

## Determination of Prospective Science Teachers' knowledge levels about earthquake

Suleyman Aydin<sup>1\*</sup>

<sup>1</sup>Agri Ibrahim Cecen University, Educational Faculty, Department of Mathematics and Sciences Education, Agri, Turkey

### INFORMATION

#### Article history

Received 10 December 2019

Revised 25 December 2019

Accepted 26 December 2019

Available 31 December 2019

#### Keywords

Earthquake

Natural disaster

Science teacher

Statistical analysis

Prospective Science Teacher

#### Contact

Suleyman Aydin\*

yupul@hotmail.com

### ABSTRACT

Earthquake is the event that takes its source from the depths of the earth in its broadest sense and causes sudden vibrations that occur as a result of fractures within the earth's crust, causing waves to shake the earth's surface. In this study, it was aimed to determine the knowledge levels of prospective science teachers about earthquake. The sample of the study consists of 24 4th grade students studying in the Science Teaching Department of the Department of Mathematics and Science Education, Faculty of Education, Agri Ibrahim Cecen University. In this research, Earthquake Achievement Test taken from literature was used for prospective science teachers from literature. The obtained data were analyzed by descriptive analysis method. It was determined that the knowledge levels of prospective teachers were statistically significant, but the level of knowledge about what to do during an earthquake was insufficient.

### 1. Introduction

Natural disasters can be defined as events that cause economic and social losses in societies, adversely affect human life, occur beyond the control of people and cause loss of life and property. Natural disasters are classified as geological-morphological, climatic-meteorological, hydrographic and biological disaster types. One of the natural disasters with geological and morphological characteristics is earthquakes. Earthquake is the event that takes its source from the depths of the earth in its broadest sense and causes sudden vibrations that occur as a result of breaks in the earth's crust, causing waves to shake the earth's surface.

Earthquakes occur as a result of breaking of the shell layer or the energy accumulated in the upper mantle from the weak areas of the earth to the surface and occur at the boundaries where the plates join, move away from each other or move side by side (Karademir et al., 2019). Earthquakes are classified as tectonic, volcanic and collapse earthquakes according to their causes of formations. The most effective of these is tectonic earthquakes. Tectonic earthquakes can be effective and destructive in large areas (Aksoy and Sözen, 2014). Therefore, most earthquakes in Turkey were seen in North Anatolia, Hatay surroundings, Aegean Region, Marmara Region and Eastern Anatolia (Levy and Salvari, 2000). Especially North Anatolian Fault (NAF) is one of the most active fault of Turkey where large

earthquakes have occurred. Along the NAF, nine major earthquakes of 6.7 magnitude occurred between 1939 and 1999, and a large number of people lost their life as a result of these earthquakes (Demirci and Yildirim, 2015).

Disasters sometimes hit hard and the severity of the damage reflects the preparedness and education level of the society and the country which face the earthquake. It is widely accepted today that overcoming the disasters and recovering quickly after them is only possible with learning and using the basic knowledge on disasters (Varol 2007; Özgen et al., 2011). It has been considered that it is possible to decrease the harmful effects of earthquakes on human beings by increasing the knowledge levels of the individuals on earthquake. This is only possible with an efficient earthquake education and training. The earthquake education and training is the process in which the structure of the crust of the earth, the earthquake, and the damages that may appear after them are explained, and then the ways to protect oneself from these damages are taught (Öcal, 2005).

Fig. 1, shows the North Anatolian Fault Line (NAF) is one of the fastest moving and most active, right-lateral and strike-slip faults in the world. NAF is an 1100 km long right-handed and strike-slip active fault line. It cuts all northern Anatolia from Lake Van to Saros Gulf. It is not a single fault; it is a fault zone

consisting of many parts.

At the schools, the teaching of natural disasters is becoming widespread with a great speed. Each country teaches the natural disasters lessons that are mostly related with the natural disasters that are more probable for the country in order to know these disasters better and make them known by its people (Öcal, 2005). "For example, in 41,2% of the colleges and

universities in the North America, classes that deal with the natural disasters are taught. Mostly regional examples are given in the natural disasters classes. While in California, the classes related with the earthquakes are taught more, in regions near the Mississippi River and Mid-Atlantic areas, the floods are the main subjects (Öztürk, 2013). Societies living on the seismic belt have to get used to living with earthquakes.

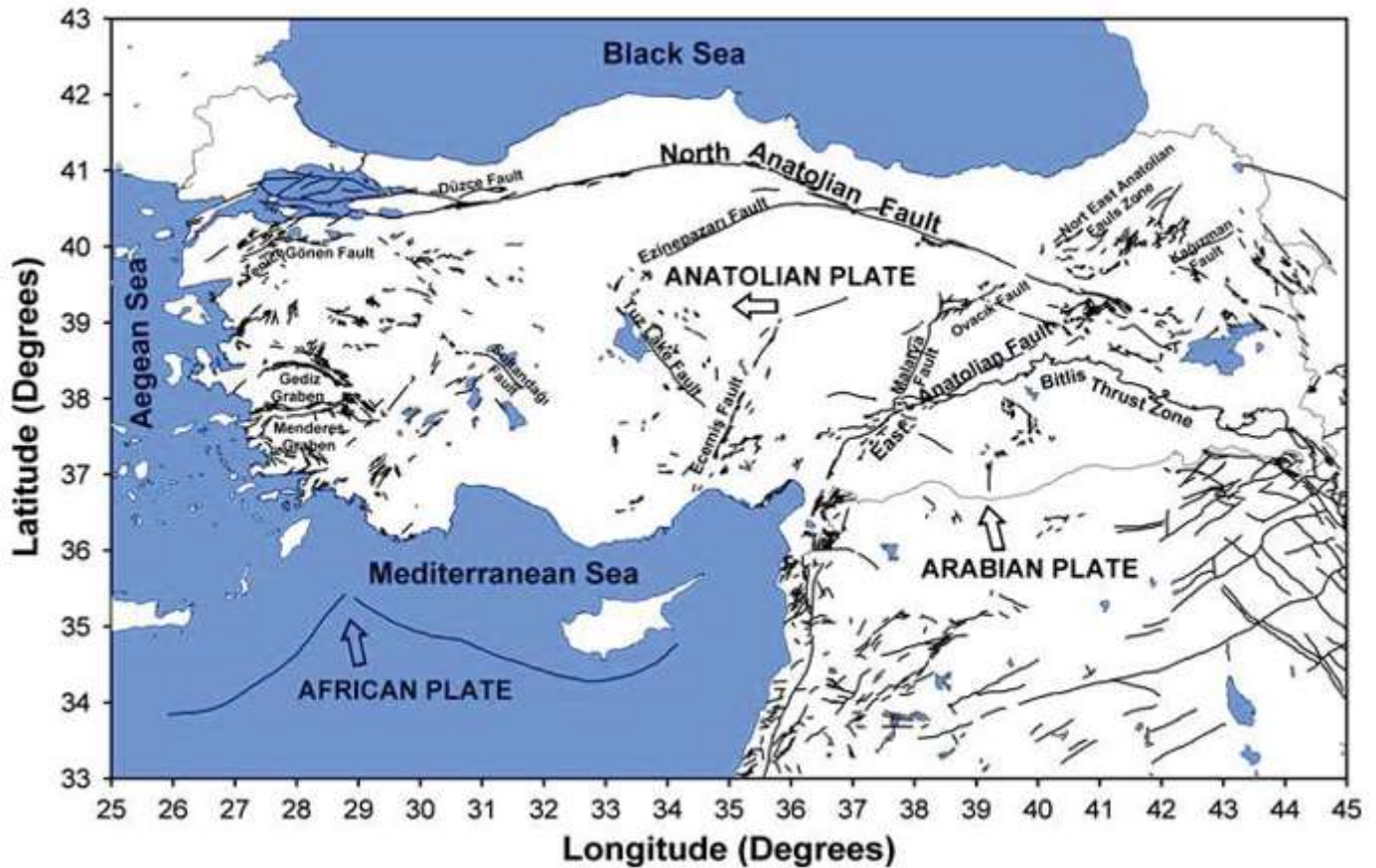


Fig. 1. Active tectonic features of Turkey (Bayrak et al., 2009).

In the past, earthquakes have occurred in different countries of the world with high destructive severity and the possibility of loss of property and lives as a result of earthquakes that may occur in the following years is an undeniable fact. Therefore, it is necessary to be prepared for the damages caused by the earthquake. For this purpose, it should be envisaged to create earthquake awareness in individuals and to provide earthquake education to individuals by experts. Earthquake education is an education process that describes the earthquake and its formation mechanism and teaches the damages that may occur as a result of the earthquake and the ways of protection against these damages, starting from the structure of the earth's crust (Ocal, 2014). For this purpose, all the public should be educated and informed by starting from preschool education.

Because individuals learn the best way to meet their basic needs in a balanced way by recognizing the natural and social environment in educational institutions (Uşak et al., 2005). Otherwise, students' lack of knowledge about earthquakes may lead them to continue their traditional views about earthquakes

and fall into various misconceptions (Tsai, 2001; Ross and Shuell, 1993; Ocal, 2014). Every country in the world should be familiar with the natural disaster which is important for themselves in order to take all necessary physical and social precautions regarding disasters, to prepare all the members of the society for disasters and to minimize the effects of disasters (Arı and Yılmaz, 2016). When considered the primary and secondary education courses in Turkey, it is seen that the achievements related to natural disasters take place in different courses almost every year. Although life sciences and social studies courses are mainly focused on the recognition of natural disasters and protection from the damages of natural disasters. In the science course, the definition of earthquake, the formation of earthquakes and the measures to be taken against earthquake hazard were discussed (Demirci and Yildirim, 2015). New approaches in education are interdisciplinary (Holbrook, 2001). Due to the fact that the earthquake was included in more than one scope, the inter discipline of 'Disaster Protection and Safe Life' was included in the 2018 Science Course Curriculum.

When the relevant literature was examined, the studies; the development of earthquake awareness among students (Demirci and Yıldırım, 2015), examination of the knowledge and attitudes of university students towards earthquakes (Ulukoca et al., 2017), high school students' views on earthquake education (Aksoy and Sözen, 2014), determination the earthquake knowledge levels of primary school teachers (Öztürk, 2013), determination the effective learning styles of teacher candidates for natural disasters (Özgen et al., 2011) have been conducted.

Science teachers have important responsibilities in reducing the damages of natural disasters and conducting disaster education consciously. In this study, it was aimed to determine the knowledge levels of prospective science teachers about earthquake.

## 2. Method

The survey model was used in the research. Survey models are research approaches that aim to describe a past or present situation in an existing way. The subject, individual or object that is the subject of the research is tried to be defined in its own conditions and as it is (Karasar, 2007). The study was carried out with 24 prospective science teachers studying in the fourth grade of the Faculty of Education at the Agri İbrahim Cecen University.

In this study, the Earthquake Achievement Test consisting of 20 questions has been taken from the literature was used as data collection tool (Aydin et al., 2016). The answers of the students who answered the test correctly were entered into SPSS 24 program as "1" and wrong and empty answers as "0". The highest score from the test is 20 and the lowest score is zero. Detailed information about the Earthquake Knowledge Test was given in Table 1.

Table 1. Content analysis of Earthquake Knowledge Test (Aydin et al., 2016)

Earthquake acquisitions	Question items
The topics like seismology, seismologist, aftershocks, foreshocks, magnitude, fault line, and earthquake area are emphasized.	1-4-5-11-15-16-17-18
The students know that seismology is a science and the people working on this field are called as seismologists.	2-3
The students establish relations with the earthquake areas of Turkey and the fault lines.	6-7-8
The students discuss the reasons of the earthquakes and the negative results they will cause.	9-10-12-14
The students discuss the precautions taken against the danger of earthquakes and the things that must be done during an earthquake.	19-20
The students know the estimation ways of the earthquakes.	13

Of the 20 questions that form the test according to Table 1, questions 1-4-5-11-15-16-17-18 are field-related questions. Questions 2-3 are about seismology and seismologist. 6-7-8 numbered questions are related to Turkey's earthquake fault lines and areas. Questions 9-10-12-14 deal with the causes of the earthquake and the negative effects caused by the earthquake. Questions 19-20 relate to the measures to be taken before the earthquake and the actions to be taken during the earthquake. Question 13 is related to the data used to estimate the earthquake.

## 3. Findings

The data obtained from the prospective science teachers through Earthquake Knowledge Test was analyzed. After the application, descriptive statistical analysis and normality tests (Kolmogorov-Smirnov and Shapiro-Wilk) were calculated in order to test the data obtained in SPSS 24th package program. 18 females and 6 males 4th grade science teacher candidates participated in the study. As a result of descriptive statistics, the arithmetic mean (12), kurtosis (-.509) and skewness (-.567) values are found to be between +1 and -1. Since the test showed normal distribution one sample t-test was used to determine the significance of prospective science teachers' knowledge levels according to the mean score of the test.

Table 2 shows the group statistics and the mean score of the Earthquake Knowledge Test. The mean score of female science teacher candidates was found 11,72 and male science teacher candidates' mean score as 12,5.

Table 2. Group statistics

Gender	N	Mean	Standard deviation	Standard error mean
Women	18	11,7222	2,32140	,54716
Man	6	12,5000	1,04881	,42817

As shown in Table 3, One-Sample t-test results of prospective science teachers reveal that their Earthquake Knowledge Test achievement levels differ statistically significantly ( $p = .04$ ). This situation shows that pre-service teachers' level of earthquake knowledge is sufficient.

Table 3. One sample t-test results

	t	df	Sig. (2-tailed)	Mean difference	95% confidence interval of the difference	
					Lower	Upper
Total	2,155	23	,042	,91667	,0369	1,7964

( $P < 0.05$ )

## 4. Results and Discussion

This study was carried out to evaluate the level of earthquake awareness among students at the end of undergraduate education through the sample of Agri province. In this study, an achievement test with reliability and validity was obtained from the literature and applied to 24 prospective science teachers.

In the study where the earthquake awareness of secondary school students in Istanbul was evaluated, it was concluded that the knowledge of the students was sufficient to explain the

cause of the earthquake, but the attitudes and behaviors of the students that could be useful in reducing the damages caused by the earthquake were below the desired level (Demirci and Yıldırım, 2015). Ulukoca et al. (2017) examined students' knowledge and attitudes towards earthquake in Kırklareli University and they found that students' attitudes towards earthquakes changed significantly according to gender and type of school, and there was no significant difference in attitudes according to age and living environment.

In their study, Aksoy and Sözen (2014) found that high school students' views on earthquake education in geography class did not show a significant difference according to their gender, property status of the housing they live in, the number of floors of the house they live in, income levels and the institution variable they trust the most. According to the type of school variable, there is a significant difference between vocational high school and Anatolian teacher high school in favor of vocational high school students.

In addition, as a result of a research on the experiences of the prospective classroom teachers in their lives, it was seen that although the general classroom teachers in the research group were directly or indirectly affected by the earthquake, they were not prepared for an earthquake that might occur after the earthquake (Öztürk, 2013). In another study, it was found statistically that pre-service teachers preferred 'natural disasters' in the form of 'visual learning', whereas 'self-learning' was the less preferred learning style by prospective teachers (Ozgen et al., 2011). Descriptive content analysis on training earthquake researches in Turkey is made and it was determined that the knowledge level of prospective teachers and adults about earthquake was not sufficient (Değirmençay and Cin, 2016).

## 5. Conclusion

When the findings obtained from this study were evaluated, it was found that the pre-service science teachers' level of earthquake knowledge was sufficient in contrast to the literature, but their level of knowledge about the measures to be taken after the earthquake was not sufficient.

The result of this study is thought to be due to the fact that prospective science teachers are more interested in the earthquake than the prospective teachers from the other branches. At the same time, the fact that the province of Agri, where the study was conducted, is located in the earthquake region may be one of the reasons for the focus of the prospective teachers' interest.

Considering the fact that earthquakes and natural disasters are included in the textbooks, it is suggested that the activities and dramatizations in the related schools will increase the students' knowledge about earthquakes and natural disasters at all levels and that this information will be transformed into behavior.

## References

- Aksoy, B., Sözen, E., 2014. Lise öğrencilerinin coğrafya dersindeki deprem eğitimine ilişkin görüşlerinin çeşitli değişkenler açısından incelenmesi (Düzce ili örneği). Uşak Üniversitesi Sosyal Bilimler Dergisi 7 (1), 279-297 (in Turkish).
- Arı, E., Yılmaz, S., 2016. Sorgulayıcı araştırma odaklı fen bilimleri uygulamaları: afetten korunma ve güvenli yaşam ara disiplini. Uluslararası Beşeri Bilimler ve Eğitim Dergisi 2 (1), 100-122 (in Turkish).
- Aydin, S., Haşiloğlu, M. A., Kunduraci, A., 2016. The establishment of an achievement test for determination of primary teachers' knowledge level of earthquake. In AIP Conference Proceedings (Vol. 1726, No. 1, p. 020011). AIP Publishing.
- Bayrak, Y., Öztürk, S., Çınar, H., Kalafat, D., Tsapanos, T.M., Koravos, G.C., Leventakis, G.A., 2009. Estimating earthquake hazard parameters from instrumental data for different regions in and around Turkey. Engineering Geology 105 (3-4), 200-210.
- Bozkurt, E., 2001. Neotectonics of Turkey – a synthesis. Geodin Acta, 14, 3-30. J. A. Cross, Environmental Hazards 2, 77-86 (2000).
- Değirmençay, S.A., Cin M., 2016. Türkiye'deki deprem eğitimi araştırmaları: betimsel içerik analizi. Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi 13 (1), 301-314 (in Turkish).
- Demirci, A., Yıldırım, S., 2015. İstanbul'da Ortaöğretim Öğrencilerinin Deprem Bilincinin Değerlendirilmesi. Milli Eğitim Dergisi, 45 (207), 89-118 (in Turkish).
- Holbrook, J., 2001. Operationalising Scientific and Technological Literacy- A New Approach to Science Teaching. Proceedings of the 1st IOSTE Symposium in Southern Europe Science and Technology Education: Preparing Future Citizens, Vol. 1 pp: 215-221.
- Karademir, N., Ortaç, Y., Bilinir, S., 2019. Samsat'ta (Adıyaman) Deprem Algısı ve Yerleşme İlişkisi. International Journal of Geography and Geography Education 40, 248-265.
- Karasar, N., 2007. Bilimsel Araştırma Yöntemi, Nobel Yayınları, Ankara (in Turkish).
- Levy, M., Salvori, M., 2000. Deprem Kuşağı: Deprem Nedir? Ne Değildir? (Çev. Turgut GÜRER ). İstanbul: Doğan Kitapçılık A. S. (in Turkish).
- Öcal, A., 2014. İlköğretim Sosyal Bilgiler dersinde deprem eğitiminin değerlendirilmesi. Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi 25(1), 169-184 (in Turkish).
- Öcal, A., 2005. The evaluation of earthquake education in the elementary school social studies courses. Gazi Eğitim Fakültesi Dergisi 25(1), 169-184.
- Özgen, N., Ünalı, E., Bindak, R., 2011. Öğretmen Adaylarının Doğal Afetler Konusuna Yönelik "Etkili Öğrenme Biçimleri" nin Belirlenmesi. Journal of Kırşehir Education Faculty 12 (4), 303-323.
- Öztürk, M.K., 2013. Sınıf Öğretmeni Adaylarının Deprem Deneyimleri Üzerine Bir Araştırma. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi 28 (1), 308-319.
- Ulukoca, N., Bas, D., Kuloğlu, Y., 2017. Kırklareli Üniversitesi'nde Okuyan Öğrencilerin Depreme Yönelik Bilgi Ve Tutumlarının incelenmesi. Turan: Stratejik Araştırmalar Merkezi 9 (36), 768-776.
- Usak, M., Sensoy, Ö., Yıldırım, H.I., Hançer, A.H., 2005. İlköğretim Fen Bilgisi ve Matematik Öğretmen Adaylarının Deprem Hakkındaki Bilgi Düzeylerinin Bazı Değişkenlere Göre Karşılaştırılması. Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi (in Turkish).
- Varol, N., 2007. Doğal ve teknolojik afetler konusunda toplumun bilinçlendirilmesi ve "AFEM" in rolü. Proceedings from: TMMOB Afet Sempozyumu, Ankara, 127-131.