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Evaluation of University Students Earthquake Perceptions within the Perspective of Sustainable Earthquake Awareness[1]

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Abstract

This research was conducted to determine the earthquake awareness of students studying at a university located in the southwest of the Marmara Region. The descriptive survey model, one of the quantitative research methods, was used in the study. The sample of the study consisted of 564 students determined by the non-random convenience sampling method. In the analysis process, independent t-test, ANOVA and TUKEY multiple comparison test were applied from parametric tests. According to the research results, it was determined that the level of knowledge of female participants about earthquakes was generally higher than that of male participants. In addition, a significant difference was found in terms of earthquake knowledge levels according to the classes students were studying. However no statistically significant difference was found between the classes in the earthquake impact knowledge sub-dimension. In addition, it was observed that the majority of the participants (90.43%) had a moderate level of awareness in terms of the Sustainable Earthquake Awareness Scale (SEAS), but the rate of those who reached a high level of awareness was quite low (7.27%). Accordingly suggestions such as applying general disaster courses to all grade levels and developing gender-sensitive disaster education emerge.

Key Words

Earthquake knowledge level
University students
Marmara Region
Sustainable earthquake awareness

About Article

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Introduction

Sustainable disaster awareness means that individuals and societies understand disaster risks, take the necessary precautions to reduce these risks, and adopt sustainable development approaches to increase resilience against disasters. This concept goes beyond managing the short-term effects of disasters and includes an integrated approach with long-term social, economic and environmental sustainability goals. In particular reducing the effects of disasters and building social resilience are an integral part of sustainable development goals (UN, 2015; UNISDR, 2015). McEntire, Fuller, Johnston and Weber (2002) state that sustainable development makes positive contributions to sustainable disaster mitigation, disaster studies and disaster risk reduction processes. This relationship highlights that disaster management should be integrated with long-term development goals so that both social and environmental resilience can be increased. Therefore strengthening disaster resilience is of critical importance to minimize the impacts of disasters and increase social resilience. Disaster resilience includes not only post-disaster recovery but also developing a proactive approach to disasters.

Ensuring resilience against disasters requires a multidisciplinary approach and cooperation. International roadmaps are needed to carry out these processes systematically and to certain standards. The Hyogo Action Plan and the Sendai Action Plan provide a guide for countries in this direction, enabling them to develop strategies to reduce disaster risks and increase resilience. Therefore establishing a disaster resilience culture has become one of the priority goals of countries. Strengthening disaster resilience is possible through the implementation of educational programs at all levels. This situation enables societies to be better prepared for disasters. This situation provides an opportunity for societies to be better prepared for disasters (Varol & Kırıkkaya, 2017).

The Hyogo Plan of Action and the Sendai Framework stand out as important international documents in terms of raising disaster awareness and reducing disaster risks. Particularly within the scope of the Hyogo Action Plan, between 2005 and 2015, it was aimed to reduce disaster risks and make societies more resilient to disasters. In line with the Hyogo Plan of Action, strategies have been developed to encourage joint efforts by governments, local authorities and communities to raise disaster awareness (UNISDR, 2005). The Sendai Framework, adopted in 2015, addressed strengthening resilience against disasters and increasing social awareness. In addition, within the scope of this agreement, emphasis is placed on increasing disaster awareness, and the importance of predicting disasters and disseminating training and awareness campaigns to reduce the effects of disasters are underlined (UNISDR, 2015). As a result both agreements encourage international cooperation to better understand and prepare for disaster risks.

Following the explanations discussed above, global efforts to increase disaster awareness require a sustainable approach to minimize the effects of natural disasters, especially earthquakes. In particular earthquake awareness includes not only immediate intervention but also developing long-term strategies. Accordingly within the scope of sustainable earthquake awareness, it is aimed for communities to be conscious of disasters, understand the risks and be prepared for these risks. This understanding needs to be strengthened through both education and community-based practices (UNISDR, 2015). As a result of disasters in the last century, millions of people have lost their lives and billions of dollars of economic losses have occurred worldwide. The relationship between the level of development of countries, the degree to which they are affected by disasters and their resilience capacities stands out as a determining factor in this process (Gündüz, 2022). Therefore, at this point, exemplary practices regarding sustainable earthquake awareness in the world are important. In this context it is possible to give examples of successful practices regarding sustainable earthquake awareness in countries such as Japan and New Zealand.

Japan in particular is one of the leading countries in earthquake awareness and preparedness. Earthquake awareness programs included in the education curriculum, regular drills and effective cooperation with local governments have created awareness throughout society. In addition the Japanese disaster management system supports awareness efforts by improving building standards and developing technological early warning systems (Shaw & Goda, 2004). In addition the “Bosai” culture in Japan represents a holistic approach to disaster risk reduction. This concept is derived from two

Japanese roots meaning “prevention” and “disaster.” Bosai represents the people’s historical tradition of being prepared for natural disasters and learning from experience. Developed after devastating events such as the Great Hanshin and Tohoku earthquakes in Japan, this culture offers a multi-level system that includes individual responsibility, social solidarity, and technical measures. Therefore, bosai culture ensures that earthquake awareness is transmitted across generations (Yazıcı, 2023).

On the other hand New Zealand promotes earthquake awareness with its “Get Ready, Get Thru” campaign. This campaign is designed with a sustainable approach to provide information on what the community should do during an earthquake, as well as encouraging them to adopt long-term risk reduction measures. Moreover, the campaign also contributes to the development of a sustainable disaster awareness culture by encouraging long-term risk reduction measures. Educational materials and public service announcements within the scope of the campaign were prepared to appeal to different age and social groups (Ministry of Civil Defence Emergency Management, 2015).

Similar to practices around the world, sustainable earthquake awareness studies in Türkiye are supported by training programs and drills conducted by the Disaster and Emergency Management Presidency (DEMP). Especially within the scope of the “Türkiye Disaster Education Year” launched in 2021, millions of people have been trained in disaster awareness, and this awareness has been made permanent with events such as “Disaster Awareness Week.” These practices aim to make individuals and societies resilient to disasters (AFAD, 2021).

In addition the Twelfth Development Plan (2024-2028) includes content for developing strategies to reduce Türkiye’s earthquake risk. In this context it is envisaged to strengthen earthquake preparations throughout the country, to implement strategies to reduce disaster risks and to integrate sustainable development goals with disaster management. Within the scope of the plan, priority areas such as geodynamic research, earthquake risk analysis and development of new technologies have been determined. In addition it is aimed to increase various training and awareness programs in order to prepare for disasters and create social awareness on this issue. In this way, it is planned to make Türkiye more resilient to earthquake risk and to achieve sustainability goals in this process (Presidency of the Republic of Türkiye Strategy and Budget Directorate, 2024). Within the framework of the 2024 Türkiye Century Education Model Geography Curriculum of the Ministry of National Education, it is aimed to increase the environmental awareness of students through achievements regarding disasters and environmental problems in geography education. In this context the basic approach of the geography curriculum enables students to develop a conscious approach to disasters and use this information for the benefit of society (MEB [Ministry of National Education], 2023). These steps taken for the curriculum are expected to make significant contributions to sustainable earthquake awareness. In the literature review on earthquake awareness conducted with university students, the following studies were identified: Ertuğrul and Ünal (2020), Tekin (2020), Genç and Sözen (2021), Tekin and Dikmenli (2021), Bilen and Polat (2022), Gezer and Şahin (2022), Arslan and Kuyulu (2023), Bor (2023), Budak and Kandil (2023), Doğru and Coşkun (2023), Sözen and Genç (2023), Şen and Yetim (2023), Yıldız and Öztürk (2023), Atalay (2024), Değirmenci and Altunay (2024), and Yalçın (2024). In these studies, it was observed that studies on sustainable earthquake awareness were limited. In the existing literature, the general awareness and preparedness level for earthquakes has generally been examined. In addition, it was understood that the studies examining the sustainable earthquake awareness dimension were limited to the studies of Sözen and Genç (2023) and Budak and Kandil (2023). Moreover the study of Budak and Kandil (2023) was carried out in the field of sports sciences.

However, in the current literature, earthquake awareness appears to be sufficiently addressed in studies conducted in the university context of the Marmara Region. This situation is considered as an important formation considering the high earthquake risk structure in the region.

Transforming earthquake awareness into a sustainable lifestyle is not limited to individuals having knowledge. It is also necessary to transform this knowledge into behavior and integrate it into daily life. Therefore in order to increase social resilience, it is important to acquire disaster awareness at an early age and especially to reinforce it at the university level. University students are seen as

carriers of disaster awareness due to both their openness to learning and the roles they will undertake in the future.

The Purpose of the Research

The aim of this research is to determine the earthquake awareness levels of students studying at a university located in the southwest of the Marmara Region. The region in question is at risk of a possible major earthquake due to its proximity to active fault lines and increasing population density. Therefore, the level of knowledge and preparedness of the young population in the region regarding disasters has the potential to provide meaningful data in terms of disaster management policies at both regional and national levels.

In line with this purpose, the following sub-objectives were focused on:

- Do the earthquake knowledge and sustainable earthquake awareness of the participants differ according to gender?
- How are the earthquake knowledge and sustainable earthquake awareness of the participants distributed according to their grade levels?
- What is the distribution of the descriptive statistics of the total scores of the participants regarding the sustainable earthquake awareness and earthquake knowledge level scales?
- What is the distribution of the multiple correlation analysis of the total scores and sub-dimensions obtained from the Earthquake Knowledge Level Scale and Sustainable Earthquake Awareness scales?

Method

Research Design

The research was conducted using quantitative research design. Quantitative research is a method in which data is collected through secondary sources such as statistics or structured questionnaires produced by the researcher (secondary data) (Kozak, 2014). According to Creswell (2014), quantitative research is a method that aims to test a certain hypothesis through the collection, analysis and interpretation of measurable data during the research process. This type of research is usually carried out using numerical data collection tools (surveys, tests, observations) and through statistical analysis. Accordingly quantitative modeling in the research was carried out according to the descriptive survey model. Descriptive survey model is a research design used to define the current situation regarding a research topic and to reveal the characteristics of this situation. This model collects data to describe the current status of individuals, objects or events at a particular time and is usually based on surveys, observations or analysis of existing records (Karasar, 2013). Therefore the application of the survey technique was considered to be an ideal approach in terms of revealing the extent of the relationship between participant awareness and factors such as education, social consciousness and environmental factors.

Sample

In the study non-random convenience sampling method was used because it is advantageous in terms of practicality, time management, ease of access and inclusive participation (Creswell, 2014; Etikan, Musa, & Alkassim, 2016). The sample of the study consisted of 564 students, 350 female and 214 male, studying in different faculties of a university located in the southwest of the Marmara Region. Frequency and percentage distribution data regarding the characteristics of the research sample are given in Table 1.

Table 1. Frequency and percentage distribution data of the research sample

Variable	Category	N	(%)
Gender	Male	214	37.94
	Female	350	62.06
Class	1st Class	148	26.24
	2nd Class	147	26.06
	3rd Class	138	24.48
	4th Class	118	20.92
	5th Class	13	2.30
Department of Education	Emergency Aid and Disaster Management	160	28.37
	Geography	129	22.87
	Social Studies Teaching	187	33.16
	Geography Teaching	88	15.60
TOTAL		564	100

Data Collection Process

Before the data collection process, the necessary permissions were obtained from the Ethics Committee of Çanakkale Onsekiz Mart University Graduate Education Institute. Then, the necessary permissions were obtained from the faculty deans within the scope of the Rectorate approval. The data in the study were collected between 25/03/2024 and 03/01/2025. The participants answered the survey questions online.

Data Collection Tool

Two different data collection tools were used in the research. These are the Sustainable Earthquake Awareness Scale and the Earthquake Knowledge Level Scale developed by Genç and Sözen (2021) and Genç and Sözen (2022), both of which are 5-point Likert-type scales. Sustainable Earthquake Awareness Scale is a tool consisting of three dimensions and 22 positive items. The internal consistency coefficient of the scale (Cronbach alpha) was determined as 0.884. The dimensions of the scale were defined as Earthquake-Structure Relationship (4 items), Earthquake Preparedness Application (11 items) and Earthquake Preparedness (7 items). The lowest score that can be obtained from this scale is 22, and the highest score is 110. Increased scores from the scale indicate that individuals have greater awareness of earthquakes. In this study, the internal consistency coefficient of the scale was found to be 0.827. Earthquake Knowledge Level Scale is also a 5-point Likert-type scale and consists of 19 positive items in three dimensions. In previous studies conducted by researchers, the internal consistency coefficient (Cronbach alpha) of this scale was found to be 0.868. The dimensions of the scale were determined as Knowledge of the Distribution of Earthquake Zones (7 items), Knowledge of Earthquake Effects (7 items) and Earthquake Education (5 items). The lowest score that can be obtained from this scale is 19, and the highest score is 95. Increased scores from the scale indicate that individuals have more knowledge about earthquakes. In this study, the internal consistency coefficient of the scale was found to be 0.919.

Data analysis

After the research data were collected, descriptive and relational analyses were conducted. The analysis process began with the examination of normality findings. According to the test results, it was determined that the majority of the data showed normal distribution. In order to make a definitive assessment, skewness and kurtosis values were examined. According to George and Mallery (2016), skewness and kurtosis values between -2 and +2 indicate acceptable normal distribution, while a stricter criterion between -1 and +1 indicates a stronger normal distribution. It was determined that the skewness and kurtosis values obtained in the study varied between -0.599 and 0.993 for the knowledge level scale and between 0.012 and 1.305 for the awareness scale. Accordingly, it was concluded that the data had a normal distribution since the values in question were between -1.5 and +1.5. After determining that the data showed normal distribution, independent sample t-test, one-way analysis of variance (ANOVA) and TUKEY Multiple Comparison Test were applied. Additionally, the Pearson

Correlation test was used to examine the relationships between the scales and their sub-dimensions used in the study.

Findings

In this study in which the earthquake awareness of students studying in different faculties and departments of the university is examined in terms of various variables, findings are included according to the research problems of the study.

Findings regarding the First Sub-Problem

In this section the distribution of participants' earthquake awareness according to the gender variable was evaluated.

Table 2. T-test results for the differences in the sub-dimensions of the earthquake knowledge level scale of the participants according to gender

Variables	Gender	N	$\overline{X}$	S	sd	*t*	*p*
Earthquake knowledge level	Female	350	74.05	11.17	562	2.70	.007
	Male	214	71.12	13.21			
Knowledge of the distribution of earthquake zones	Female	350	28.03	4.86	562	2.44	.015
	Male	214	26.88	5.69			
Knowledge of earthquake effects	Female	350	28.94	4.71	562	2.63	.009
	Male	214	27.77	5.34			
Earthquake education	Female	350	28.94	4.94	562	1.40	.160
	Male	214	7.77	5.12			

According to Table 2, it is seen that the level of knowledge of female participants about earthquakes is generally higher than that of male participants. In particular, it was determined that the average scores of female participants were significantly higher in the variables of earthquake distribution knowledge (t=2.44, p=0.01), earthquake effects knowledge (t=2.63, p=0.009) and total earthquake knowledge level (t=2.70, p=0.007). However, it is noteworthy that there is no significant difference between genders in the earthquake education (t=1.40, p=0.16) sub-dimension.

Table 3. T-test results for the differences in the sub-dimensions of the sustainable earthquake awareness scale of the participants according to gender

Variables	Gender	N	$\overline{X}$	S	sd	*t*	*p*
Sustainable Earthquake Awareness	Female	350	69.74	7.96	562	2.397	.017
	Male	214	67.90	9.29			
Earthquake-Structure Relationship	Female	350	12.42	3.22	562	1.604	.109
	Male	214	11.96	3.35			
Earthquake Preparedness Application	Female	350	31.22	8.02	562	-.243	.808
	Male	214	31.40	8.54			
Earthquake Preparedness	Female	350	26.08	6.08	562	3.048	.002
	Male	214	24.53	5.47			

According to Table 3, it was found that women had higher awareness than men in the variables of sustainable earthquake awareness (t = 2.40, p = 0.01) and earthquake preparedness (t =

3.05, p = 0.002) and it was found to be statistically significant. However, it is noteworthy that there is no significant difference between the genders in the variables of earthquake-structure relationship (t = 1.60, p = 0.10) and earthquake preparedness practice (t = -0.24, p = 0.80).

Findings related to the Second Sub-Problem

In this section the distribution of the participants' earthquake awareness according to the variable of the grade level they study was evaluated. Accordingly firstly the ANOVA test results were evaluated. Finally TUKEY analysis was performed for significant differences. All the workflows performed for the Earthquake Knowledge Level Scale were also performed for Sustainable Earthquake Awareness.

Table 4. ANOVA analysis results for the class level difference of the earthquake knowledge level scale of the participants

Dimensions	Source of Variance	KT	sd	KO	*F*	*p*	Significant Difference
Earthquake Knowledge Level	Intergroup	2160.691	5	540.173	3.783	.005**	1-4
	Intragroup	79810.378	559	142.773			2-4
	Total	81971.069	563				
Knowledge of the Distribution of Earthquake Zones	Intergroup	369.000	4	92.250	3.443	.009**	1-4
	Intragroup	14976.636	559	26.792			
	Total	15345.637	563				
Knowledge of Earthquake Effects	Intergroup	173.076	4	43.269	1.746	.138	
	Intragroup	13851.922	559	24.780			
	Total	14024.998	563				
Earthquake Education	Intergroup	424.592	4	106.148	4.316	.002**	1-4
	Intragroup	13748.363	559	24.595			3-4
	Total	14172.956	563				

** p<0.05 [1st Grade (1), 2nd Grade (2), 3rd Grade (3), 4th Grade (4), 5th Grade (5)]

According to Table 4, significant differences were found between the groups in terms of earthquake knowledge level dimension [F(4-559) = 3.783; p = 0.005]. Significant differences were found between groups 1-4 and 2-4. Significant differences were also observed in the knowledge of the distribution of earthquake zones dimension [F(4-559) = 3.443; p = 0.009], and the difference was found between groups 1-4. No significant difference was found between the groups in the knowledge of earthquake effects dimension [F(4-559) = 1.746; p = 0.138]. Significant differences were found in the earthquake education dimension [F(4-559) = 4.316; p = 0.002], and significant differences were found between groups 1-4 and 3-4.

Sustainable earthquake awareness of the participants according to their educational status is shown in Table 5.

Table 5. ANOVA analysis results for the class level difference of the sustainable earthquake awareness scale of the participants

Dimensions	Source of Variance	KT	sd	KO	*F*	*p*	Significant Difference
Sustainable Earthquake Awareness	Intergroup	853.447	4	213.362	2.971	.019**	1-4
	Intragroup	40142.445	559	71.811			
	Total	40995.892	563				
Earthquake-Structure Relationship	Intergroup	92.488	4	23.122	2.170	.071	
	Intragroup	5957.262	559	10.657			
	Total	6049.750	563				
Earthquake Preparedness Application	Intergroup	969.492	4	242.373	.654	.006**	1-4
	Intragroup	37077.649	559	66.329			
	Total	38047.142	563				
Earthquake Preparedness	Intergroup	233.489	4	58.372	1.680	.153	
	Intragroup	19417.511	559	34.736			
	Total	19651.000	563				

** p<0.05 [1st Grade (1), 2nd Grade (2), 3rd Grade (3), 4th Grade (4), 5th Grade (5)]

According to Table 5, a significant difference was found between the groups in terms of sustainable earthquake awareness dimension [F(4-559) = 2.971; p = 0.019]. A significant difference was found between groups 1-4. No significant difference was found in the earthquake-structure relationship dimension [F(4-559) = 2.170; p = 0.071]. Significant differences were observed in the earthquake preparedness practice dimension [F(4-559) = 3.654; p = 0.006], and a significant difference was found between groups 1-4. No significant difference was observed between the groups in the earthquake preparedness dimension [F(4-559) = 1.680; p = 0.153].

As a result, a statistically significant difference was found between the groups in terms of sustainable earthquake awareness, and this difference was particularly evident between the first and fourth groups. However, no significant difference was found between the groups in terms of earthquake-structure relationship. When evaluated in terms of earthquake preparedness practices, a significant difference was observed between the groups, and this difference was again found to be evident between the first and fourth groups. On the other hand, no statistically significant difference was found between the groups in terms of earthquake preparedness in general.

Findings related to the Third Sub-Problem

In this title, the distribution of descriptive statistics regarding the total scores of sustainable earthquake awareness and earthquake knowledge level scales is given.

Table 6. Descriptive statistics of the total scores of the participants for the Sustainable Earthquake Awareness Scale and Earthquake Knowledge Level Scale

	SEAS				EKLS			
Classification	Score Range	$\bar{X}$	f	%	Score Range	$\bar{X}$	f	%
Low Level	22-51.33		13	2.30	19-44.33		10	1.77
Intermediate Level	51.34-80.67		510	90.43	44.34-69.66		182	32.27
High Level	80.68-110		41	7.27	69.67-95		372	65.96
Total		69.044	564	100		72.94	564	100

According to Table 6 it is seen that a medium level of awareness is exhibited with the Sustainable Earthquake Awareness Scale (SEAS) mean score ($\bar{X}$ = 69.04). In addition, it was determined that the students' earthquake knowledge levels were high with the Earthquake Knowledge Level Scale (EKLS) mean score ($\bar{X}$ = 72.94). These results show that the students' earthquake knowledge and awareness levels are generally above average and that they have a strong awareness and knowledge level in both scales.

Findings regarding the Fourth Sub-Problem

In this title, the distribution of multiple correlation analysis of total scores and sub-dimensions obtained from the Earthquake Knowledge Level Scale and Sustainable Earthquake Awareness Scales

was evaluated. The relationships between these variables were examined to determine the extent to which earthquake knowledge contributes to sustainable earthquake awareness. Additionally, the strength and direction of correlations among the sub-dimensions were analyzed to identify significant patterns and potential predictors. These findings provide insights into the role of knowledge in fostering a culture of earthquake preparedness and resilience.

Table 7. Multiple correlation analysis of the total scores and sub-dimensions of the participants from EKLS and SEAS

		EKLS	Knowledge of the Distribution of Earthquake Zones	Knowledge of Earthquake Effects	Earthquake Education	SEAS	Earthquake-Structure Relationship	Earthquake Preparedness Application	Earthquake Preparedness
EKLS	Correlation	1	.815**	.858**	.703**	.388**	.336**	.237**	.044**
	Sig.		.000	.000	.000	.000	.000	.000	.296
	N		564	564	564	564	564	564	564
Knowledge of the Distribution of Earthquake Zones	Correlation		1	.641**	.282**	. 273**	.198	.097	.149**
	Sig.			.000	.000	.000	.000	.021	.000
	N			564	564	564	564	564	564
Knowledge of Earthquake Effects	Correlation			1	.400**	.277**	.202**	.074**	.185**
	Sig.				.000	.000	.000	.078	.000
	N				564	564	564	564	564
Earthquake Education	Correlation				1	.373**	.403	.395	-,234**
	Sig.					.000	.000	.000	.000
	N					564	564	564	564
SEAS	Correlation					1	.687	.783	-,026**
	Sig.						.000	.000	.533
	N							564	564
Earthquake-Structure Relationship	Correlation						1	.595**	-,389**
	Sig.							.000	.000
	N							564	564
Earthquake Preparedness Application	Correlation							1	-,591**
	Sig.								.000
	N								564
Earthquake Preparedness	Correlation								1
	Sig.								
	N								564

**p<0.01, p<0.05 * (N=564)

According to Table 7, there is a positive and strong relationship between Earthquake Knowledge Level Scale (EKLS) and Knowledge of the Distribution of Earthquake Zones ($r = 0.815$, $p < 0.05$), Knowledge of Earthquake Effects ($r = 0.858$, $p < 0.05$) and Earthquake Education ($r = 0.703$, $p < 0.05$). This shows that as earthquake knowledge increases, students' knowledge about earthquake distribution, effects and education also increase. Highly significant relationships were found between Sustainable Earthquake Awareness Scale (SEAS) and Earthquake-Structure Relationship ($r = 0.687$, $p < 0.05$) and Earthquake Preparedness Application ($r = 0.783$, $p < 0.05$). However, the correlations between Earthquake Preparedness and other variables are lower, and there is a negative relationship between Earthquake Education and Earthquake Preparedness ($r = -0.234$, $p < 0.05$). Finally, a negative and significant relationship was found between Earthquake Preparedness and Earthquake Preparedness Application ($r = -0.591$, $p < 0.05$).

When the relationship between the Earthquake Knowledge Level Scale (EKLS) and the Sustainable Earthquake Awareness Scale (SEAS) is examined, it is seen that there is a significant

correlation between the two scales ($r = 0.388$, $p < 0.05$). This finding shows that as individuals' knowledge levels about earthquakes increase, their sustainable earthquake awareness also increases.

In addition, the correlations between the sub-dimensions of the EKLS (Knowledge of the Distribution of Earthquake Zones, Knowledge of Earthquake Effects, Earthquake Education) and the SEAS are positive and significant. In particular, the relationships between Knowledge of the Distribution of Earthquake Zones ($r = 0.273$, $p < 0.05$) and the SEAS show that individuals' having more knowledge about earthquakes increases their awareness levels.

Discussion, Conclusion and Suggestions

According to the research findings, female students' knowledge levels in areas such as "Earthquake Knowledge Level," "Knowledge of Earthquake Effects," "Earthquake Preparedness," and "Knowledge of the Distribution of Earthquake Zones" are generally higher than those of male students. However, both groups demonstrate similar levels of awareness in "Earthquake Preparedness Application" and "Earthquake–Structure Relationship." As a result, it can be said that although the effect of the gender factor on earthquake awareness is evident, education and awareness-raising activities should be strengthened in both gender groups in order to turn awareness into practice. On the other hand, in the study conducted by Sözen and Genç (2023), it was found that male students had significantly higher knowledge in the "Knowledge of Earthquake Effects" dimension than female students; and female students had significantly higher awareness in the "Earthquake-Structure Relationship" dimension than male students. It was determined that male students had a higher perception of earthquake consequences, while female students had a higher perception of earthquake-resistant structures. Similarly in the research conducted Türksever (2021) on undergraduate students, it was concluded that the scores of female students were slightly higher than the scores of male students. When the results found by Kayalı (2018) and Kıvrak (2019) and the results found by Sözen (2019) and Aksoy and Sözen (2014) are evaluated together, it is understood that a gender-based approach does not show a definite tendency in earthquake-themed studies. Gündüz (2022) stated that gender-sensitive steps should be taken in integrated disaster management to reduce social vulnerability in disasters. This approach is of great importance in terms of not ignoring the unique risks that groups such as women, children and the elderly face during disaster processes. Restructuring disaster training and response plans according to different gender roles both increase the level of pre-disaster preparedness and make the post-disaster recovery process more inclusive. Therefore, adopting gender equality perspective in disaster management policies will increase resilience at both individual and societal levels. Akbal and Taşbaş (2024) emphasize the importance of gender equality in disaster management and emphasize that women should be supported psychologically, socially and economically. Our research findings show that female participants have higher earthquake awareness levels compared to male participants. This result supports the fact that empowering women in terms of knowledge and awareness against disasters is critical for sustainable earthquake awareness. Gender-sensitive education and awareness-raising activities will increase the overall resilience of society by ensuring that women take an active role in disaster processes.

When the ANOVA results were evaluated according to the participants' "Earthquake Knowledge Level" scale, there were significant differences in the subjects of "Earthquake Knowledge Level", "Knowledge of the Distribution of Earthquake Zones" and "Earthquake Education" according to the grade level of the students. Therefore, the knowledge levels of students on these subjects vary according to the grade level. However, no difference was found according to the grade level in the subject of "Knowledge of Earthquake Effects". This shows that students have a similar level of knowledge about earthquake effects and that grade level is not a determining factor in this regard. In the study by Sözen and Genç (2023), it was determined that 4th graders had significantly higher average scores than 1st graders in the "Earthquake Education" sub-dimension according to their grade levels. While it is observed that the average scores increase as the grade level increases in this sub-dimension, the significant difference is between the 1st and 4th grades. This result is consistent with the findings in the research.

When the TUKEY test results were examined for the grade-level differences in the Sustainable Earthquake Awareness Scale, significant differences were found between 1st and 4th graders in the total

dimension of "Sustainable Earthquake Awareness" and the sub-dimension of "Earthquake Preparedness Application." This suggests that topics such as "Earthquake-Structure Relationship" and "Earthquake Preparedness" show a homogeneous pattern across grade levels. Since significant differences exist between classes in "Sustainable Earthquake Awareness" and "Earthquake Preparedness Application," these topics should be addressed more effectively in the curriculum during the later stages of education. Similarly, Sözen and Genç (2023) found that 4th graders scored significantly higher than 1st graders in total "Sustainable Earthquake Awareness" scores, which aligns with the current findings. Kılıçbey et al. (2024) also reported significant grade-level differences in the sub-dimensions of "earthquake education," "earthquake preparedness application," and the overall "sustainable earthquake awareness," with higher scores observed among 4th graders. However, consistent with the present study, no significant differences were found in the sub-dimensions of "knowledge of earthquake effects" and "earthquake-structure relationship" by grade level, indicating that grade does not influence knowledge in these areas. In addition, Kıvrak (2019) and Sözcü and Aydınözü (2019) emphasized the importance of disaster education at all levels of education, supporting the need for comprehensive curricula throughout schooling years. On the other hand, Kılıçbey et al. (2024) did not find significant grade-level differences in the "knowledge of the distribution of earthquake zones" sub-dimension, which contrasts with the current findings. Additionally, Değirmenci and Altunay (2024) observed no significant differences in knowledge level and awareness scales across grade levels overall, though they reported a significant difference favoring 2nd graders in the "earthquake education" sub-dimension.

On the other hand, it was determined that the majority of the participants had a moderate level of awareness (90.43%) in terms of the Sustainable Earthquake Awareness Scale, but the rate of those who reached a high level of awareness was quite low (7.27%). In the research of Sözen and Genç (2023), it is seen that the "Sustainable Earthquake Awareness Scale" scores are low and moderate (62.86%). On the other hand, the results of the Earthquake Knowledge Level Scale show that the majority of the participants have moderate (32.27%) to high (65.96%) knowledge. The fact that the rate of individuals with a low level of knowledge is quite low (1.77%) indicates that the participants are generally knowledgeable about earthquakes. In the research of Sözen and Genç (2023), it is seen that the "Earthquake Knowledge Level Scale" scores of university students are at medium (45.36%) and high levels (53.73%). This shows that students have basic knowledge about earthquakes, but this knowledge does not turn into sustainable awareness. Therefore, while students have sufficient knowledge about what an earthquake is and how it occurs, it can be said that this knowledge is not sufficiently reflected in the precautions and preparation processes applicable in daily life. Moreover, it is understood that there is awareness about earthquakes but the precautions that need to be taken and long-term preparations are not sufficiently adopted. It also reveals the necessity of more practical training and applications in order for disaster awareness to go beyond theoretical knowledge.

The findings obtained in this study are similar to the study of Genç and Sözen (2022) in some aspects but also contain some differences. First of all, the strong and positive correlations between the Earthquake Knowledge Level Scale (EKLS) and the dimensions of Knowledge of the Distribution of Earthquake Zones, Knowledge of Earthquake Effectsand Earthquake Education ($r=0.815$; $r=0.858$; $r=0.703$; $p<0.05$) largely overlap with the findings of Genç and Sözen (2022). In both studies, it was revealed that as earthquake knowledge increased, individuals became more equipped with the spatial distribution, effects and education of earthquakes. This situation also overlaps with the previous literature emphasizing the importance of education and information in earthquake awareness studies.

On the other hand, similarly strong and significant relationships ($r=0.687$; $r=0.783$; $p<0.05$) were reported by Genç and Sözen (2022) between the Sustainable Earthquake Awareness Scale (SEAS) and the Earthquake-Structure Relationship and Earthquake Preparedness Application. In both studies, it was determined that sustainable earthquake awareness is closely related to building safety and individual preparedness processes. In particular, the high correlation between the Earthquake Preparedness Application and SEAS ($r=0.783$) shows that individuals attach more importance to earthquake preparedness applications as their sustainable awareness levels increase.

However significant differences were observed in the correlations between the Earthquake Preparedness dimension and other variables. While Genç and Sözen (2022) determined a significant

and moderate correlation between Earthquake Preparedness and Earthquake Knowledge Level, this relationship is weaker and insignificant in the current study ($r=-0.026$, $p>0.05$). It is thought that this difference may be due to the sample groups used in the studies, sensitivity differences in the data collection tools, or individual perceptions of the participants.

Additionally, the significant negative correlation between Earthquake Preparedness and Earthquake Preparedness Application ($r=-0.591$, $p<0.05$) is a finding that differs from the study of Genç and Sözen (2022). While Genç and Sözen (2022) suggested that earthquake preparedness and applications are positively correlated, the opposite trend was observed in this study. This may suggest that even if individuals are aware of earthquake preparedness, they experience deficiencies in implementing preparedness applications. It should be taken into consideration that factors such as individual effort and lack of resources may be effective, especially in preparation processes.

In addition, the negative relationship between Earthquake Education and Earthquake Preparedness ($r=-0.234$, $p<0.05$) is noteworthy. While Genç and Sözen (2022) did not report a significant negative correlation between these two variables, a negative relationship was observed in the current study. This suggests that educational processes may affect individuals' perception of earthquake preparedness in different ways and that the differences between the educational content and the perceptions of the participants may have led to this result. However, it is thought that disaster education may affect individuals' perceptions of preparedness in different ways and that differences in the training content and perceptions of the participants may have caused this result. There is evidence in the literature that disaster awareness and resilience are acquired from an early age (Aslanderen and Berkant, 2023; Çavuş and Balçın, 2020; Şahin and Durualp, 2024; Tuncer, Sözen and Sakar, 2021). These findings show the importance of disaster education in increasing the preparedness levels of individuals against disasters. However, the negative correlation obtained reveals the complexity of the timing, content and implementation methods of disaster education. This situation shows that disaster education should be designed in a continuous and context-sensitive manner appropriate to age and education level. In this context, it is important that disaster education is not limited to the transfer of information only, but also supported by practical applications aimed at increasing the sensitivity and preparedness levels of individuals against disasters.

Finally, the positive correlation between the Earthquake Knowledge Level Scale and the Sustainable Earthquake Awareness Scale ($r=0.388$, $p<0.05$) shows that as individuals' earthquake knowledge increases, their sustainable awareness also increases. This finding is in line with Genç and Sözen (2022) and Sözen and Genç (2025) supporting that earthquake education can be an important tool for increasing sustainable awareness.

In line with the results explained above, the following recommendations are made:

- Course contents on disaster awareness in universities should be expanded to all grades and interdisciplinary courses focusing on providing sustainable earthquake awareness should be added.
- Practical training programs that include drills, simulations and field studies to support theoretical knowledge should be developed, especially so that individuals with high earthquake awareness can integrate this information into daily life.
- Disaster education programs should be organized by taking gender differences into consideration and taking into account sensitivities in this regard.
- In order for earthquake awareness to become sustainable, a disaster culture should be created not only through education but also through media, social campaigns and public awareness activities.
- Interactive and practical education methods should be developed especially for male students. Similarly, special education programs should be prepared for class levels with low sustainable awareness levels.
- Considering that earthquake-building relationship and preparedness practices are significantly related to sustainable awareness, education and awareness campaigns on building safety, disaster preparedness strategies of local governments and individual preparedness measures should be encouraged.

- In order to increase the awareness of university students about earthquakes and to train individuals who are prepared for disasters; seminars, drills and practical training programs should be organized in cooperation with universities, 112 Emergency Call Center, Provincial Health Directorates, fire departments, The Turkish Red Crescent and local governments.
- In addition to educational activities, sustainable earthquake awareness can be created through continuous and targeted information campaigns to be carried out on social and visual media platforms; thus, society can be supported to become resilient to disasters.
- Conducting similar studies in regions with different earthquake hazard levels, at different education levels (secondary school, high school, university, etc.) and in different socio-demographic groups will make significant contributions to measuring and developing sustainable earthquake awareness throughout society.
- Future research can reveal the connection between course content in different departments and students' disaster awareness, preparedness, and response skills.
- The harmony between university disaster management strategies and student awareness can be evaluated and campus-based sustainable awareness models can be proposed.
- This research only focused on earthquakes. In future studies, examining individual and social awareness and preparedness levels for other types of natural disasters such as floods, fires, hurricanes and landslides will contribute to the creation of a comprehensive disaster awareness.

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