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Development of Disaster Awareness Scale: A Validity and Reliability Study

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Abstract

The main purpose of this study is to develop a disaster awareness scale to determine the disaster consciousness of teacher candidates. The study group consisted of 820 preservice teacher who studied in different departments of Kırşehir Kırşehir Ahi Evran University Faculty of Education in the 2016-2017 academic year. Of the pre-service teachers in the sample, 74.3% were female, and 25.7% were male. The initial state of the scale created after the scanning of the relevant literature consisted of 50 items. As a result of expert opinions, the number of items was reduced to 46 and applied to the working group. An exploratory factor analysis was performed to determine the validity of the scale, and item factor total correlations and substance discrimination values were calculated. The internal consistency level and stability levels were calculated in order to determine the reliability of the scale. This left 46 items, but the factor loads of 10 items were below 0.30. Thus, they were removed from the scale. As a result, the final scale has a total of 36 items, of which 27 are positive and 9 are negative; and consists of 4 dimensions, called "disaster education awareness", "pre-disaster awareness", "false disaster awareness" and "post-disaster awareness." As a result of the analyses made, it was determined that the scale is valid and reliable and can be used to determine disaster awareness levels.

Keywords

Disaster, Disaster Education, Disaster Awareness, Scale Development, Validity and Reliability

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Disasters are defined as events that can originate from both humans and nature which cause losses of life, property, and social value, as well as stopping or interrupting human activities (Ergünay 1996; Özey, 2006; Şahin & Sipahioğlu, 2007). As this definition states, disasters are generally found to arise from two sources, being either natural or initiated by humans. Disasters such as earthquakes, lightning strikes, volcanic eruptions, drought, landslides, rocks falling, avalanches, storms, hurricanes, and flooding are considered to be natural disasters, whilst many forest fires, any kind of accidents and wars are man-made disasters.

Today, depending on the type of disaster in focus, the dimensions of the destruction that may occur as a result of disasters seem to be very large for both humans and the environment. Therefore, every society needs to have an action plan for disasters and give importance to these efforts in order to reduce losses and maintain daily life. Because human behaviors surrounding the issue of coping with unforeseen events are related to each individuals' levels of preparedness, knowledge and consciousness, identifying levels of knowledge and awareness about disasters, especially in young people, and working to increase their knowledge and awareness, will provide preventive and protective support for societies.

Disaster awareness is not limited to taking action during or after a disaster but also includes taking necessary precautions and making preparations before disasters begin. These actions are at least as effective as a response to disasters. Risk reduction and preparatory activities before disasters are the most important stages of modern disaster management. Following the catastrophic earthquake in 1999, Turkey's agenda became heavily focussed on disasters. After the earthquake, every institution that worked with society focused on disaster education and awareness, and they implemented educational programs in this direction. However, these programs were not yet satisfactory. This is because the focus was on post-disaster actions rather than pre-disaster preparedness (Uluğ 2009). Today, in Turkey, people lack knowledge of disasters, lack awareness, and lack protective and preventive measures against disasters (Caymaz, Akyon & Erenel, 2013; Kadıoğlu, 2011).

The concept of "culture" has appeared in numerous documents and websites that strive to improve disaster education. Concepts such as security culture, risk culture, and preparation culture are disaster awareness-related concepts. With this in mind, education is used intensively to spread disaster culture in society (Benadusi, 2014). Disaster awareness can be taught to young people through education. This can be best achieved through the dynamic and sustained involvement of all concerned parties (Khorram-Manesh et al., 2016; Wang, 2016).

Turkey's location, geological structure, topography and climatic characteristics make natural disasters common in the country. Due to different aspects of its topography and climate, different disasters such as flooding, droughts, earthquakes, and landslides occur in different regions of the country. Therefore, disasters are events that leave different negative effects on the society, culture and economy of each region of Turkey. The most effective way to combat disasters is to see the threats that may cause a disaster in

advance, and then to take precautions and measures to reduce the damage and losses that they can cause. To achieve this, disaster awareness needs to be widespread across society, and this can be achieved via educational practices (Johnson et al., 2014). Countries that effectively use science and technology for monitoring and precaution are faced with fewer disasters. However, countries that do not keep up with developments in science and technology or cannot use such developments for the benefit of their societies face more disasters and therefore have bigger losses, both materially and morally (Demirci & Karakuyu, 2004). Lessons people learn from disasters, in terms of transferring their experiences, their abilities to take precautions, and the frequency of disasters are different from each other (Erkal & Değerliyurt, 2009). Therefore, disasters' effects are not the same in every part of the world.

Disasters' potential hazards are not preventable, but their damage can be reduced and humans' abilities to cope with disasters can be increased. To achieve this, societies' disaster awareness should be improved. If disaster awareness can be raised in all people, protective and preventative behaviors against disasters will be developed, which will minimize the damage and loss of life and property from threats that may arise from disasters (Özgüven, 2006). People with disaster consciousness have enough information about disasters, and may be aware of potential threats and risks, and consequently can make an action plan for disasters, and act correctly during a disaster.

Although disasters kill thousands of people and negatively affect many more, in many ways around the world, there is lack of studies which investigate and develop disaster awareness. Existing studies have mostly described the existing situation or focused on a single type of disaster (Bartolucci & Magni, 2016; Begum et al., 2014; Bozyiğit & Kaya, 2017; Cin, 2010; Karakuş & Önger, 2017; Onuma, Shin & Managi, 2017; Perez-Lugo, 2001; Sugimoto, Iemura & Shaw, 2010; Sun, Deng & Qi, 2017). This situation may stem from the lack of a valid and reliable instrument to determine the disaster awareness of people. On the other hand, teachers may play key roles in society's acquiring of disaster awareness (Özgen, Ünaldı & Bindak, 2011). Therefore, focusing on teachers' disaster awareness, both pre-service and in-service, is necessary. This is the intention of this study and makes it a significant study for the field. Because, in order to gain positive awareness about any event or situation, it is necessary to first determine the level of individuals' awareness about an issue or topic. To conclude, the aim of this study is to develop a valid and reliable instrument for determining the disaster awareness of teacher candidates.

Method

Population And Sample

The study's participants included 820 prospective primary school teachers, social studies teachers, science teachers, and primary school mathematics teachers in the Faculty of Education at Kırşehir Kırşehir Ahi Evran University in Turkey. The prospective teachers were placed into two groups; the first group provided explanatory factor analysis data, and the second group provided the confirmatory factor analysis data. Participants were composed of 74.3 % females and 25.7% males. 25.5% of

participants were in the first year of their studies, 31.6% were in their second year, 25.9% were in their third year, and 16.9% were in their fourth and final year. Moreover, the participants' major field of study distribution was: 27.5% primary education, 25.5% social studies education, 28.8% science education, and 18.3% mathematics education.

Scale Development Process

The first and most important step in developing a scale is to correctly determine what to measure, because a scale is intended to measure some variables that are not directly observable. For this purpose, it is necessary to define a conceptual framework that will serve as the theoretical foundations used in order to identify the hidden variables, the direction of relations between variables, and the relation with other variables for the study (Netemeyer et al., 2003). A scale development process is researchers' efforts to explain a social phenomenon based on a certain conceptual framework which is also important in terms of the logical validity of a scale (Şencan, 2005).

In the scale development process, first, the literature was reviewed to determine general features and competencies towards disaster awareness. Each of the general characteristics was itemized to express a competency level and then inserted in an item pool. The item pool created in this way was reviewed in terms of both overlapping items and content validity by a total of three specialists, including one field expert, one assessment specialist, and one curriculum and teaching specialist. Finally, the items that were difficult to understand were either corrected or taken out of the list in collaboration with a linguist.

A pool of 46 items was created with the information obtained from the literature and the contributions of field experts. This list contained 36 positive and 10 negative statements. The scale was in a 5-point Likert-scale format. Each item had five levels of options for students to use to express their attitude. The options are: "(1) strongly disagree", "(2) disagree", "(3) neutral", "(4) agree", "(5) strongly agree".

The final draft of the scale was reproduced in a printed form. The scale was then distributed to the School of Education students under the supervision of faculty members from each major that were selected to participate in this study. The collected data were uploaded to SPSS 17.00 and LISREL 8.80 software in order to analyze the validity and reliability of the scale. Values for negative statements in the scale were reverse coded before they were uploaded to the statistical software.

Findings

Construct validity, item total correlations, corrected correlations, and item discrimination were examined to assess the validity of the Disaster Awareness Scale, and the findings obtained are explained in the following sections.

Construct Validity

Kaiser-Meyer-Oklin (KMO) and Bartlett's tests were applied to the data obtained during the study to determine whether the data were appropriate for testing the construct

validity of the scale. KMO = 0.911 and χ^2 = 10080.362 (p<0.001) values indicated that the data were appropriate for factor analyses (Korkmaz, 2012; Russell, 2002).

To carry out the factor analyses, firstly, Principal Component Analysis was used to determine whether the scale was one-dimensional or multidimensional. The Varimax rotation technique (Balcı, 2009) was used while applying the Principal Component Analysis. Factor loads are the basic criteria for the evaluation of factor analyses results. A high factor load (> 0.30) for an item indicates that the item is related to that factor (Büyüköztürk, 2002). Moreover, common factor variance is important for multi-factorial intruments. If an item's common factor variance is less than 0.10, it may need to be removed from the scale (Scherer, Wiebe, Luther & Adams, 1988). A total of ten items were removed from the scale, because four items' between-factor loads were smaller than 0.1 and six items' load factors were lower than 0.30. Factor analyses was re-done with the remaining items. Following this, the scale was evaluated by two experts to establish whether the removed items affected the content validity of the scale.

The results indicated that the remaining 36 items were grouped under four factors. The final draft of the scale had a KMO value of 0.904 and Bartlett's test value of χ^2 = 7178.15 (p<0.001). Non-rotated factor load values were between 0.341 and 0.608. After applying the Varimax rotation technique, the rotated factor loads were between 0.329 and 0.663. Additionally, it was seen that the added items and factors explained 37.888% of the total variance. The factors were then named based on their included items. Thirteen of the items fell under the "Disaster Education Awareness" factor, eight items under the "Pre-Disaster Awareness" factor, eight items under the "False Disaster Awareness" factor, and seven items under the "After Disaster Awareness" factor.

Table 1
Eigenvalue, Factor Variance, and Item Load Values of 36 Items in the Final Form of the Scale

Factors		**Items**	**Common Factor Variance**	**F1**	**F2**	**F3**	**F4**
Disaster Education Awareness	13	I need to tell my parents and relatives that I am safe after a disaster.	.513	.663			
	10	I think first aid training is important in disaster education.	.476	.641			
	8	Disasters can happen anywhere, anytime.	.477	.641			
	16	The destructive effects of disasters should be shown to students.	.480	.619			
	3	I think I know the disaster types in general.	.406	.576			
	1	I can define disaster.	.382	.568			
	27	Potential risks that may cause a disaster should be determined in advance.	.419	.501			
	26	I am aware that a disaster may happen any time.	.324	.482			
	14	I think that while the buildings are a great risk for some disasters, they may provide great protection against some disasters.	.273	.470			

	32	Nuclear and chemical accidents are actually technological disasters.	.242	.427		
	2	I find the scope of disaster education given in schools inadequate.	.285	.422		
	6	I find it unnecessary to set a meeting point during disasters.	.225	.362		
	28	I think that I need some general information about disasters.	.230	.353		
Pre-Disaster Awareness	50	Planning and preparation should be done with family members for disasters.	.495		.644	
	47	It is best to follow the warnings that the authorities will make from various communication means such as speakers and radio.	.425		.641	
	45	I think societies should be organized against disasters.	.484		.630	
	52	It is very important to identify a contact person from outside of a disaster region to ensure communication after a disaster.	.425		.617	
	40	Disaster and Emergency kits should be available in every house.	.521		.608	
	43	I mostly know disaster types that cause material damage and loss of life.	.389		.607	
	54	Some of the disasters' arrival times can be predicted beforehand.	.300		.522	
	29	I am aware of the risky disasters in my region.	.246		.329	
False Disaster Awareness	24	It is unnecessary to act cautiously if it is my destiny to be hurt in a disaster.	.564			.670
	22	I see it as a waste of time applying the "drop-cover-hold on" method during disasters.	.525			.670
	30	It is not possible to reduce destructive effects of disasters.	.392			.577
	31	The concept of natural disaster reminds me only of earthquakes.	.378			.553
	20	Disaster education is not necessary for everyone.	.371			.542
	44	It is more accurate to talk about the consequences of disasters rather than the measures to be taken.	.404			-.513
	48	If it is in your destiny, you cannot escape from disasters.	.296			.488
	53	Shutting down electricity, water, and natural gas vents at the time of evacuation is very time consuming.	.219			.378
After Disaster Awareness	25	I think I am good enough about applying first aid after a disaster.	.366			.605
	23	I know which government agency to contact after a disaster.	.431			.581
	46	I know how I will be informed during emergencies and where to stay.	.380			.575

35	I know which numbers to call in case of disasters.	.353				.568
4	I must be prepared enough to deal with disasters.	.295				.542
38	I know the after disaster "meeting point" in my neighborhood.	.409				.519
15	I am aware of the organizations that are working to reduce the damage of disasters.	.334				.489
	Eigenvalue		**7.344**	**2.840**	**1.995**	**1.460**
	Explained Variance		**11.748**	**9.688**	**9.532**	**6.920**

Item-Factor Correlations

In this section, the correlation values between the items and the factors they belong to were calculated. These Item-Factor correlation values are presented in Table 2.

Table 2
Item-Factor Correlations

Disaster Education Awareness		Pre-Disaster Awareness		False Disaster Awareness		After Disaster Awareness	
M	r	M	r	M	r	M	r
13	.684*	50	.692*	24	.710*	25	.592*
10	.666*	47	.641*	22	.620*	23	.569*
8	.658*	45	.667*	30	.633*	46	.617*
16	.665*	52	.646*	31	.588*	35	.588*
3	.558*	40	.707*	20	.604*	4	.511*
1	.557*	43	.616*	44	-.421*	38	.608*
27	.628*	54	.553*	48	.561*	15	.535*
26	.587*	29	.490*	53	.461*		
14	.469*						
32	.506*						
2	.402*						
6	.452*						
28	.459*						

N=396; *p<.001

As can be seen in Table 2, item-factor correlations for Disaster Education Awareness were between 0.402 and 0.684; for Pre-Disaster Awareness, correlations were between 0.490 and 0.707; for False Disaster Awareness, they were between 0.421 and 0.710; and for After Disaster Awareness, they were between 0.511 and 0.617. Positive and statistically significant correlations ($p<0.001$) exist between each item and its factor. Thus, it can be stated that each item is related to the factor to which it belongs, which means it works towards the common purpose.

Confirmatory Factor Analysis

Confirmatory factor analysis was performed with the four-factor model which was composed as a result of explanatory factor analysis. The final form of the scale was applied to 820 students. Data obtained from these students were analyzed through LISREL 8.0 software. The scale's Cronbach's Alpha reliability coefficient was 0.873. The Chi-square compliance test, Goodness of Fit (GFI), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Normed Fit Index (NFI), Relative Fit Index (RFI), Incremental Fit Index (IFI), and Adjusted Googdess of Fit Index (AGFI) compliance indices were used to evaluate the data obtained in the confirmatory factor analysis. In evaluating the RMSEA compliance index, the value of 0.08 was used as a criterion value and lower values were considered acceptable. In the evaluation of the other indexes, values greater than 0.90 were considered acceptable and values of 0.95 and above were considered perfect (Şimşek, 2007). Primary level confirmatory factor analysis results are presented in Figure 1.

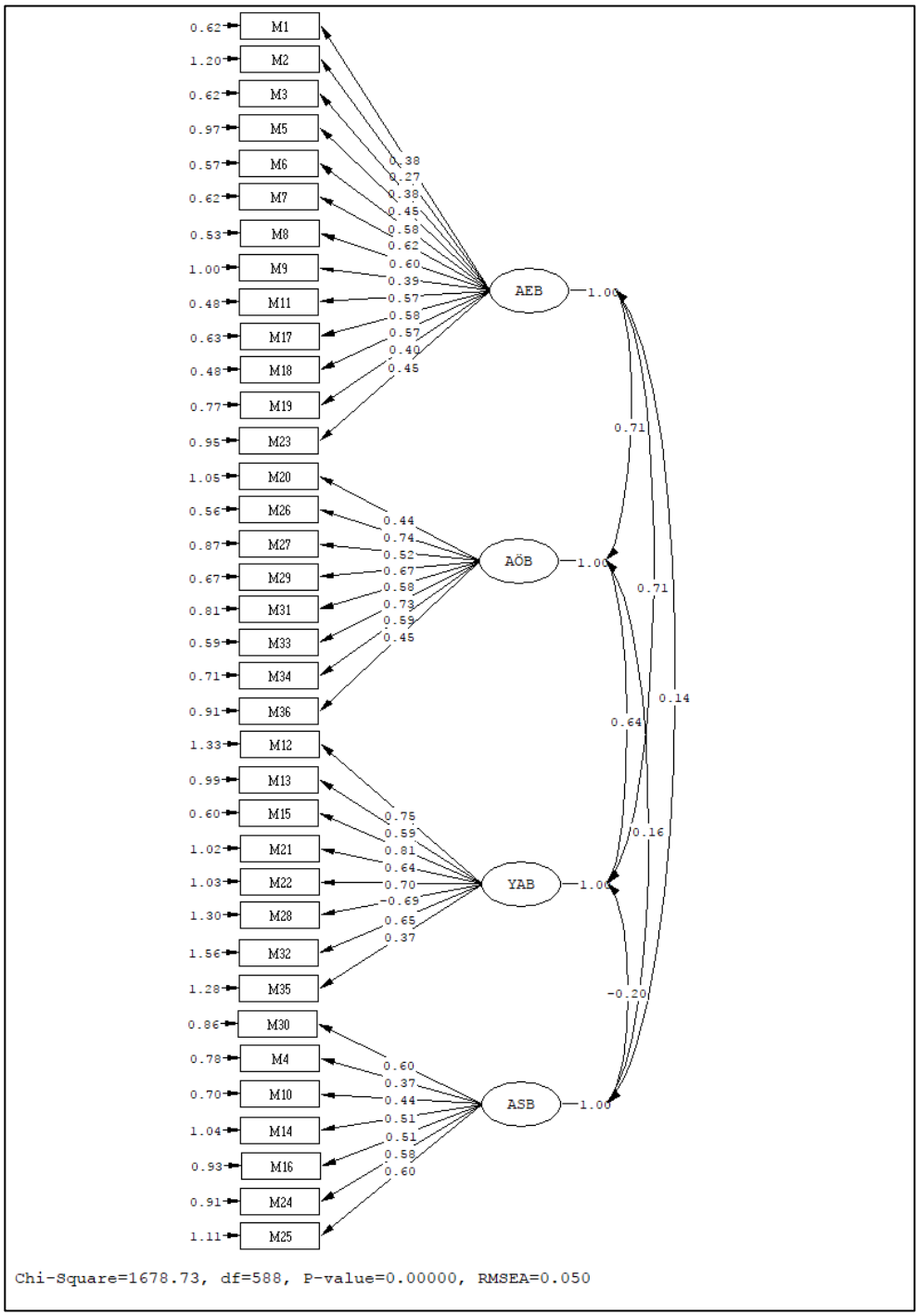

Figure 1. Primary Level Confirmatory Factor Analyses

From Figure 1, it can be seen that the following items' error variances are high: 2, 9, 20, 12, 21, 22, 28, 32, 35, 14, and 25. However, when the t-values were examined, it was seen that there was no significance at a 0.01 level. Non-significant t-values indicate that error variances do not have important effects. Dividing the obtained chi-squared

value by the degree of freedom, a ratio of 2.85 was calculated. Since this value is smaller than 3, it was concluded that there was perfect compliance (Sümer, 2000). By examining indexes that were obtained from primary level confirmatory analysis, results found: NFI = 0.92, CFI = 0.95, IFI = 0.95, RFI = 0.91, GFI = 0.90, and AGFI = 0.89. Also, the RMSA index was calculated as 0.050. Primary level confirmatory analyses were performed based on these results, and the obtained indices from these procedures were found to be acceptable. The path diagram obtained from the secondary level confirmatory factor analysis is presented in Figure 2.

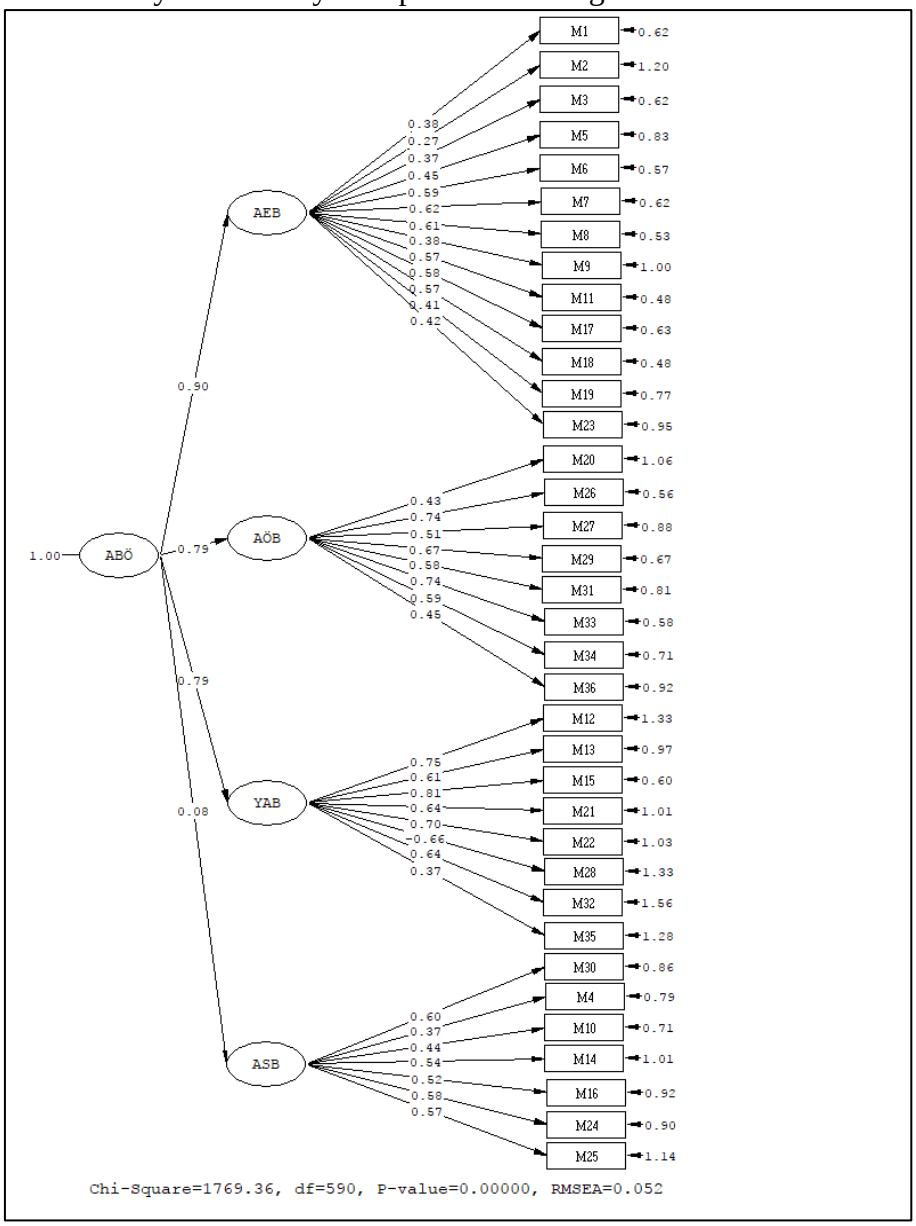

Figure 2. Secondary Level Confirmatory Factor Analysis Path Diagram

The chi-squared ratio, obtained as a result of the secondary level confirmatory factor analysis, to the degree of freedom is 2.99. Since this ratio is smaller than 3, it can be said that there is a perfect compliance. The following values were also calculated: NFI = 0.91, CFI = 0.94, IFI = 0.94, RFI = 0.91, GFI = 0.90, AGFI = 0.89, and RMSA = 0.052.

Internal Consistency Coefficient

Cronbach's Alpha reliability coefficient was calculated to examine the reliability of the scores obtained from the scale and its factors. The result of the reliability analysis of each factor and scale is presented in Table 3.

Table 3
Reliability Analysis Results for Factors and the Scale

Factors	Number of Items	Cronbach's Alpha
Disaster Education Awareness	13	.750
Pre-Disaster Awareness	8	.769
False Disaster Awareness	8	.696
After Disaster Awareness	7	.672
Total	36	.722

As seen in Table 3, the Cronbach's Alpha reliability coefficient for the scale consisting of 36 items, which was grouped through 4 factors, and was determined as .722. Also, the individual factor goups' Cronbach's Alpha values are between .672 and .769. Based on these results, it can be said that the scale's internal consistency coefficient value is rather high.

Interpretation of Scores

The Disaster Awareness Scale is a five-point Likert type scale. The scale consists of a total of 36 items, 27 positively and 9 negatively stated. Item numbers 12, 22, 23, 24, 25, 26, 27, 28, and 29 were stated negatively, but they were reverse coded before conducting the data analyses. The lowest score that can be derived from the "Disaster Education Awareness" factor, which has 13 items, is 13, and the highest score is 65. The high score on this factor means that teacher candidates' disaster education awareness levels are high. In the "Pre-Disaster Awareness" factor, which has 8 items, the lowest possible score is 8, and the highest is 40. The high score on this factor means that teacher candidates' Pre-Disaster Awareness levels are high. The third factor in the scale is the "False Disaster Awareness" factor and this also consists of eight items. The lowest possible score is 8, and the highest is 40. But, the high score on this factor means that teacher candidates' False Disaster Awareness levels are low. The last factor in the scale is "After Disaster Awareness", which has 7 items. The lowest possible score is 7, and the highest is 35. The high score on this factor means that teacher candidates' After Disaster Awareness levels are high. The lowest possible score in the whole scale is 36, and the highest is 180. Achieving high scores in the scale means that teacher candidates' disaster awareness is high, and vice versa.

Conclusions

In this study, a scale was developed to determine the disaster awareness levels in students. This disaster awareness scale is a five-point Likert type scale that consists of 36 items listed under four factors. The items in the scale were created through reviewing disaster management, disaster education, and disaster awareness literature (AFAD, 2013; Battersby, Mitchell & Cutter, 2011; Clerveaux, Spence & Katada, 2010; Guo & Li, 2016; Izadkhah & Hosseini, 2005; İnal, Kocagöz & Turan, 2012; Maquaire et al., 2009; MEB, 2015; Özgüven, 2006; Pavlova et al., 2015; Petal & Izadkhah, 2008; Pınar, 2017; Sarah, Jerry & Susan, 2011; Tatebe & Mutch, 2015).

In this developed Disaster Awareness Scale, the general characteristics of the items were along similar themes. Therefore, items were gathered under four factors; the first factor that the thirteen items were congregated under was named "Disaster Education Awareness", the second factor under which eight items were gathered was named "Pre-Disaster Awareness", the third factor under which eight items were gathered was named "False Disaster Awareness", and the fourth factor under which seven items were gathered was named "After Disaster Awareness".

The validity of the scale was examined by two different methods, factor analysis and discriminant analyses. The item-total correlations were calculated to determine the extent of each of the items that can be measured by the factor to which they are attributed. Based on these data, it has been found that every item and factor in the scale meaningfully serves the general purpose of the scale as well as their specific purpose. The scale's internal consistency coefficients were calculated using the Cronbach's Alpha reliability formula and it was found that the scores obtained from the scale were very reliable.

To conclude, it can be said that the Disaster Awareness Scale is a valid and reliable scale that can be used to determine disaster awareness levels. In the literature, this study did not encounter any alternative valid and reliable scale for measuring the disaster awareness levels of undergraduate students. Therefore, it is predicted that this instrument can provide important contributions to the literature. This developed scale can be used as a data collection tool in future research. However, the validity and reliability tests for this scale were limited to 820 education faculty students. It can be recommended that researchers repeat validity and reliability tests with students from different grades so that the scale can be used at different levels of education.

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