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# Earthquake knowledge level and sustainable earthquake awareness of university students

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**Abstract**
Health professionals have always had essential duties in earthquake events experienced from the past to the present. Possible earthquake expectations make sustainable earthquake awareness and attitudes of students, who are future healthcare professionals, influential. Therefore, this study aims to determine the relationship between the earthquake knowledge level of university students and their sustainable earthquake awareness levels. A descriptive-cross-sectional study was conducted in April 2023 with 546 students in the School of Health Services. Data were collected using the Student Information Form, Earthquake Knowledge Level Scale, and Sustainable Earthquake Awareness Scale. Percentage means standard deviations, Mann-Whitney U test, Kruskal-Wallis analysis, Bonferroni correction, Tamhane's T2 test, and Spearman correlation analysis were used for data evaluation. Before answering the study questions, informed consent was obtained from the students after obtaining ethical committee approval. Among the participants, 82.1% were female, with a mean age of 20.78±2.17. 55.7% of the students had experienced an earthquake, 19.2% had lost a loved one in an earthquake, and 5.5% had participated in earthquake response efforts. Students' earthquake knowledge level was found to be above the midpoint, while sustainable earthquake awareness was found to be below the midpoint. The level of earthquake knowledge, knowledge of the distribution of earthquake zones and knowledge of earthquake effects were higher in those who took part in the earthquake. In males, knowledge of the distribution of earthquake zones was significantly higher. Knowledge of earthquake effects was significantly higher in those who experienced an earthquake and those who lost a relative in an earthquake. A positively moderate and significant correlation was found between earthquake knowledge level and sustainable earthquake awareness. The earthquake knowledge level of the students is medium, while their sustainable earthquake awareness needs to be higher. As the level of earthquake knowledge increases, sustainable earthquake awareness rises. The effect of earthquake experience on knowledge and awareness shows that applied training will contribute to sustainable earthquake awareness in society.

**Keywords** Disaster · Awareness · Earthquake education · Protection

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## 1 Introduction

Disasters are defined as events that create a need for assistance at a national or international level, causing significant damage, destruction, and loss of life, typically occurring suddenly and unexpectedly (Şimşek and Gündüz 2021). The importance of mapping and creating safe areas for reducing the adverse effects of disasters is emphasised in studies (Karpouza et al. 2021, 2023). The adverse impact of a disaster is determined by its magnitude and the adaptability and mechanisms of individuals in the face of the disaster. Awareness created within society reduces vulnerability to and risk of disasters (Wei et al. 2020). Previous studies have shown that university students have a high level of knowledge about disasters (Bıçakçı et al. 2022) and are familiar with basic concepts related to disaster awareness (Gümüş Şekerci et al. 2023). Still, their conscious understanding is inadequate (Avcı et al. 2020). The lack of knowledge about disasters can lead to significant damages; therefore, education on disaster management should be regularly conducted in schools (Tsai 2001), (Ross and Shuell 1993). The literature categorises disaster management into pre-disaster risk management and post-disaster crisis management. Pre-disaster risk management includes risk analysis, damage reduction, and preparedness. In the post-disaster phase, intervention, recovery, and reconstruction are crucial (Şahin and Üçgül 2019).

One of the disasters that significantly impact human life is an earthquake (Doğan et al. 2021). Earthquakes, which cannot be prevented and have unpredictable durations, result in loss of life and property (C. N. Erdoğan and Aksoy 2020). An earthquake is defined as the breaking or separation of the Earth's crust (C. N. Erdoğan and Aksoy 2020) (Improta et al. 2023), (Bikar et al. 2021), and it is known that there are an average of half a million earthquakes worldwide in a year. Still, most of them occur with minor tremors that are not detectable (Taşçı and Özsoy 2021). Scientific studies suggest that earthquakes will continue (Yolcu and Bekler 2020), (Aksoy and Sözen 2014). In Turkey, earthquakes most frequently occur along the Western, Northern, and Eastern Anatolian Fault lines (Doğan et al. 2021), (Telli and Altun 2023). The devastating earthquake on February 6 affected 11 provinces in Turkey and occurred in two separate earthquakes with short intervals. The first occurred in Pazarcık district of Kahramanmaraş with a magnitude of 7.7, and the second one centred in Elbistan with a magnitude of 7.6. It is reported that a total of approximately 50,783 people lost their lives in these earthquakes (Erdoğan 2023).

The level of knowledge individuals have about earthquakes is a factor that influences their preparedness for earthquake actions (Çavuş and Balçın 2020), (Ao et al. 2021). Being prepared and having sustainable awareness against earthquakes, which pose a significant threat of causing severe damage, is of vital importance (Tsai 2001) (Ross and Shuell 1993) and plays a crucial role in coping with the impact of disasters (Xu et al. 2019). Sustainability, in its literal sense, means not depriving future generations of their ability to meet their needs (Çetin et al. 2020). Sustainable earthquake awareness is associated with concepts such as sustainable earthquake education (Akpolat et al. 2021), post-earthquake sustainable psychosocial support (Yıldırım 2023), and sustainable healthcare services in disasters (Canatan 2020). Societies that lack sufficient levels of sustainable earthquake awareness and consciousness may remain weak and ineffective in earthquake preparedness, response, and recovery processes (Yolcu and Bekler 2020). Countries should particularly reach the student population to ensure sustainable earthquake awareness (Budak and Kandil 2023).

In addition to developing earthquake awareness, it is also essential to cultivate attitudes to be exhibited during an earthquake (Demirci and Yıldırım 2015). Beyond the shaking of the earth's crust, an earthquake is a process that involves many concepts such as material, human, social, psychological and health. To look at this process from different perspectives, to reveal road maps and to find holistic solutions, research on the subject should be handled multi-dimensionally. Increasing individuals' knowledge levels about disasters and earthquakes will influence their display of positive attitudes during earthquakes. For this purpose, multidisciplinary studies are needed to manage disaster processes (Avcı et al. 2020). Healthcare services play a crucial role among these disciplines, and healthcare professionals have significant responsibilities (Seçer et al. 2021). In the aftermath of an earthquake, health professionals provide health care by addressing injuries related to the damage caused by the disaster in the short term and chronic medical conditions in the long term. In the literature, there is a lack of sufficient studies on earthquake knowledge levels and sustainable earthquake awareness among university students studying healthcare.

To promote socially sustainable earthquake awareness and appropriate attitudes, it is essential to build earthquake awareness among healthcare students, who will constitute the future healthcare workforce and provide significant services to the community during disasters. Therefore, this study aims to determine university students' earthquake knowledge levels and sustainable earthquake awareness.

## 2 Material and method

This research is a descriptive cross-sectional study conducted in April 2023. The population of the research consists of 780 people, including Recep Tayyip Erdoğan University Health Services Vocational School Anaesthesia Department (168), First and Emergency Aid Department (155), Elderly Care Department (152), Medical Laboratory Department (152), Physiotherapy Department (153). The study was completed with 546 students who agreed to participate without choosing a sample. 70% of the universe has been reached. The data was collected via Google Forms.

### 2.1 Data collection tools

The study data were collected using the Student Information Form, Earthquake Knowledge Level Scale (EKLS), and Sustainable Earthquake Awareness Scale (SEAS).

**Student Information From** This form, prepared by the researchers, consists of 8 questions that include age, gender, department of study, grade level, personal experience of experiencing an earthquake, loss of a close relative in an earthquake, and involvement in earthquake-related activities.

**Earthquake knowledge level scale (EKLS)** Developed by Genç and Sözen (2022), this scale aims to assess individuals' awareness levels regarding earthquakes (Murat & Sözen 2022). The scale consists of 19 items on a 5-point Likert scale (1 = Strongly Disagree, …, 5 = Strongly Agree). The scale does not include reverse-scored items; the possible scores range from 19 to 95. Higher scores indicate higher awareness levels regarding the topic. The

scale has three sub-dimensions: "Distribution of Earthquake Zones Knowledge," "Earthquake Effects Knowledge," and "Earthquake Education." The overall Cronbach's alpha reliability coefficient for the scale is 0.868. In this study, the Cronbach's alpha coefficient was found to be 0.950.

**Sustainable earthquake awareness scale (SEAS)** Developed by Genç and Sözen (2021), this scale aims to assess individuals' awareness levels regarding sustainable earthquake practices (Murat & Sözen,. The scale consists of 22 items on a 5-point Likert scale (1 = Strongly Disagree, …, 5 = Strongly Agree). The lowest possible score is 22, and the highest score is 110. Higher scores indicate higher awareness levels regarding the topic. The scale has three sub-dimensions: "Earthquake-Structure Relationship," "Earthquake Preparedness Application," and "Being Prepared for Earthquakes." The overall Cronbach's alpha reliability coefficient for the scale is 0.884. In this study, the Cronbach's alpha coefficient was found to be 0.920.

### 2.2 Statistical analysis

The statistical data analysis was performed using the SPSS 22 software package. Descriptive statistics such as percentages, means, and standard deviations were used for quantitative data. For non-parametric data, the Mann-Whitney U test and Kruskal-Wallis analysis were conducted. Bonferroni correction and Tamhane's T2 post hoc test were applied for multiple comparisons. The relationship between variables was evaluated using Spearman correlation analysis. In the correlation analysis, a correlation coefficient between 0 and 0.39 was considered a weak relationship, 0.40–0.69 was considered a moderate relationship, 0.70–0.89 was a relationship, and 0.90-1.00 was considered a powerful relationship, considered a strong one. The significance level was set at $p < .05$.

### 2.3 Ethical considerations

This study was conducted by the guidelines and regulations set by a university's Social and Human Sciences Ethics Committee, under the permission and institutional approval of 30.03.2023 with reference number 2023/126.

### 2.4 Findings

Of the students participating in the study, 82.1% were female, with a mean age of 20.78 ± 2.17. 47.6% of the students were in their first year, while 52.4% were in their second year. The distribution of students by department was as follows: 17.6% in anaesthesia, 21.2% in physiotherapy, 19.0% in elderly care, 23.4% in first aid, and 18.7% in medical laboratory program. 55.7% of the students had experienced an earthquake, 19.2% had lost a relative in an earthquake, and 5.5% had been involved in earthquake response efforts. The mean scores of students on the EKLS and SEAS scales are presented in Table 1.

Participants' total and subscale scores on the earthquake knowledge level scale were above the midpoint. The total score and the subscale score of being prepared for earthquakes on the sustainable earthquake awareness scale were below the midpoint, while the subscale

**Table 1** Mean scores of participants on the earthquake knowledge level and sustainable scale of earthquake awareness

| Scales | n | Min. | Max. | Mean | Std. deviation |
|---|---|---|---|---|---|
| Earthquake knowledge assessment scale | 546 | 19 | 95 | 69.13 | 13.794 |
| Earthquake region distribution aspect | 546 | 7 | 35 | 24.91 | 5.461 |
| The effects of earthquake aspect | 546 | 7 | 35 | 27.34 | 5.843 |
| Earthquake education aspect | 546 | 5 | 25 | 16.88 | 5.263 |
| The sustainable scale of earthquake awareness | 546 | 22 | 104 | 64.65 | 14.895 |
| Earthquake structure relationship | 546 | 4 | 20 | 12.83 | 3.413 |
| Earthquake preparation application | 546 | 11 | 55 | 33.29 | 9.227 |
| Earthquake preparedness | 546 | 7 | 31 | 18.53 | 4.687 |

scores of earthquake-structure relationship and implementation of earthquake preparedness were at the midpoint. The comparison of independent variables with the earthquake knowledge level scale is shown in Table 2.

In the study, the total score of the earthquake knowledge level scale was significantly higher in those who participated in earthquake operations ($p=.030$). Gender, department, grade, experience of earthquake, and loss of close ones in the earthquake did not show significant differences ($p=.656$, $p=.105$, $p=.996$, $p=.136$, $p=.444$). Among the sub-dimensions, the score of knowledge about the distribution of earthquake zones was significantly higher in men and those who participated in earthquake operations ($p=.034$, $p=.002$). Department, class, experience of earthquake, and loss of close ones in the earthquake did not show significant differences ($p=.066$, $p=.416$, $p=.779$, $p=.824$). The sub-dimension of knowledge about the effects of earthquakes showed a considerable difference in department ($p=.044$). However, after Bonferroni correction, the groups had no significant difference. Knowledge about the effects of earthquakes was significantly higher in those who experienced an earthquake, those who lost close ones, and those who participated in earthquake operations ($p=.000$, $p=.000$, $p=.001$). Gender and class did not differ significantly ($p=.662$, $p=.901$). In the sub-dimension of earthquake education, gender, department, class, experience of earthquake, loss of close ones in the earthquake, and participation in earthquake operations did not show significant differences ($p=.668$, $p=.183$, $p=.499$, $p=.668$, $p=.155$, $p=.493$). The analysis of the participants' sustainable earthquake awareness scale is shown in Table 3.

In the study, gender, department, grade, earthquake experience, loss of close ones in the earthquake, and participation in earthquake operations did not significantly affect the total score and sub-dimensions of the sustainable earthquake awareness scale ($p>.05$). Table 4.

No significant relationship was found between age and earthquake knowledge level ($p=.558$). No significant relationship was found between age and sustainable earthquake awareness ($p=.997$). However, a significant positive moderate-level relationship was found between earthquake knowledge level and sustainable earthquake awareness ($r=.499$, $p<.001$).

**Table 2** Analysis of independent variables with earthquake knowledge assessment scale

| | | Earthquake region distribution aspect | The effects of earthquake aspect | Earthquake education aspect | Total earthquake knowledge assessment scale |
|---|---|---|---|---|---|
| | *n* | Mean rank | Mean rank | Mean rank | Mean rank |
| *Gender* | | | | | |
| Female | 448 | 266.83 | 274.88 | 274.83 | 272.10 |
| Male | 98 | 303.98 | 267.21 | 267.41 | 279.92 |
| | | z= -2.118<br>***p*=.034** | z=−0.437<br>*p*=.662 | z=−0.428<br>*p*=.668 | z=-0.445<br>*p*=.656 |
| *Department* | | | | | |
| Anaesthesia | 96 | 246.19 | 297.60 | 258.74 | 263.00 |
| Physiotherapy | 116 | 284.46 | 266.97 | 255.30 | 261.29 |
| Elderly care | 104 | 267.70 | 271.91 | 289.44 | 279.90 |
| Emergency and first aid | 128 | 301.74 | 291.96 | 294.74 | 303.54 |
| Medical laboratory | 102 | 257.22 | 236.71 | 265.18 | 253.03 |
| | | $X^2$Kw=8.819<br>*p*=.066 | $X^2$Kw=9.819<br>***p*=.044** | $X^2$Kw=6.231<br>*p*=.183 | $X^2$Kw=7.659<br>*p*=.105 |
| *Grade* | | | | | |
| 1 | 260 | 267.76 | 272.63 | 278.22 | 273.53 |
| 2 | 286 | 278.72 | 274.30 | 269.21 | 273.47 |
| | | z=−0.814<br>*p*=.416 | z=−0.124<br>*p*=.901 | z=−0.676<br>*p*=.499 | z=−0.005<br>*p*=.996 |
| *Experience of earthquake* | | | | | |
| Yes | 304 | 271.82 | 300.22 | 270.96 | 282.47 |
| No | 242 | 275.62 | 239.94 | 276.70 | 262.23 |
| | | z=−0.280<br>*p*=.779 | z= -4.451<br>***p*=.000** | z=−0.429<br>*p*=.668 | z= -1.490<br>*p*=.136 |
| *Loss of close ones in an earthquake* | | | | | |
| Yes | 105 | 276.56 | 323.98 | 254.11 | 284.08 |
| No | 441 | 272.77 | 261.48 | 278.12 | 270.98 |
| | | z=−0.222<br>*p*=.824 | z=-3.661<br>***p*=.000** | z= -1.422<br>*p*=.155 | z=−0.765<br>*p*=.444 |
| *Involvement in earthquake operations* | | | | | |
| Yes | 30 | 358.07 | 368.03 | 254.57 | 334.37 |
| No | 516 | 268.58 | 268.00 | 274.60 | 269.96 |
| | | z= -3.030<br>***p*=.002** | z= -3.388<br>***p*=.001** | z=−0.686<br>*p*=.493 | z= -2.175<br>***p*=.030** |

z: Man Whitney U, $X^2$Kw: Kruskal Wallis

## 3 Discussion

Earthquakes have caused numerous casualties and property losses throughout history. The most important task to be undertaken by various institutions is to create earthquake awareness among individuals (Aksoy and Sözen 2014) (Kırıkkaya et al. 2011). In this study, the total and subscale scores of students on the earthquake knowledge level scale were above the midpoint. Following the major earthquake in Türkiye in February 2023, frequent dissemination of information by earthquake experts through various media channels may have contributed to the increase in students' knowledge levels. Furthermore, the training

**Table 3** Analysis of independent variables and sustainable earthquake awareness scale

| | | Earthquake structure relationship | Earthquake preparation application | Earthquake preparedness | The sustainable scale of earthquake awareness total |
|---|---|---|---|---|---|
| | *n* | Mean rank | Mean rank | Mean rank | Mean rank |
| *Gender* | | | | | |
| Female | 448 | 270.96 | 278.64 | 272.89 | 275.84 |
| Male | 98 | 285.11 | 250.02 | 267.29 | 262.79 |
| | | z=−0.810<br>*p*=.418 | z= -1.629<br>*p*=.103 | z=−0.194<br>*p*=.847 | z=-0.742<br>*p*=.458 |
| *Department* | | | | | |
| Anaesthesia | 96 | 258.51 | 258.38 | 256.58 | 255.22 |
| Physiotherapy | 116 | 270.92 | 272.09 | 266.22 | 268.95 |
| Elderly care | 104 | 280.88 | 292.30 | 306.84 | 297.23 |
| Emergency and First aid | 128 | 282.49 | 275.12 | 264.17 | 275.45 |
| Medical Laboratory | 102 | 271.74 | 268.13 | 275.42 | 269.24 |
| | | $X^2$Kw=1.575<br>*p*=.813 | $X^2$Kw=2.507<br>*p*=.643 | $X^2$Kw=6.494<br>*p*=.165 | $X^2$Kw=3.836<br>*p*=.429 |
| *Grade* | | | | | |
| 1 | 260 | 269.89 | 280.71 | 278.89 | 277.98 |
| 2 | 286 | 276.71 | 266.94 | 268.60 | 269.43 |
| | | z=−0.513<br>*p*=.608 | z= -1.020<br>*p*=.308 | z=−0.764<br>*p*=.445 | z=−0.632<br>*p*=.527 |
| *Experience of earthquake* | | | | | |
| Yes | 304 | 268.40 | 275.85 | 266.78 | 271.71 |
| No | 242 | 279.90 | 270.55 | 281.94 | 275.75 |
| | | z=−0.852<br>*p*=.394 | z=−0.391<br>*p*=.696 | z= -1.118<br>*p*=.264 | z=−0.298<br>*p*=.766 |
| *Loss of close ones in an earthquake* | | | | | |
| Yes | 105 | 264.78 | 264.98 | 267.53 | 264.22 |
| No | 441 | 275.58 | 275.53 | 274.92 | 275.71 |
| | | z=−0.634<br>*p*=.526 | z=−0.616<br>*p*=.538 | z=−0.432<br>*p*=.665 | z=−0.671<br>*p*=.502 |
| *Involvement in earthquake operations* | | | | | |
| Yes | 30 | 317.37 | 292.17 | 285.87 | 300.08 |
| No | 516 | 270.95 | 272.41 | 272.78 | 271.95 |
| | | z= -1.577<br>*p*=.115 | z=−0.667<br>*p*=.504 | z=−0.443<br>*p*=.658 | z=−0.959<br>*p*=.342 |

z: Man Whitney U, $X^2$Kw: Kruskal Wallis

provided by the Disaster and Emergency Management Authority (also known as AFAD in Turkish) has been effective in increasing the community's knowledge level and promoting sustainability.

According to the findings of the study, the total score of the earthquake knowledge level scale did not show a significant difference in terms of gender. Some studies in the literature also support this finding, as they did not find a substantial difference in earthquake knowledge scores between genders (Yayla 2016), (Öcal 2007), (Polat 2014). However, in contrast, Soffer et al. (2010) found higher levels of earthquake knowledge among males (Soffer et al. 2011). Similarly, in this study, only the knowledge about the distribution of

**Table 4** Correlation analysis between age, earthquake knowledge scale, and sustainable earthquake awareness scale

| | | Age | Earthquake knowledge level | Sustainable earthquake awareness |
|---|---|---|---|---|
| Age | r | 1.000 | 0.025 | 0.000 |
| Earthquake knowledge level | r | | 1.000 | 0.499*** |

***$P < .001$

earthquake regions was higher among males. The fact that the education targets the entire community may explain the lack of gender differences. Additionally, gaining experience by participating in earthquake-related activities in the affected regions can enhance knowledge. Following the recent earthquake (February 6, 2023), students studying in the healthcare field voluntarily participated in fieldwork and worked in field hospitals. The high scores on the earthquake knowledge level scale, including total scores and the subscale of knowledge about the distribution of earthquake regions and the effects of earthquakes, among students who participated in earthquake-related activities reflect this involvement. Another study supporting this finding is the one that found higher levels of knowledge among emergency medical service personnel who were involved in earthquake response (Çelebi and Uçku 2017). While the subscale of knowledge about the effects of earthquakes was higher among those who experienced earthquakes or lost loved ones in this study, Yayla (2016) did not find a significant difference among earthquake survivors and individuals who lost loved ones in the Erzincan province (Yayla 2016). The passage of years since the destructive Erzincan earthquake in 1939 may explain this difference in findings.

Creating sustainable awareness about natural disasters before earthquakes can help communities be prepared (Sözen 2019), (Dölek 2020), (Köseoğlu 2015), (Demirci and Yıldırım 2015). According to the study's findings, the scores of the sustainable earthquake awareness scale and the preparedness for earthquakes subscale were below the midpoint. This finding is consistent with the survey conducted by Sözen (2019), which found low levels of sustainable awareness regarding earthquake preparedness among undergraduate students (Sözen 2019). The reason for the discrepancy between the high levels of knowledge among students and the low scores on the readiness for earthquakes subscale may be attributed to the inclusion of questions in the scale, such as "We are prepared for a potential earthquake as a country" and "We are prepared for a potential earthquake in our city." Additionally, significant destruction and loss of life due to the earthquake on February 6 may have made students perceive that the country is not adequately prepared for major earthquakes. However, this finding contradicts the study conducted by Türksever (2021), which found high levels of sustainable awareness regarding earthquake preparedness among undergraduate students (Türksever 2021). This discrepancy may be attributed to the timing of the study, as it was conducted immediately after the earthquake.

A significant positive correlation exists between earthquake knowledge level and sustainable earthquake awareness. It is expected that earthquake knowledge level and sustainable earthquake awareness would influence each other.

## 4 Conclusion and recommendations

In conclusion, the study found that students had a moderate level of earthquake knowledge, and those who had participated in earthquake-related activities had higher knowledge levels—however, the level of sustainable earthquake awareness and preparedness perception needed to be at the moderate level. There was a positive correlation between earthquake knowledge level and sustainable earthquake awareness.

By initiating a systematic information process in parallel with educational efforts, sustainable awareness can be increased, and a resilient community can be built to withstand earthquakes. Emphasis should be placed on earthquake education to enhance awareness further. It is noted in the literature that randomly teaching information about earthquakes can lead to misconceptions (Gezer and Şahin 2022), (Öcal et al. 2016). Therefore, it is recommended that experts, in a planned manner, conduct education on earthquake knowledge and sustainable earthquake awareness to enhance learning and understanding. The findings also indicated that experience contributes to increased knowledge levels. Thus, educational programs must be action-oriented and practical to enhance experiential learning.

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### Declarations

**Conflict of interest** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.



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