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Game-Based Learning for Disaster Management Education in Secondary School 5th Grade Students: An Experimental Study

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Abstract

Learning through play provides children with meaningful and lasting knowledge while fostering empathy, social responsibility, and cooperation. In disaster education, where vital life skills are addressed, game-based approaches have become increasingly important. This study, the first experimental research conducted in Türkiye's Ardahan province, examined the effects of game-based disaster education on fifth-grade students. Designed as a quasi-experimental study, the research involved an experimental group receiving game-based training and a control group receiving traditional instruction. Data were collected through the Academic Achievement Questionnaire, Disaster Awareness Scale, and Solidarity Tendency Scale. Findings showed that the experimental group outperformed the control group in academic achievement and disaster awareness, although follow-up results indicated differences only in achievement. No significant changes were observed in solidarity tendencies. Overall, the study suggests that integrating game-based strategies into disaster education enhances cognitive performance, raises awareness, and motivates students to become better prepared individuals.

Highlights

- Game-based learning boosted students' disaster awareness and achievement.
- No change observed in solidarity, showing emotional gains need longer time.
- Follow-up scores confirmed lasting impact on academic achievement.
- The study is the first of its kind in Ardahan on disaster education.

1. INTRODUCTION

Türkiye has faced numerous disasters and emergencies, including floods, forest fires, and political crises. It has also been hit by devastating earthquakes, primarily as it is located in an active earthquake zone. Between 1900 and 2022, it experienced 90 earthquakes classified as disasters according to EM-DAT criteria. These earthquakes caused 96,721 deaths [1,2]. The earthquakes in Burdur in 1914, Erzincan in 1939, and Kocaeli in 1999 caused many casualties. The Eastern Anatolia region suffered the highest number of casualties, accounting for about 60 percent of the total death toll [3]. Turkiye's location in a seismically active region poses a significant risk to its population. Eastern Anatolia is particularly vulnerable due to its proximity to the Eastern Anatolia and Northern Anatolia Fault Lines. The last devastating earthquakes in February 2023 are among the deadliest in Turkiye's history [1].

After earthquakes, floods result in the highest loss of life. In 2021, extreme rains caused floods in Kastamonu, which resulted in more than 80 deaths and severe infrastructural and agricultural damage [4]. Located in northeastern Turkey, Ardahan is also at risk of various disasters, including floods, landslides, earthquakes, storms, and avalanches. In 2019, a landslide hit Savaşır village in Posof district, which resulted in evacuation [5]. In terms of seismicity, experts found the largest ground acceleration values around Göle district. In 1976, an earthquake in Göle resulted in the death of four people [5]. Ardahan was hit by two major earthquakes of magnitude VIII in 400 and 1868 [6]. Considering the danger posed by the Eastern Anatolian Fault Line extending between Erzurum-Ardahan and Armenia, we believe that experts in Ardahan should take necessary precautions.

Disaster management involves pre-disaster preparedness and mitigation measures. It is supported by drills, training programs, and structural and non-structural measures [7]. Disaster education and training programs play a critical role in reducing disaster risk because they help us learn how to act before, during, and after a disaster [7,8]. Research shows that adults who received disaster education during childhood are more likely to adopt behaviors

that enable them to be better prepared for disasters [9,10]. Learning through play is a motivating and informative strategy that helps students become more aware of disasters [11]. Education supported by games in various subjects (such as mathematics, science, social studies, art, etc.) has positive effects on learning [12,13]. Scenario-based education helps students develop a greater awareness of disasters [14]. Lectures based on drama allow students to enhance their social skills and achieve high academic performance [11]. People who receive disaster management education tend to have high levels of cognitive empathy, which is directly linked to a heightened sense of responsibility [15]. Moreover, individuals with strong empathy skills contribute to building a stronger society [16]. Students who receive game-based disaster education gain a better understanding of the impacts of disasters and develop greater awareness towards reducing harm. This approach also fosters their empathy and sense of social responsibility, enabling them to show greater solidarity in the face of disasters [15,17–21]. Disaster preparedness is a strategic approach because a society that embraces disaster preparedness as a culture demonstrates greater solidarity in the face of disasters [22].

We believe that game-based education will enable children to achieve more lasting learning and develop greater awareness about future disasters in Ardahan, which in turn will help to strengthen social solidarity. This is the first experimental study in Turkiye aimed at examining the effectiveness of game-based disaster education to increase disaster awareness and promote appropriate behavior during disasters among fifth-grade students in Ardahan. Accordingly, the research hypotheses were constructed in line with the theoretical framework outlined above.

H_1:. There is no significant difference in pretest scores between the experimental and control groups (*Includes three sub-hypotheses based on: a) AAQ, b) DAS, and c) STS*).

H_2: There is a significant difference in posttest scores between the experimental and control groups (*Includes three sub-hypotheses based on: a) AAQ, b) DAS, and c) STS*).

H_3: There is a significant difference in follow-up test scores between the experimental and control groups (*Includes three sub-hypotheses based on: a) AAQ, b) DAS, and c) STS*).

H_4: The experimental group has significantly different pretest, posttest, and follow-up test AAQ scores.

H_5: The experimental group has significantly different pretest, posttest, and follow-up test DASscores.

H_6: The experimental group has significantly different pretest, posttest, and follow-up test STS scores.

H_7: The control group has no significantly different pretest, posttest, and follow-up test AAQ scores.

H_8: The control group has no significantly different pretest, posttest, and follow-up test DASscores.

H_9: The control group has no significantly different pretest, posttest, and follow-up test STS scores.

2. METHODS

2.1. Research Design and Setting

This prospective and randomized-controlled study adopted a quasi-experimental research model, which is a quantitative research method. This pretest–posttest control-group quasi-experimental study investigated the effect of a game-based disaster education program on fifth-grade students' disaster awareness, solidarity tendencies, and

academic performance. The study was conducted during the 2023–2024 academic year at "Türkiye Odalar ve Borsalar Birliği Middle School," which is affiliated with the Ardahan Directorate of National Education.

2.2. Participants and Sampling

The study population consisted of all fifth graders from Türkiye Odalar ve Borsalar Birliği Middle School in Ardahan/Türkiye during the 2023–2024 school year. The sample comprised 86 participants recruited using randomized controlled sampling. The research adhered to the Consolidated Standards of Reporting Trials (CONSORT) guide [23].

The inclusion criteria were (1) volunteering, (2) having a parent who signed the informed consent form, and (3) having no physical or neurological disability. The exclusion criteria were (1) declining to participate, (2) having no parent who signed the informed consent form, and (3) having a physical or neurological disability. The third criterion was implemented because the materials, tests, and games have not yet undergone content validity assessment for individuals with special needs.

2.3. Group Allocation

The classes were determined using stratified randomization (random selection method) in order to ensure homogeneous distribution concerning disaster awareness, solidarity tendency, and academic performance. A pretest was administered using the Disaster Awareness Scale (DAS), the Solidarity Tendency Scale (STS), and the Academic Achievement Questionnaire (AAQ). Based on the pretest results, the classes were divided into two groups using stratified randomization. Classes with low and high mean scores formed the first and second strata, respectively. The classes were assigned to the groups according to the stratified randomization scheme [24]. The groups were named as follows:

- Experimental: Receiving disaster education
- Control: Receiving no disaster education

2.4. Data Collection Tools

The data were collected using a personal information form, the Disaster Awareness Scale (DAS), the Solidarity Tendency Scale (STS), and the Academic Achievement Questionnaire (AAQ)

2.4.1. Personal Information Form

The personal information form was developed by the researchers. It consisted of seven items on sociodemographic characteristics, such as age, gender, parents' education, etc.

2.4.2. Disaster Awareness Scale (DAS)

The Disaster Awareness Scale (DAS) was developed by Yetişensoy (2022) on a sample of 1293 [25]. The instrument assesses how aware middle school students are of cognitive, affective, and psychomotor knowledge and skills utilized to minimize the risks they face before, during, and after disasters. The instrument consists of 18 items rated on natural disasters such as earthquakes, landslides, floods, droughts, storms, forest fires, etc.. The items are rated on a five-point Likert-type scale ("5 = Strongly Agree" to "1 = Strongly Disagree"). The total mean score ranges from 1 to 5, with higher scores indicating more awareness of disasters. The exploratory factor analysis shows that the scale has an eigenvalue of 9.771 and explains 54.284% of the total variance. This structure was verified using

confirmatory factor analysis. The validity results also show that the scale is valid and has a Cronbach's alpha score of 0.949. All in all, the scale is a valid and reliable instrument that can be used to determine how aware middle school students are of disasters.

2.4.3. Solidarity Tendency Scale (STS)

The Solidarity Tendency Scale (STS) was developed by Sarmusak (2011) [16]. The instrument consists of 12 items rated on a four-point Likert-type scale ("4 = Always," "3 = Most of the time," "2 = Very rarely," 1 = Never). The negative items are reverse-scored. A pilot test was conducted on 150 fourth and fifth graders to determine the instrument's construct validity. Exploratory Factor Analysis (EFA) was performed to assess its factor structure. First, Kaiser Mayer Olkin (KMO) and Barlett's test results were examined for the suitability of the data for factor analysis. The scale had a KMO score of .827, for which Barlett's test score was 397,487 ($p < 0.001$). Principal Component Analysis (PCA) and orthogonal rotation (Varimax) were used to determine its factor structure. The results indicated a one-factor structure, accounting for 37% of the total variance. The items have factor loadings of .451 to .749. The total score ranges from 12 to 48, with higher scores indicating more solidarity. The scale has a Cronbach's alpha score of .8344.

2.4.4. Academic Achievement Questionnaire (AAQ)

The Academic Achievement Questionnaire (AAQ) was developed by Çoban (2017) [26]. The original instrument had 30 items. Reliability analysis was performed on 72 fourth graders. After the reliability analysis, five items that measured similar content and reduced reliability were removed from the scale. Therefore, the instrument consists of 25 items. The scale has a KR 20 (Kuder Richardson) score of 0.718. Moreover, item difficulty indices were calculated. For content validity, a specification table was prepared under the guidance of an expert working at AFAD and four primary school teachers.

2.5. Procedure

First, the researchers briefed all parents and their children on the research purpose, procedure, and confidentiality. They also told them that they could withdraw from the study any time. Second, a pretest was administered to examine the differences between the experimental and control groups. The pretest data were analyzed using the Statistical Package for Social Sciences (SPSS, v. 26). The results showed no significant difference in pretest scores between the experimental and control groups. Third, normality was tested. The results showed that the data were normally distributed. The experimental group participated in the game-based disaster education program (intervention). The main aim of the intervention was to evaluate earthquake education by comparing educational games and traditional learning methods during the teaching of the topic of "earthquakes" within the scope of the "Social Studies" course. The control group was lectured by their teacher using the traditional method based on the curriculum. The intervention lasted six class hours (two hours per week). The intervention group participants played group or individual games. To play the group games, they chose a spokesperson, who was responsible for answering questions and conducting the games. The winning group was rewarded with a prize. During the intervention, the researchers avoided practices that could pose any physical and psychological risk. They found that the games helped the intervention group participants achieve learning retention, become more interested in the lessons, and attain educational goals. Three weeks later, the experimental and control groups took the posttest. Six weeks after the intervention, they took a follow-up test. All participants were administered a pretest, posttest, and follow-up test to measure their academic achievement statistically [27].

2.6. Data Analysis

The data were analyzed using SPSS (v. 26) and AMOS at a significance level of 0.05. Descriptive statistics were used for personal information. Each scale's reliability was examined through internal consistency and factor loadings. Normality was assessed, and inferential analyses included independent samples t-test and repeated-measures ANOVA.

Normality was tested using skewness and kurtosis values divided by standard errors [28–31]. Reliability was analyzed based on Cronbach's Alpha coefficients. Table 1 shows the mean, standard deviation, skewness, kurtosis, and reliability (Cronbach's alpha) values of the scale scores. The skewness and kurtosis values showed that all pretest, posttest, and follow-up test scores were normally distributed (Table 1).

The Disaster Awareness Scale (DAS) had significantly high Cronbach's alpha scores (pretest: 0.963, posttest: 0.978, and follow-up test: 0.975), indicating reliability. The Solidarity Tendency Scale (STS) also had high Cronbach's alpha scores (pretest: 0.886, posttest: 0.788, and follow-up test: 0.867). Cronbach's alpha scores were not checked for the Academic Achievement Questionnaire (AAQ) because it is not a Likert-type instrument (Table 1).

2.7. Ethical Considerations

The study was approved by the Scientific Research and Publication Ethics Committee of Ardahan University (No: E-67796128-000-2300014527 & Date: 25.05.2023). Written consent was obtained from the parents of all participants.

3. RESULTS

The study included a total of 86 fifth-grade students. The number of participants remained the same in the pretest and posttest phases (experimental group n = 45, control group n = 41). However, the number decreased in the follow-up test due to the end of the academic year (experimental group n = 38, control group n = 34) (Table 2). Among the participants, 51.2% were male. Half of the mothers (50%) and 64% of the fathers had a bachelor's degree. While 59.3% of the students had an emergency kit at home, 74.4% reported not having a fire extinguisher, and 38.4% did not have a designated gathering area for emergencies.

The pretest results revealed no significant differences between the experimental and control groups in terms of academic achievement (AAQ) and solidarity tendency (STS), while a significant difference was found in disaster awareness (DAS), favoring the experimental group (Table 2). These results supported H1a and H1c, while H1b was rejected.

In the posttest phase, independent-sample t-tests showed that the experimental group had significantly higher scores in both AAQ and DAS compared to the control group, indicating the effectiveness of the intervention. However, no significant difference was found in STS scores between the groups (Table 2). Therefore, H2a and H2b were accepted, and H2c was rejected.

In the follow-up test, conducted six weeks after the intervention, the experimental group maintained significantly higher AAQ scores, while no significant differences were observed in DAS or STS scores between the groups (Table 2). Thus, only H3a was accepted, while H3b and H3c were rejected.

Repeated-measures ANOVA was used to evaluate within-group differences. For the experimental group, a significant difference was found in AAQ scores across pretest, posttest, and follow-up measurements, confirming H4 (Tables 3 and 4). No significant changes were observed for DAS and STS scores over time, leading to the rejection of H5 and H6.

In the control group, repeated-measures ANOVA showed no significant change in AAQ scores over time, supporting H7 (Tables 5 and 6). For DAS, a significant increase was observed from pretest to follow-up, leading to the rejection of H8. STS scores did not differ significantly across time points, supporting H9.

4. LIMITATIONS

While this study has certain limitations, it serves as a valuable starting point for future research. Conducted in a single school in Ardahan, Türkiye, and limited to fifth-grade students, the generalizability of the findings may be constrained. The duration of the intervention, consisting of six class hours, may have been insufficient to observe more pronounced changes in socio-emotional variables such as solidarity tendency. Additionally, the measurement tools used may have had limitations in fully capturing the complexities of social behavior in real disaster scenarios. Despite these constraints, the study contributes meaningful insights into the applicability of game-based disaster education.

5. DISCUSSION

This section discusses the findings. Most middle schools offer disaster education as part of geography, environmental studies, citizenship, personal development, or life skills courses [32]. Curricula must be aligned with the Sendai Framework for Disaster Risk Reduction. For example, schools in Malaysia have geography curricula aligned to the four priorities of the Sendai framework [33]. Curricula in Türkiye should also help children and adolescents become more aware of disasters in line with the Sendai Framework for Disaster Risk Reduction. In this context, curricula in Turkiye should embrace the role adopted by the United Nations (UN) Third World Conference on Disaster Risk Reduction: “Children and youth are agents of change and should be given the space and modalities to contribute to disaster risk reduction, in accordance with legislation, national practice, and educational curricula” [34]. Curriculum-based education is critical for disaster reduction. Zhu and Zhang (2017) advocate that primary and secondary schools in China should offer more school-based disaster education to raise students' awareness of disasters. Moreover, they state that most teachers believe disaster education should be included in their curricula [35]. Cvetković et al. (2015) report that Serbian secondary school students perceive disasters as a security threat. Therefore, they suggest that curricula should include topics related to disasters [36].

Our results showed significant differences in posttest AAQ and DAS scores between the experimental and control groups. Research shows that students who receive educational interventions are much better prepared for disasters. For example, Yeon et al. (2020) found that disaster education programs offered after the Pohang earthquake affected students' emotional responses, indicating they were more knowledgeable and prepared for disasters [37]. Wang et al. (2023) reported that disaster education programs made students more aware of risks and helped them adopt personal protective behaviors [38]. White-Lewis et al. (2021) determined that disaster education helped middle school students fill their knowledge gaps [39]. Feng et al. (2021) also observed that students who received disaster training through virtual reality and gaming learned more about how to be prepared for disasters [40]. Tsai et al. (2020) found that students who played games on floods developed more disaster prevention skills, became more interested in learning about disasters, built more self-awareness, and developed a stronger sense of civic responsibility [41]. All these results are consistent with our findings.

Our results showed a significant difference in follow-up test AAQ scores between the experimental and control groups. Yeon et al. (2020) determined that disaster education programs offered after the Pohang earthquake affected students' emotional responses, indicating they were more knowledgeable and prepared for disasters [37].

Wang et al. (2023) found that disaster education programs made students more aware of risks and helped them adopt personal protective behaviors [38].

Experts advocate that we should offer students of all ages disaster training and education to help them develop awareness of disasters and contribute to risk mitigation processes [32]. Game-based education is one of the most effective methods to help students develop skills and use their thought processes [41]. Rayos et al. (2024) found that a board game on hydrometeorological hazards helped eleventh graders learn more about disasters and become more aware of and prepared for them [42]. According to Huda et al. (2024), most disaster training and education programs are dull and non-interactive, which discourages students from learning about disaster preparedness [43]. Therefore, disaster education and training programs should include engaging and innovative approaches that effectively communicate the concepts of "disaster risk reduction." Huda et al. (2024) focused on a card game called "Camibee", an adaptation of Monopoly, to encourage high school students to engage in active learning, develop disaster literacy, and think critically. They found that Camibee significantly helped students understand the concepts of "disaster risk reduction." Moreover, they reported that students were eager to play Camibee, which made them more motivated to learn how to reduce the risks of disasters. They offered an alternative to traditional disaster risk reduction methods by integrating an engaging and fun board game with educational content.

Game-based disaster education helps students achieve high academic performance. However, research shows that game-based education contributes to disaster awareness only to some extent. Therefore, if we integrate traditional disaster education with game-based education methods, we can help students develop higher awareness of disasters and achieve higher academic performance. Our intervention was a student-centered approach that allowed our experimental group participants to learn about disasters and play an active role in their learning processes. It also encouraged them to act out disaster scenarios and practice what to do during disasters. Thus, they became more prepared for disasters and learned what to do in real-life situations. It also raised their awareness of the damage caused by disasters.

Social responsibility and solidarity before and after disasters are critical strategies for disaster management. As a result, if we can turn disaster preparedness into a culture, we can ensure students' solidarity during and after disasters. In this context, we believed that games could help students gain awareness of possible disasters in Ardahan and develop solidarity to deal with post-disaster effects. However, our intervention did not significantly affect our participants' solidarity tendencies because the experimental and control groups had no significant differences in their mean pretest, posttest, and follow-up test STS scores. Therefore, neither traditional nor game-based disaster education impacted students' solidarity tendencies. However, the combination of traditional and game-based education can be an effective way to increase disaster awareness and academic achievement. In other words, if we integrate traditional and game-based education methods, we can help students understand the impacts of disasters and raise awareness about what they can do to reduce the damage caused by disasters. This awareness and sense of social responsibility can help them develop solidarity tendency. Such a project can only be sustainable if it teaches students about disasters and raises awareness about disasters among parents. This culture may lead to the development of students' solidarity tendencies.

Reorganization and recovery generally follow a disaster. After a disaster, survivors solidarize and cooperate to mitigate the effects of the disaster and ensure the return of society to normal. In this way, disasters can strengthen the feelings of solidarity and cooperation in society [44–48]. Disasters can make people more prepared and help them develop attitudes towards sustainable environmental protection and adopt feelings of solidarity and

cooperation [49]. If we make students more aware of disasters through education, we can help them develop a sense of solidarity.

6. CONCLUSIONS

We believed that game-based disaster teaching could help students understand the impacts of disasters and become more aware of what they could do to reduce the damage they cause. We also believed that disaster awareness could allow students to develop empathy and a sense of social responsibility and solidarity. The intervention temporarily helped our experimental group participants perform better academically and become more aware of disasters. On the other hand, traditional disaster education helped our control group participants achieve better academic performance in the long run. However, the intervention did not help our experimental group participants develop more solidarity. Therefore, we suggest that teachers should integrate traditional and game-based disaster education methods. Researchers should recruit different samples to investigate the impact of our intervention on solidarity tendency and disaster awareness. They should investigate whether game-based disaster teaching has an impact on students' academic performance in the long run. They should also study how disaster awareness can help students develop empathy and a sense of social responsibility. They should conduct experimental studies integrating traditional and game-based disaster teaching methods to help students develop a sense of solidarity in the face of disasters

If we provide game-based disaster education to fifth graders from Ardahan, we can allow them both to acquire life-saving knowledge and to become more aware of disasters. Our intervention helped our participants to simulate disaster scenarios they might encounter in real life and to practice what they should do during disasters. It allowed them to meet experts on disasters, observe how they work during the disaster management process, and gain knowledge about disaster management. It also taught them how to behave appropriately during disasters and what they need to do to keep themselves and others safe.

Declarations

Author Contribution

Study design: MSK, MK, BMA, EEData collection: MSK, MK, BMAData analysis: MSKStudy supervision: MSK, MK, BMA, EEManuscript writing: MSK, MK, BMA, EECritical revisions for important intellectual content: MSK, BMA

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Tables

Table 1. Normality

Scales	N	$\bar{x}$	SD	Skewness	SE	Kurtosis	Std. H.	CA (α)
Pretest - AAQ	86	54,37	14,79	-,219	,260	-,232	,514	-
Pretest - DAS	86	67,21	20,65	-,843	,260	-,337	,514	,963
Pretest - STS	86	40,38	6,72	-,849	,260	,185	,514	,886
Posttest - AAQ	86	76,51	20,83	-,674	,260	-,274	,514	-
Posttest - DAS	86	71,40	22,13	-1,290	,260	,306	,514	,978
Posttest - STS	86	40,99	5,13	-,510	,260	-,707	,514	,788
Follow-up test - AAQ	72	63,29	16,56	-,779	,283	-,109	,559	-
Follow-up test - DAS	72	76,15	18,87	-1,837	,283	2,704	,559	,975
Follow-up test - STS	72	41,48	6,47	-1,190	,283	,807	,559	,867

N=Data count, $\bar{x}$=Mean, SD=Standard deviation, SE=Standard error, CA= Cronbach's alpha (α)

Table 2. Scale Scores

	Scale	Group	N	$\bar{x}$	SD	t	df	p
Pretest	AAQ	Experimental	45	55,46	14,71	,717	84	,48
		Control	41	53,17	14,97			
	DAS	Experimental	45	71,62	19,31	2,115	84	**,04***
		Control	41	62,38	21,21			
	STS	Experimental	45	40,22	6,49	-,230	84	,82
		Control	41	40,56	7,04			
Posttest	AAQ	Experimental	45	92,53	8,89	12,39	63,34	**,00***
		Control	41	58,93	15,15			
	DAS	Experimental	45	76,17	19,16	2,11	76,21	**,04***
		Control	41	66,18	24,16			
	STS	Experimental	45	41,13	4,60	,25	76,77	,81
		Experimental	45	92,53	8,89			
Follow-up Test	AAQ	Experimental	38	69,71	14,34	3,789	70	**,00***
		Control	34	56,12	16,11			
	DAS	Experimental	38	75,84	21,19	-,147	70	,88
		Control	34	76,50	16,21			
	STS	Experimental	38	41,37	5,95	-,162	70	,87
		Experimental	38	69,71	14,34			

$\bar{x}$ = Mean, N = Data count, SD = Standard deviation, t = t-test, df = Degrees of freedom, p. = Significance

Table 3. ANOVA Test Results (Experimental Group)

Scale	Test	$\bar{x}$	SD	Measurement	Sum of Squares	df	Mean of Squares	F	p
AAQ	Pretest	57,05	15,24	AAQ	24098,96	2	12049,48	106,31	**,000***
	Posttest	92,21	9,34	Error	8387,03	74	113,33		
	Follow-up test	69,71	14,34	Between-samples	202453,34	1	202453,34	2033,51	**,000***
				Error	3683,66	37	99,56		
DAS	Pretest	71,68	20,59	AAQ	418,93	2	209,46	,552	,578
	Posttest	75,65	19,62	Error	28095,97	74	379,67		
	Follow-up test	75,84	21,19	Between-samples	210302,20	1	210302,20	1265,85	**,000***
				Error	6146,96	37	166,1		
STS	Pretest	40,39	5,86	AAQ	18,64	2	9,32	,517	,599
	Posttest	41,02	4,71	Error	1334,96	74	18,04		
	Follow-up test	41,37	5,95	Between-samples	63645,34	1	63645,34	3422,90	**,000***
				Error	687,97	37	18,59		

$\bar{x}$ = Mean, SD = Standard deviation, df = Degrees of freedom, F = ANOVA (analysis of variance), p. = Significance

Table 4. Multiple Comparison Test (Experimental Group)

						95% Confidence Interval	
Scale	**Test**		**Mean Difference**	**SE**	**p**	**Lower Limit**	**Upper Limşt**
AAQ	Pretest	Posttest	-35,16	2,52	**,00***	-40,26	-30,06
		Follow-up test	-12,66	2,18	**,00***	-17,07	-8,25
	Posttest	Pretest	35,16	2,52	**,00***	30,06	40,26
		Follow-up test	22,50	2,61	**,00***	17,20	27,80
	Follow-up test	Pretest	12,66	2,18	**,00***	8,25	17,07
		Posttest	-22,50	2,61	**,00***	-27,80	-17,20
DAS	Pretest	Posttest	-3,97	4,47	1,00	-15,18	7,25
		Follow-up test	-4,16	4,30	1,00	-14,93	6,62
	Posttest	Pretest	3,97	4,47	1,00	-7,25	15,18
		Follow-up test	-,19	4,64	1,00	-11,81	11,43
	Follow-up test	Pretest	4,16	4,30	1,00	-6,62	14,93
		Posttest	,19	4,64	1,00	-11,43	11,81
STS	Pretest	Posttest	-,63	,91	1,00	-2,92	1,66
		Follow-up test	-,98	1,10	1,00	-3,75	1,79
	Posttest	Pretest	,63	,91	1,00	-1,66	2,92
		Follow-up test	-,35	,89	1,00	-2,59	1,88
	Follow-up test	Pretest	,98	1,10	1,00	-1,79	3,75
		Posttest	,35	,89	1,00	-1,88	2,59

SE = Standard error, p.=Significance

Table 5. ANOVA Test Results (Control Group)

Scale	Test	$\bar{x}$	SD	Measurement	Sum of Squares	df	Mean of Squares	F	p
AAQ	Pretest	54,82	13,98	AAQ	380,54	2	190,27	1,148	,323
	Posttest	59,41	15,70	Error	10936,78	66	165,70		
	Follow-up test	56,12	16,11	Between samples	109631,58	1	109631,58	889,34	**,000**
				Error	4067,97	33	123,27		
DAS	Pretest	62,32	21,76	AAQ	3533,68	1,62	2169,30	6,410	**,005***
	Posttest	67,16	23,90	Error	18191,38	53,75	338,41		
	Follow-up test	76,50	16,21	Between samples	160274,6	1	160274,68	635,55	**,000**
				Error	8321,95	33	252,18		
STS	Pretest	40,47	7,20	AAQ	28,82	1,56	18,39	,475	,578
	Posttest	41,58	5,37	Error	2001,80	51,708	38,71		
	Follow-up test	41,62	7,10	Between samples	57778,91	1	57778,91	2458,557	**,000**
				Error	775,53	33	23,50		

$\bar{x}$ = Mean, SD = Standard deviation, df = Degrees of freedom, F = ANOVA (analysis of variance), p.=Significance

Table 6. Multiple Comparison Test (Control Group)

						95% Confidence Interval	
Scale	**Test**		**Mean Difference**	**SE**	**p**	**Lower Limit**	**Upper Limit**
AAQ	Pretest	Posttest	-4,59	3,11	,45	-12,43	3,26
		Follow-up test	-1,29	3,21	1,00	-9,38	6,80
	Posttest	Pretest	4,59	3,11	,45	-3,26	12,43
		Follow-up test	3,29	3,05	,86	-4,39	10,98
	Follow-up test	Pretest	1,29	3,21	1,00	-6,80	9,38
		Posttest	-3,29	3,05	,86	-10,98	4,39
DAS	Pretest	Posttest	-4,84	2,92	,32	-12,21	2,53
		Follow-up test	-14,18	4,57	,01*	-25,71	-2,65
	Posttest	Pretest	4,84	2,92	,32	-2,53	12,21
		Follow-up test	-9,34	4,38	,12	-20,40	1,71
	Follow-up test	Pretest	14,18	4,57	,01*	2,65	25,71
		Posttest	9,34	4,38	,12	-1,71	20,40
STS	Pretest	Posttest	-1,11	1,18	1,00	-4,10	1,88
		Follow-up test	-1,15	1,65	1,00	-5,30	3,01
	Posttest	Pretest	1,11	1,18	1,00	-1,88	4,10
		Follow-up test	-,04	1,11	1,00	-2,84	2,76
	Follow-up test	Pretest	1,15	1,65	1,00	-3,01	5,30
		Posttest	,04	1,11	1,00	-2,76	2,84

SE = Standard error, p. = Significance