group ($p<0.001$). The hypothesis of the study, "virtual reality glasses has an effect on the physical, psychological and social anxiety sensitivity" was confirmed. Virtual reality glasses are recommended because they do not require an invasive procedure, are painless, safe, effective, easy to apply, and have no side effects. It is recommended because the anxiety levels of children using virtual reality glasses are lower than those of children who do not use virtual reality glasses.

Ethical Statement: The Ethics Committee Approval dated 01.02.2019 and numbered 33 of the Ethics Committee of Cukurova University Clinical Researches and the Official Institution Permit of Balcali Hospital was obtained. This article is based on Turnitin scanned by the software. No plagiarism was detected.
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Peer Review: External independent.
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