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Disaster Risk Perception of University Students

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Stakeholders responsible for disaster management need to understand students' disaster risk perception in order to increase community resilience. The aim of this study was to develop a scale to determine disaster risk perception of university students on campus and to investigate the disaster risk perception of the students of Gümüşhane University in Turkey. The data of the study were collected from 617 students and analyzed by means of SPSS and AMOS programs. Descriptive statistics, factor analysis, Mann–Whitney U test, Kruskal–Wallis H test, and structural equation model were applied. Consequently, a valid and reliable scale consisting of four factors (exposure, anxiety, effect, and uncontrollable) was obtained. According to the students, rockfall was most likely to occur on campus. Gender and type of school had a significant effect on disaster risk perception, while disaster experience, disaster education, disaster volunteer, and class level did not have a significant effect on disaster risk perception. Students with chronic illness had significantly higher perceptions of the uncontrollable. The structural equation model showed that exposure, effect, and uncontrollable were significant and positive predictors of anxiety.

KEY WORDS: campus, disaster, disaster risk perception, Gümüşhane University, university student

摘要

为增强社区复原力，负责灾害管理的利益攸关方需了解学生的灾害风险感知。本研究旨在提出一个衡量等级，以确定大学生对校园灾害风险的感知，并调查了土耳其居米什哈内大学的学生对灾害风险的感知。从*617*名学生处取得研究数据，并用*SPSS*和*AMOS*程序进行数据分析。应用了描述性统计、因素分析、曼-惠特尼*U*检验、*Kruskal-Wallis H*检验和结构方程模型。结果得出了一个由四因素(即暴露、焦虑、效果、不可控)组成的有效可信的衡量等级。学生认为，校园最易发生落石。性别与学校类型对灾害风险感知产生了显著影响，而灾害经历、灾害教育、灾害志愿者以及学生年级并未对灾害风险感知产生显著影响。患有慢性病的学生对不可控因素的感知显著更高。结构方程模型显示，暴露、效果、不可控三因素是焦虑因素的显著且积极预测物。

关键词: 灾害, 灾害风险感知, 大学生, 居米什哈内大学, 校园

RESUMEN

Las partes interesadas responsables de la gestión de desastres deben comprender la percepción del riesgo de desastres de los estudiantes para aumentar la resiliencia de la comunidad. El objetivo de este estudio

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fue desarrollar una escala para determinar la percepción del riesgo de desastres de los estudiantes universitarios en el campus e investigar la percepción del riesgo de desastres de los estudiantes de la Universidad de Gümüşhane en Turquía. Los datos del estudio fueron recolectados de 617 estudiantes y analizados mediante los programas SPSS y AMOS. Se aplicó estadística descriptiva, análisis factorial, prueba U de Mann-Whitney, prueba H de Kruskal-Wallis y modelo de ecuación estructural. En consecuencia, se obtuvo una escala válida y confiable que consta de cuatro factores (exposición, ansiedad, efecto, incontrolable). Según los estudiantes, el desprendimiento de rocas era lo más probable en el campus. El género y el tipo de escuela tuvieron un efecto significativo en la percepción del riesgo de desastres, mientras que la experiencia en desastres, la educación en desastres, el voluntariado en desastres y el nivel de clase no tuvieron un efecto significativo en la percepción del riesgo de desastres. Los estudiantes con enfermedades crónicas tenían percepciones significativamente más altas de lo incontrolable. El modelo de ecuación estructural mostró que la exposición, el efecto y lo incontrolable eran predictores significativos y positivos de ansiedad.

PALABRAS CLAVE: Desastre, Percepción del riesgo de desastres, Estudiante universitario, Universidad de Gümüşhane, Campus

Introduction

Disasters cause death, injury, economic loss, social collapse, and environmental damage worldwide. For example, natural disasters affected 68.5 million people and caused huge economic damage (132 billion US$) and 11,804 deaths worldwide in 2018 (Centre for Research on the Epidemiology of Disasters, 2019). Marmara earthquakes, occurred in 1999 in Turkey, caused 18,373 deaths, 48,901 serious injuries, and 23,400 heavily damaged buildings (Durukal & Erdik, 2008). In addition, Marmara earthquakes destroyed 43 schools and damaged 381 schools (Ersoy & Koçak, 2016). Furthermore, disasters demolish university campuses and cause damage to students, disruption of education, and severe economic damage. For instance, the Northridge earthquake damaged almost all the buildings of California State University and caused about $380 million in economic damage (Federal Emergency Management Agency, 2003).

Risk is one of the significant factors, which influence how people can live in safer and more sustainable communities. “Risk is a product of the likelihood of an incident occurring and its possible consequences” (Jóhannesdóttir & Gísladóttir, 2010, 411). In the risk management literature, the perception of individuals and societies related to risk has started to gain importance (Birkholz, Muro, Jeffrey, & Smith, 2014). Because knowing how people perceive the risks they face can affect the efficiency of risk management activities (Prabhakar, Srinivasan, & Shaw, 2009).

Risk perception studies in disaster management allow managers to predict public response, to have a better understanding attitude to the concept of risk, to prevent conflicts during emergency situations, and to establish risk communication (Jóhannesdóttir & Gísladóttir, 2010). “It is critical to study and understand the real perceptions and concerns of the population in order to design plans, programs, and policies that enable the development of better prepared and more resilient

communities in the face of disasters" (Bronfman, Cisternas, López-Vázquez, & Cifuentes, 2016, 308). In other words, risk perception studies can be of great benefit in the efficiency of the education given to individuals and families and in the actions of society for mitigation (Kung & Chen, 2012).

In the field of disaster management, scientists have examined the relationship between disaster risk perception and earthquake insurance (Xu, Liu, Wang, Tang, & Liu, 2018), sense of place (Peng, Lin, Liu, & De Xu, 2017), mitigation and adaptation behavior (Lee, Tung, & Lin, 2019), disaster preparedness (Yong, Gie, Lemyre, Pinsent, & Krewski, 2017), disaster knowledge (Zhang et al., 2017), mental health (Miura et al., 2017), trust (Bronfman et al., 2016), and anxiety (Nakayachi, Yokoyama, & Oki, 2015). Scientists have investigated the relationship between demographic characteristics, disaster experience, culture, socioeconomic status and location, and disaster risk perception (Hajito, Gesesew, Bayu, & Tsehay, 2015; O'Neill, Brereton, Shahumyan, & Clinch, 2016; Xu et al., 2016). A large number of scales have been developed to determine the risk perception pertaining to different types of disasters (Adelekan & Asiyanbi, 2016; Dominicis, Fornara, Cancellieri, Twigger-Ross, & Bonaiuto, 2015; Kellens, Zaalberg, Neutens, Vanneuville, & De Maeyer, 2011; Kung & Chen, 2012; Peng et al., 2017; Trumbo et al., 2016; Xu et al., 2016; Zhang et al., 2017). The samples of disaster risk perception studies generally include disaster victims (Havenaar, De Wilde, Van den Bout, Drottz-Sjöberg, & Van den Brink, 2003), households (Lawrence, Quade, & Becker, 2014), public (Zhang et al., 2017), and students (Baytiyeh & Öcal, 2016).

University students have an important place in disaster risk perception studies. Simms, Kusenbach, and Tobin (2013) stated that it is particularly noteworthy to study students, as students are both more vulnerable and more resilient to disasters than local people in the community; that is, they are a special group with advantages and disadvantages in coping with disasters. Similarly, Wu, Greer, Murphy, and Chang (2017) emphasize that it is important to investigate students' thoughts regarding risk, disaster preparedness, and mitigation measures since they are a vulnerable population. It should also be noted that Turkey has more than seven million university students and 207 universities (Council of Higher Education, 2020) and more than 223 million university students in the world (The World Bank, 2020). However, despite the number of university and university students in the world and the vulnerability of students, the literature lacks a comprehensive scale that measures students' perception of risk against disaster hazards on campus. Measuring students' disaster risk perception accurately and precisely can ensure more powerful risk and crisis management practices for students. Finally, understanding the disaster risk perception of students, which constitute the majority of the community, will enable the development of effective disaster risk reduction policies for students, thus ensuring that both the community and students are resilient to disasters.

This research has two main objectives. The first objective is to develop a valid and reliable measurement tool to determine how university students perceive disaster risks on their campus. The second objective is to reveal the disaster risk perception of the students studying in Gümüşhane University (Turkey) and the factors affecting it. Disaster managers developing disaster policy for students and scientists studying

related to disaster risk perception may use the scale obtained from this research in order to determine the students' disaster risk perception.

Disasters and Student

Students play an important role in reducing disaster risk in schools and communities by working with teachers and other adults. To give a special example, a student saved the lives of many people during the Indian Ocean Tsunami, thanks to the education-related to tsunami she had received in the geography lesson in England (United Nations Office for Disaster Risk Reduction, 2016). In addition, students are the young and dynamic population of the community. Disaster management public policy practices around the world (The Sendai Framework for Disaster Risk Reduction 2015-2030) consider children and young people as a stakeholder in the design and implementation of disaster plans, which can contribute to disaster risk reduction, and states that their leadership in the community should be promoted in the design of disaster policies (United Nations Office for Disaster Risk Reduction, 2015). Students in focus group interviews stated that students who prepared for disaster had more characteristics, such as leadership and conscientiousness (Davis, Weber, Schulenberg, & Green, 2019). On the contrary, students' knowledge and attitudes regarding disasters can enable universities to change and improve their current disaster management practices (Chen & Adefila, 2020; Tkachuck, Schulenberg, & Lair, 2018). For instance, in the study on disaster preparedness of university students, students provided useful suggestions regarding university emergency preparedness, policies, and training programs on the campus, and how to motivate students for emergency preparedness (Davis et al., 2019).

Even though students' high education level, good health, and renter status make them more resilient to disasters, on the other hand, their lack of experience, financial and emotional dependence on their families can make them more vulnerable (Simms et al., 2013). The fact that students from other cities or countries are unaware of the city's institutions, risk and safety awareness, and social structure make them more vulnerable to disasters (Magni, Pescaroli, & Bartolucci, 2019). On the contrary, scientific studies have shown that students' disaster preparedness and mitigation situations are quite low (Lovekamp & Tate 2008; Tanner & Doberstein, 2015; Wu et al., 2017). In addition, university students are less prepared for disasters compared with local people in the city they are going to study and need long-term outside help after disasters (Tanner & Doberstein, 2015). Moreover, students had hurricane experience; they had misperceptions and knowledge gap, lack of preparedness, and lack of concern related to hurricane (Simms et al., 2013).

Students' Disaster Risk Perception

Scientific studies related to students' disaster risk perception provide information for disaster management policies. For example, the study conducted to investigate earthquake risk perception of high school students in Turkey and

Lebanon showed that disaster risk education given in the school in both countries was not successful enough (Baytiyeh & Öcal, 2016). The local knowledge of flood, perception of environmental cues, and perceived fear of 15-year-old students living in the flood-prone area in the Netherlands significantly predicted the perception of flood risk (Bosschaart, Kuiper, van der Schee, & Schoonenboom, 2013). In another study, Turkish students had the highest disaster-related fear among university students in three countries (Turkey, Serbia, and Macedonia) (Cvetković, Öcal, & Ivanov, 2019). Tkachuck et al. (2018) found a negative and significant relationship between the disaster preparedness of the university, as perceived by students, and concern related to disaster hazards on campus.

Researchers have measured the disaster risk perception of students in different ways. For instance, a study conducted in Turkey and Lebanon so as to measure the earthquake risk perception of high school students considered hazard perception, fatalistic beliefs, and education (Baytiyeh & Öcal, 2016). Disaster likelihood and disaster concerns were measured in order to examine university students' perception of risk pertaining to seven natural disasters that may occur on campus in the next year (Tkachuck et al., 2018). The scale in the study, which investigates the perception of flood risk among 15-year-old students in the Netherlands, undertook the hazards around the school (Bosschaart et al., 2013). The risk perception of school students in Nepal was determined toward all disaster types, with the help of five questions, and no hazardous areas such as school or campus were specified in the measurement tool (Tuladhar, Yatabe, Dahal, & Bhandary, 2014). Lovekamp and Tate (2008) determined the risk perception of students with four questions, ranging from zero to ten, as regards a tornado and an earthquake that might affect their school and environment. Wu et al. (2017) measured the earthquake risk perception of university students in two ways. First, they asked the students about the likelihood of earthquake occurrence across 1, 5, and 10 years. Second, they asked about the possibility of earthquake damage.

Method

Research Design

The quantitative research method was employed to reveal whether the characteristics of the variables specified in the research sampling differed statistically and to develop a Likert-type scale. In order to explain in more detail, this research is both causal-comparative and correlational research, which is one of the quantitative research methods. While causal-comparative research explores whether there is a significant difference between the properties of two or more groups, correlational research reveals whether there is a relationship between the two variables and if there is a relationship, the direction, and strength of the relationship (Fraenkel, Wallen, & Hyun, 2012). The data collected online by the survey method in April 2018 were analyzed via descriptive statistics, mean comparison tests, and the Structural Equation Model (SEM).

Study Area

This study was conducted on the campus of Gümüşhane University in Turkey (Figure 1). There are more than ten tunnels in the entrance and exit areas of Gümüşhane city center. Damaging these tunnels due to a disaster can make it difficult to get help from other regions and evacuate people to other regions (Çoruh, Aydın, & Öztürk, 2018). Gümüşhane has an extremely steep and rocky land structure, and therefore, intensive excavations are carried out on the ground for urbanization. These excavations trigger landslides and cause structural damage to buildings (Alemdag, Akgun, Kaya, & Gokceoglu, 2014). The primary disasters that occur in Gümüşhane are landslides, rockfalls, floods, avalanches, and earthquakes, respectively (Öztürk & Şahinöz, 2018). Due to rockfalls and landslides, traffic flows in and out of the city are frequently interrupted. Gümüşhane University, founded in 2008, is on a rocky and sloping terrain (Figure 1). Therefore, deep and wide excavations were made on the ground before the buildings were built on the campus. The campus is particularly vulnerable to natural disasters such as landslides, rockfalls, and floods. The university management built many lengthy and high retaining walls on the campus to prevent landslides and rockfalls. Since the campus is on sloping land, on-campus transportation is difficult in winter. Because the campus's ground features are on a weak and water-retaining land, buildings are more vulnerable to disasters, and rainwater from sloping areas increases the risk of slipping of buildings and retaining walls (Aydın & Çoruh, 2018). Gümüşhane University was chosen as a study area since it is located in a disaster-prone area. The number of students studying on the campus of Gümüşhane University is 14,913, excluding graduate (MA and PhD) students (Council of Higher Education, 2018).

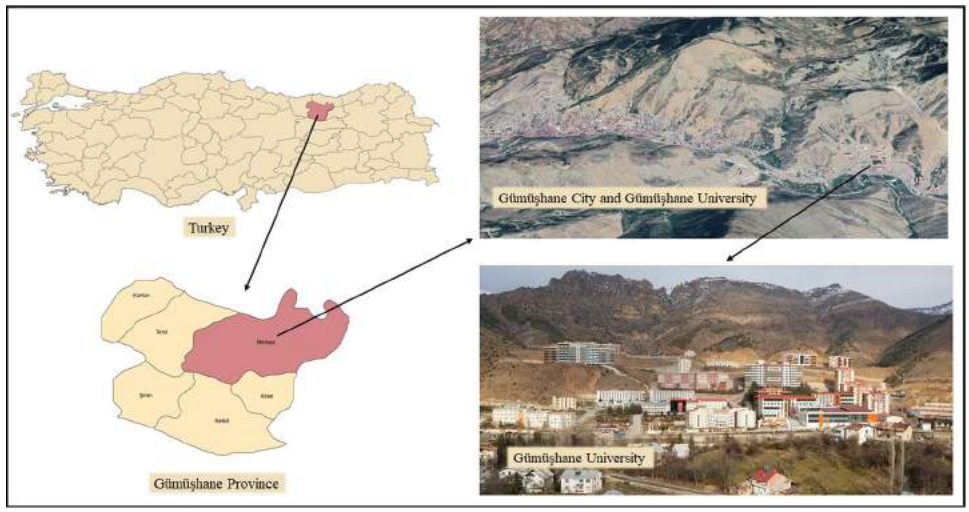

Figure 1. Study Area.

Scale Development

A literature review was conducted through Google Scholar, using risk, risk perception, disaster risk perception, and risk perception according to disaster types (earthquake, flood, landslide, etc.). Then, the criteria, methods, models, and approaches used in the studies determining disaster risk perceptions were scrutinized. At the same time, the content of these studies and the studies addressing students' disaster risk perception were elaborately examined. Since the measurement tools used in these studies were not suitable and comprehensive for the purpose of this research, there was a need to develop a scale that measures the disaster risk perception of university students. The scale items were not arranged for any type of disaster, they were prepared regarding all disasters from a holistic point of view, and the risk profile of the university was not included in order to be used in other universities. In order to create the scale items, items from academic studies were taken, adapted, or based on the approaches of scientists to determine disaster risk perception (Table 1). For instance, Xu et al. (2018) measured whether the participants had a constant feeling about a landslide that would happen (You have the constant feeling that a landslide will happen one day). Item 15 (I have the constant feeling that a disaster will happen on campus) was created by inspiring this approach. Due to the possibility of disasters damaging buildings and disruption of education, students may want to leave the university with the fear that their education will be disrupted or their education will be extended. Based on this, item 20 was added to determine whether students want to leave the university due to disaster concerns. University Students Disaster Risk Perception Scale (USDRPS) consisting of 20 items in a 5-point Likert type was developed in this study.

The scale items were scored on a Likert type (1 = strongly disagree and 5 = strongly agree). As the score obtained from the scale increases, the disaster risk

Table 1. The Sources of the Scale Items

Item No.	References
1	Baytiyeh and Öcal (2016); Knuth et al. (2014); Terpstra (2011); Tuladhar et al. (2014); Tuladhar, Yatabe, Dahal, and Bhandary (2015); Xu et al. (2016)
2	Miceli et al. (2008); Tuladhar et al. (2014, 2015)
3	Adelekan and Asiyanbi (2016); Baytiyeh and Öcal (2016); Kellens, Terpstra, and De Maeyer (2013)
4, 5, 6, 7	Dominicis et al. (2015); Kellens et al. (2013); Miceli et al. (2008)
8, 9, 10, 11, 12, 13, 14	Xu et al. (2016); Liu, Li, Shen, Xie, and Zhang (2018); Terpstra (2011); Trumbo et al. (2016); Zhang et al. (2017)
15	Xu et al. (2016)
16	Terpstra (2011)
17, 18, 19	Adelekan and Asiyanbi (2016); Fernandez, Tun, Okazaki, Zaw, and Kyaw (2018); Kung and Chen (2012); Pan (2012); Qasim, Nawaz Khan, Prasad Shrestha, and Qasim. (2015); Xu et al. (2016); Zhu et al. (2011)
20	Authors

perception increases. For the translation of scale items, two scientists from the field of English assisted. Two scientists in the field of disaster management and two scientists in the field of statistics checked the scale items. The scale was then applied to 108 undergraduate university students in the Emergency Aid and Disaster Management department to check the intelligibility of the items. The students of this department receive both theoretical and practical training in the fields of first aid and emergency care, fire and fire safety, search and rescue, risk, hazard, crisis, emergency, and disaster management. The students stated their views on the intelligibility of the items as open-ended for each item. Not all the students stated any problems in understanding all of the scale items. After the authors evaluated the answers of the students, no changes were made to the scale, and they decided on the final version of the scale.

Students coded gender as (1) male or (0) female. Students coded the following variables as (1) yes or (0) no: disaster experience, disaster education, chronic disease status, and whether they are registered for any organization to work in disaster management (disaster volunteer). Students reported the building in which they studied from one of the following options. (0) High School of Physical Education and Sports (HSPES), (1) Faculty of Economics and Administrative Sciences and Communication Faculty (FEAS and CF), (2) Faculty of Health Sciences (FHS), (3) Faculty of Engineering and Natural Sciences (FENS), (4) Gümüşhane Vocational School (GVS), (5) Gümüşhane Vocational School of Health Services (GVSH), (6) Faculty of Literature and Faculty of Theology (FL and FT). Students coded their class level (0) first grade, (1) second grade, (2) third grade, and (3) fourth grade. Students coded the type of disaster that may occur on the campus according to their own thoughts (earthquakes, floods, landslides, rockfalls, avalanches, fires, disease outbreak, terrorism, major traffic accidents, chemical explosions). Researchers added an open-ended question in addition to these types of disasters.

Data Collection Process

All the data were collected by the researchers of this study. The data were collected online by the survey method in April 2018. The researchers randomly interviewed students on the campus and checked whether the questionnaire was available to the students. The questionnaire was sent three times to remind the students. The researchers interviewed the students face-to-face in the schools where there was little participation, and they asked to fill out the questionnaire sent online. The aim of the researchers was to reach all the students; however, 617 students participated in the study voluntarily.

Data Analysis

The data were analyzed by SPSS 21 (Statistical Package for Social Sciences) and AMOS 18 (Analysis of Moment Structures). Construct validity was checked by the

factor analysis method. Exploratory factor analysis (EFA), means (M), standard deviation (SD), test of normality, Cronbach's α (CA) for reliability analysis, multicollinearity, Mann–Whitney U test, and Kruskal–Wallis H test were performed by means of SPSS software. AMOS program was used for confirmatory factor analysis and SEM. Whether the data were suitable for factor analysis or not was tested through Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's test of sphericity (Bartlett's test) by using SPSS. Factor extractions and rotation methods for EFA were all tested in the data collected in this study. The researchers preferred principal component analysis (PCA) and Varimax to ensure the integrity and consistency of the scale. Factors with an eigenvalue greater than one were accepted. Factors with a factor load over 0.4 were included in the factors. After EFA, SPSS was used to determine whether each of these factors was combined under one factor. In other words, the PCA and Varimax rotation methods were employed for each factor. After this procedure, item 5 with communality less than 0.5 was excluded from the analysis. Factor analysis was repeated and interpreted according to these latest results. In order to check the compatibility between the data and the model for SEM, χ^2/Degree of Freedom (CMIN/DF), Root-Mean-Square Error Approximation (RMSEA), Goodness-of-fit Index (GFI), Adjusted Goodness-of-fit Index (AGFI), and Comparative Fit Index (CFI) parameters were evaluated. Whether the dependent variable (anxiety) was predicted by independent (exposure, effect, uncontrollable) variables were tested by SEM. Statistical significance was accepted as 0.05.

Ethical Considerations

The students voluntarily participated in the research, while data were being collected. Before starting the study, ethical permission was obtained from the Scientific Research and Publication Ethics Committee of Gümüşhane University.

Results

Sample Characteristics

A total of 617 university students participated in the study and all the questionnaires were included in the analysis since there was no missing value. Table 2 shows the sociodemographic characteristics of the students. 37.4 percent (231) of the students were male and 62.6 percent (386) were female. While 34 percent of the students (210) experienced a disaster, 66 percent (407) of the students did not experience any disasters. The rate of the students receiving disaster education was 54 percent (333), while the rate of the students who did not receive disaster education was 46 percent (284). 8.5 percent (55) of the students had chronic diseases; 91.1 percent of the students had no chronic disease (562). 8.6 percent (55) of the students were disaster volunteer, and 91.4 percent of the students were a

Table 2. The Sociodemographic Characteristics of the Students

Variable	Groups	Frequency	Percent
Gender	Male	231	37.4
	Female	386	62.6
Disaster experience	Yes	210	34.0
	No	407	66.0
Disaster education	Yes	333	54.0
	No	284	46.0
Chronic diseases	Yes	55	8.9
	No	562	91.1
Disaster volunteer	Yes	53	8.6
	No	564	91.4
Type of school	HSPES	22	3.6
	FEAS and CF	96	15.6
	FHS	284	46.0
	FENS	77	12.5
	GVS	15	2.4
	GVSH	52	8.4
	FL and FT	71	11.5
Class level	The first year	165	26.7
	The second year	139	22.5
	The third year	182	29.5
	The fourth year	131	21.2

CF, Communication Faculty; FEAS, Faculty of Economics and Administrative Sciences; FENS, Faculty of Engineering and Natural Sciences; FHS, Faculty of Health Sciences; FL and FT, Faculty of Literature and Faculty of Theology; GVS, Gümüşhane Vocational School; GVSH, Gümüşhane Vocational School of Health Services; HSPES, High School of Physical Education and Sports.

nondisaster volunteer (564). The percentage of the students according to type of school was 3.6 percent (22) HSPES, 15.6 percent (96) FEAS and CF, 46 percent (284) FHS, 12.5 percent (77) FENS, 2.4 percent (15) GVS, 8.4 percent (52) GVSH, and 11.5 percent (71) FL and FT. At the class level, the rate of the students in the first year was 1.45 percent (165), whereas the second year was 22.5 percent (139), the third year was 29.5 percent (182), and the fourth year was 21.2 percent (131).

Table 2 shows that nearly half of the respondents were studying at the FHS; however, this may be advantageous. The student studying at the FHS can better assess the disaster risks on campus as they are trained in disaster management, nursing, health management, and occupational health and safety. The trainings received by students may have increased their interest in research.

Validity and Reliability

Scale items, M, and SDs of items were presented in Table 3. The scale mean was 3.006, and the standard deviation was 0.7498. The item with the highest mean was "I think that disasters pose great financial damage on campus ($M = 3.582$, $SD = 1.0585$)." The item with the lowest mean is "I have the constant feeling that a disaster will happen on campus ($M = 2.010$, $SD = 1.0506$). The results of the first EFA

Table 3. Items, Mean, and Standard Deviation of Measurement Instrument

Items	*M*	SD
1. I am likely to have a disaster on campus before I graduate from college.	3.459	1.0454
2. My school is not resilient against all disasters.	3.126	0.9920
3. Disasters pose a great threat to campus.	3.350	1.0784
4. It is likely that I could be harmed in disasters on campus.	3.541	0.9747
5. *It is likely that I could be harmed in disasters more easily than other students on campus.*[a]	2.382	1.0079
6. It is possible that I can die because of disasters on campus.	3.147	1.0838
7. I feel exposed to disaster risk on campus.	3.452	0.9576
8. Disasters make me worry when I come to campus.	2.656	1.1546
9. Disasters make me dread when I come to campus.	2.613	1.1313
10. When I think of disasters on campus, I get depressed.	2.045	1.0574
11. I think that disasters may cause catastrophic destruction on campus.	3.360	1.1651
12. I think that disasters may cause widespread death on campus.	3.282	1.1158
13. I think that disasters pose great financial damage on campus.	3.582	1.0585
14. I think that disasters pose a threat to future students that will study on campus.	3.538	1.0533
15. I have the constant feeling that a disaster will happen on campus.	2.010	1.0506
16. When a disaster occurs on campus, education at the university stops for a long time.	3.143	1.1729
17. When a disaster occurs on campus, I cannot protect myself.	2.802	1.1324
18. Disaster plans cannot be successfully implemented in the building I study during the disaster.	2.906	1.0964
19. I do not trust university management about disasters.	3.006	1.1952
20. I want to leave this university because of the possibility of disasters.	2.096	1.1448
Scale mean	3.006	0.7498

[a]This item was excluded from the scale.

showed that the scale consisted of four factors (Table 4). These four factors explained 69.695 percent of the total variance. In addition, KMO and Barlett's test indicated that the data were suitable for factor analysis (Field, 2013; Ho, 2014; Pallant, 2013). The first factor (item 4, 1, 7, 6, 3, and 2), named as exposure, took factor loading ranging from 0.796 to 616, its eigenvalue was 4.339 and explained 22.839 percent of the total variance (M = 3.3460, SD = 0.8203, CA = 0.889). The second factor (item 10, 15, 9, 8, 20), named as anxiety, took factor loading ranging from 0.814 to 0.669, its eigenvalue was 3.483 and explained 18.330 percent of the total variance (M = 2.2840, SD = 0.9206, CA = 0.887). The third factor (item 13, 12, 11, 16, 14), named as the effect, took factor loading ranging from 0.804 to 0.583, its eigenvalue was 3.336, and explained 17.560 percent of the total variance (M = 3.3809, SD = 0.9158, CA = 0.880). The fourth factor, named as uncontrollable (item 18, 19, 17), took the factor loading ranging from 0.807 to 0.473, its eigenvalue was 2.084 and explained 10.967 percent of the total variance (M = 2.9049, SD = 0.9806, CA = 0.778). While the mean of the exposure factor (M = 3.3460) was the highest, the mean of the anxiety factor (M = 2.2840) was the lowest. In addition, the overall reliability of the scale was quite high (CA = 0.938).

Four factors that emerged as a result of the first EFA were re-analyzed by SPSS and presented in Table 5. To explain, all the items of the first factor (4, 1, 7, 6, 3, 2) were analyzed by PCA factor extraction and by the Varimax rotation method to determine whether these items were collected under a factor. This process showed that each of the four factors was a factor in itself. Since the commonality value

Table 4. Structural Properties of Measurement Instrument

1	2	3	4	5	6	7	8	9	10	11
Exposure	4	0.796	4.339	22.839	69.695	0.934	0.000	3.3460	0.8203	0.889
	1	0.738								
	7	0.735								
	6	0.717								
	3	0.714								
	2	0.616								
Anxiety	10	0.814	3.483	18.330				2.2840	0.9206	0.887
	15	0.777								
	9	0.749								
	8	0.730								
	20	0.669								
Effect	13	0.804	3.336	17.560				3.3809	0.9158	0.880
	12	0.770								
	11	0.718								
	16	0.645								
	14	0.583								
Uncontrollable	18	0.807	2.084	10.967				2.9049	0.9806	0.778
	19	0.792								
	17	0.473								

1 = Factor name, 2 = Item no, 3 = Factor load, 4 = Eigenvalue, 5 = Variance explained, 6 = Total variance explained, 7 = Kaiser-Meyer-Olkin (KMO), 8 = Barlett's test, 9 = mean (M), 10 = standard deviation (SD), 11 = Cronbach's α (CA).

of item 5 in the second factor was less than 0.5, this item was excluded from the scale. Field (2013) states that the commonalities value should be above 0.5. An item with low commonality value adversely affects the outcome of factor analysis (Fabrigar, Wegener, MacCallum, & Strahan, 1999; Mundfrom, Shaw, & Ke, 2005;

Table 5. One-Factor Structural Properties of Factors

Factor Name	Item No.	Factor Load	KMO	Barlett's Test	Total Variance Explained
Exposure	4	887	0.884	0.000	64.929
	1	736			
	7	853			
	6	848			
	3	810			
	2	681			
Anxiety	10	842	0.795	0.000	69.343
	15	817			
	9	891			
	8	883			
	20	725			
Effect	13	838	0.870	0.000	68.054
	12	883			
	11	839			
	16	727			
	14	728			
Uncontrollable	18	788	0.658	0.000	69.614
	19	721			
	17	580			

Widaman, 1993). The removal of this item from the analysis will increase the amount of variance explained (Pallant, 2013). Therefore, item 5 was excluded from the analysis and factor analyses were repeated. The first factor in the one-factor structure had a factor loading ranging from 0.887 to 0.681, and the total variance explained was 64.929 percent (KMO = 0.884, $p = 0.000$). The second factor had a factor loading ranging from 0.842 to 0.725, the total variance explained was 69.343 percent (KMO = 0.795, $p = 0.000$). The third factor had a factor loading ranging from 0.838 to 0.728, the total variance explained was 68.054 percent (KMO = 0.870, $p = 0.000$). The fourth factor had a factor loading ranging from 0.788 to 0.580, the total variance explained was 69.614 percent (KMO = 0.658, $p = 0.000$).

Perceived Likelihood of Disasters

Figure 2 shows the percentage and the number of disaster types that may occur mostly on the campus, according to the students. 69.9 percent (428) of the students stated that the most common type of disaster on the campus was rockfall. 15.1 percent (93) of the students thought that there would be a landslide on the campus, while 6.2 percent (38) of them thought that there would be an earthquake. The students stated that the major traffic accidents were the least seen disaster type on the campus (0.2 percent). Only one student stated that major traffic accidents were the least common type of disaster on the campus (0.2 percent). In addition, all the students stated that chemical explosions would not happen on the campus. In addition, no students marked the open-ended question.

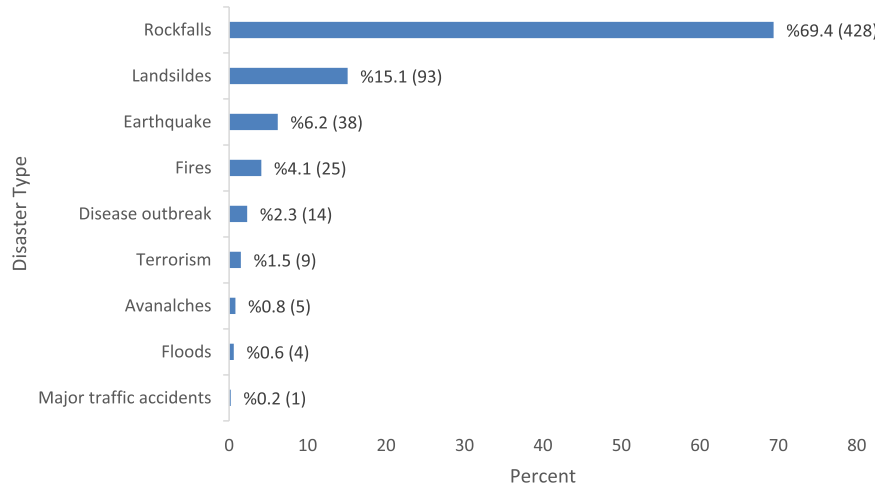

Figure 2. Perceived Likelihood of Disasters.

Mann–Whitney U Test and Kruskal–Wallis H Test

Since the Kolmogorov–Smirnov test showed that the data did not have normal distribution characteristics, the Mann–Whitney U test and Kruskal–Wallis H test were used. The Mann–Whitney U test results showed that while there was no significant difference between gender and anxiety ($p = 0.052$) and uncontrollable ($p = 0.094$), there was a significant difference between gender and exposure ($p = 0.015$) and effect ($p = 0.005$). The exposure and effect mean of the female students was higher than that of the male students. No significant difference was observed between disaster experience and exposure ($p = 0.274$), anxiety ($p = 0.217$), effect ($p = 0.385$), and uncontrollable ($p = 0.945$). There was no significant difference between disaster education and exposure ($p = 0.647$), anxiety ($p = 0.451$), effect ($p = 0.120$), and uncontrollable ($p = 0.249$). While there was a significant difference between chronic disease and uncontrollable ($p = 0.002$), there was no significant difference between chronic disease and exposure ($p = 0.181$), anxiety ($p = 0.752$), and effect ($p = 0.108$). On the contrary, the mean of uncontrollable of those with chronic disease was significantly higher. There was no significant difference between disaster volunteer and exposure ($p = 0.136$), anxiety ($p = 0.885$), effect ($p = 0.457$), and uncontrollable ($p = 0.590$).

A significant difference was found between school type and exposure ($p = 0.000$), anxiety ($p = 0.022$), effect ($p = 0.006$), and uncontrollable ($p = 0.033$) according to the result of the Kruskal–Wallis H test. Besides, the means of schools varied according to factors. The exposure mean of FHS was the highest; the exposure means of FL and FT were the lowest. While the anxiety of HSPES was the highest, the anxiety of FL and FT was the lowest. GVSH had the highest mean in the effect factor, while FL and FT had the lowest mean. The uncontrollable of the FENS was the highest, the uncontrollable of the FL and FT was the lowest. There was no significant difference between class level and exposure ($p = 0.909$), anxiety ($p = 0.705$), effect ($p = 0.624$), and uncontrollable ($p = 0.212$).

SEM. In order for SEM analysis involving multiple regression to be suitable for use, there should be no multicollinearity problems. The fact that the variance inflation factor values (exposure = 2,073, effect = 2,272, and uncontrollable = 1,656), resulting from the multicollinearity analysis, were less than 10 and showed that the assumption for SEM analysis was fulfilled (O'brien, 2007). The results of SEM showed the relationship between anxiety, exposure, effect, and uncontrollable (Figure 3). According to the SEM results, exposure ($\beta = 0.47$, $p = 0.000$), effect ($\beta = 0.17$, $p = 0.000$), and uncontrollable ($\beta = 0.14$, $p = 0.000$) predicted anxiety significantly and positively. While the most predictive variable of anxiety was exposure, the least predictive variable was uncontrollable. The value of the goodness of the fit indexes of the model was CMIN/DF = 3.994, RMSEA = 0.07, GFI = 0.910, AGFI = 0.880, and CFI = 0.945. According to these values, the model showed good fit (Hair, Black, Babin, & Anderson, 2010; Hooper, Coughlan, & Mullen, 2008; Schermelleh-Engel, Moosbrugger, & Müller, 2003; Schumacker & Lomax, 2010).

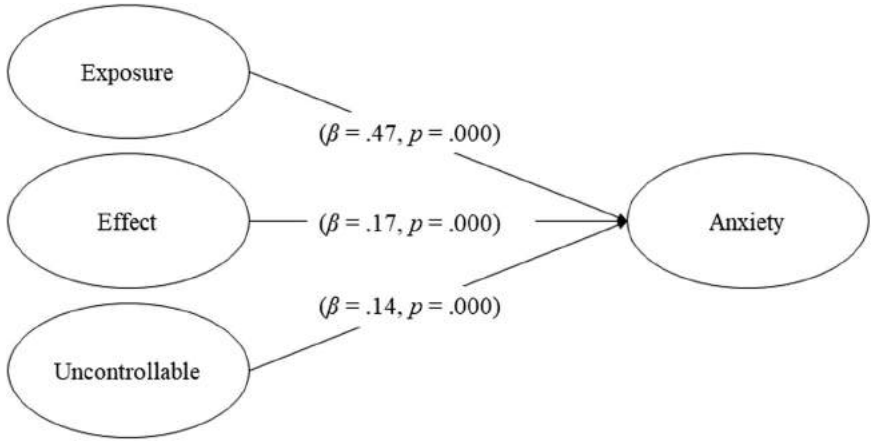

Figure 3. Structural Equation Model.

Discussion

A large number of the sampled students thought that rockfalls and landslides were the most common disasters on the campus, although many measures were taken against landslides and rockfalls on the campus. People responsible for disaster management at Gümüşhane University should investigate students' thoughts and attitudes toward landslides and rockfalls on the campus. Thus, the preparedness and mitigation actions taken in these regions may make the students feel safer regarding these disasters. Although no student thought the chemical explosion as a disaster on the campus, a chemical explosion occurred in May 2018 in which the entire university was evacuated. This indicates that students' perception of risk should be investigated separately against the structures used by all the students on campus such as laboratories, sports facilities, dining hall, and library.

The disaster risk perception of the female students studying at Gümüşhane University is higher than that of the males and is consistent with many studies in the literature. For example, Lovekamp and Tate (2008) found that female university students had significantly higher levels of tornado and earthquake fear than male university students. Similarly, fear of female university students about disasters was higher than that of males (Cvetković et al., 2019; Lovekamp & Mcmahon, 2011). Furthermore, disaster risk perception of women related to flood (Kellens et al., 2011), earthquake (Tekeli-Yeşil, Dedeoğlu, Braun-Fahrlaender, & Tanner, 2011), terrorism (Bourque et al., 2013), and natural disaster (Bronfman et al., 2016) was higher than men's disaster risk perception. These results indicate that these vulnerabilities of female students should be taken into account while disaster educations and plans are made for the campus. Moreover, female students should be included in more disaster education and practices to improve their ability to cope with disasters and increase disaster preparedness. In this way, they may be less concerned regarding disasters as their resilience to disasters will increase.

The disaster experience of the students at Gümüşhane University did not significantly affect their risk perception. For instance, the study conducted in New Zealand showed that exposure to ash coming from the volcano increased risk perception against volcanoes (Paton, Smith, Daly, & Johnston, 2008). After a flood disaster, people were more aware of potential risks and took the risk more seriously (Bera & Daněk, 2018). According to the results of the study on individuals living in different countries, exposure to hazards increases risk perception (Knuth, Kehl, Hulse, & Schmidt, 2014). Lawrence et al. (2014) found that the experience of disaster increased risk perception in their household survey. In the present study, students' disaster exposure was not asked in detail, including when, how many times, physically, psychologically, and financially, thus the results have may be restricted. In addition, because students come to Gümüşhane University from different cities, exposure to disasters at different times and places may also affect the result. Hence, further research is required to estimate the impact of disaster experience on disaster risk perception. Researching when and how students were exposed to which type of disaster might increase the validity of the results.

In this study, no significant difference was found in the comparisons with disaster education. Miceli, Sotgiu, and Settanni (2008) did not find a significant relationship between flood risk perception and information about flooding. In another study conducted in seven different countries, a positive significant relationship was found between the perceived emergency information and disaster risk perception (Knuth et al., 2014). Altarawneh, Mackee, and Gajendran (2018) found that information about hazard was a significant predictor of risk perception. The fact that students receive disaster education differently, at different times and from various sources, and that the trainings are theoretical and practical may affect their attitudes and thoughts related to disaster risks. After pondering these differences, investigating the relationship between disaster education and disaster risk perception may yield more reliable and valid results. Since students who receive both theoretical and practical disaster training will have more awareness and knowledge, they will be able to cope better with disasters and thus less worry about disaster probability and impact.

The results of scientific studies showed that individuals with a chronic disease or physical disability had higher disaster risk perception. Marceron and Rohrbeck (2019) found that there was a significant negative relationship between perceived threat and self-efficacy regarding disasters. While there was a significant positive relationship between the number of people with disabilities and landslide risk perception, there was an insignificant positive relationship between the number of people with disabilities and earthquake risk perception (Castro, Sarmiento, Edwards, Hoberman, & Wyndham, 2017). The study conducted in different countries concluded that well-being was highly correlated with a concern related to disasters (Jones et al., 2013). In the present study, the high level of the vulnerability of the students with chronic diseases to disasters may cause a higher uncontrollable. The differences in the type and severity of the chronic disease of the students of Gümüşhane university may cause no significant difference between chronic disease and other factors. Increasing the resilience of students with chronic diseases to

disasters and arranging the environment according to their needs may enable these students to cope better with disasters; consequently, these students may feel more confident in buildings and on campus. In particular, the disaster risk perception of these students can be understood more deeply with the help of qualitative studies.

In this study, no significant difference was found between the disaster volunteer variable and disaster risk perception factors. Similarly, Miceli et al. (2008) did not find a significant relationship between participation in civil defense work and flood risk perception. The level of the participation of volunteer students in disaster management activities such as disaster education, evacuation, and drills may also affect disaster risk perception. Moreover, characteristics of organizations related to disasters in which Gümüşhane University students are members can also affect their risk perception. Further studies with disaster volunteer students may show the reason why these students are involved in disaster-related organizations and actions, and how they affect their perception of risk.

This result showed that the education of students in different schools on campus had a significant effect on disaster risk perception. In other words, students' education, such as sports sciences, management, health sciences, engineering, natural sciences, religion, and other fields, differentiate their disaster risk perceptions. Furthermore, while the ranking of disaster risk perception means by schools varied for each factor, FL and FT was the school with the lowest mean of all the factors. Similarly, Gerdan (2014) found that disaster awareness of engineering students and attitudes of students studying in the health department were significantly higher than those students in other departments. Different educational experiences of students may enable multifaceted assessment of disaster risks on the campus so that it can be conducted in other scientific studies on disasters in different schools. As these studies will enable better identification of disaster risks on campus, the campus will be safer and less risky. This study revealed that the class level did not significantly affect disaster risk perception. Although the level of the education of the students increases as the grade level increases, the level of education does not affect the disaster risk perception of the students.

Different studies indicated that disasters triggered negative feelings of people. For example, a study showed that the risk perception related to floods was a significant predictor of negative emotions (fear, anger, distress, and powerlessness) (Altarawneh et al., 2018). Pan (2012) found a significant negative correlation between the ability to be protected from the damages of a geological hazard and fear. In the same study, Pan (2012) found a positive correlation between fear and geological hazard affecting human life and quality of life. Zhu, Xie, and Gan (2011) found a positive and significant correlation between the level of damage and risk perception. When the students participating in this research think that the landslide was uncontrollable, and when they fear the landslide, their thoughts on the possibility of landslides were increasing (Peng et al., 2017). When the student thinks that they will experience disasters, will be affected by disasters, and will suffer from damage, the anxiety of the student increases more. It is possible for people to be less affected by disasters and to respond to disasters successfully with disaster training that provides the elimination of the factors causing anxiety. In other words, if the

vulnerability of students is reduced and their capacity to cope with disasters is increased, the possibility of disaster may worry them less.

Conclusion, Recommendations, and Limitations

This study provided a valid and reliable scale to determine the disaster risk perception of university students. The scale consisted of four factors, namely, exposure, anxiety, effect, and uncontrollable. According to the students, the campus of Gümüşhane University would be exposed to rockfall and landslide frequently, and the campus would not be exposed to a chemical explosion. The female students' perception of disaster risk was higher than that of the male students. Disaster experience, disaster education, disaster volunteer, and class level did not influence students' disaster risk perception. The students with chronic disease had higher disaster risk perception. The mean perception of the risk of the students affected by the type of school changed in each factor. This research showed that the students' perceptions of exposure, effect, and uncontrollable related to disasters predicted significantly positively their anxiety caused by disasters. Consequently, the knowledge of the sociodemographic characteristics, attitudes, and thoughts that affect disaster risk perception can enable the decision makers to create more effective and productive approaches.

Disaster managers and scientists can utilize the USDRPS in order to measure disaster risk perception of students. Since the scale does not specifically indicate any resources or disaster hazards belonging to the university, it can be used as such, and it can also be adapted to other types of disasters, and it can be expanded. In addition, it can be investigated whether disaster risk perception affects the behaviors of students. For example, it can be examined whether disaster risk perception affects the relationship of students with each other and their teachers, their adaptation to the school environment, their commitment to school, and their academic success. University management should consider disaster risk perceptions of students while they plan disaster management policies for campus and students.

This study has some limitations. First, despite all persistence and efforts, very few students participated in the study. Even though a sufficient sample size was reached for analysis, all the students at the university or a larger sample could provide more accurate and comprehensive results. In addition, the number of students varies greatly, according to schools. Second, the research was conducted only at Gümüşhane University. Therefore, the findings obtained from this research cannot be generalized to other universities. Third, disaster hazards outside the campus were not taken into account because the campus was outside the city, and there was no significant urbanization and industry around the campus. Fourth, the research was conducted only for students, and the opinions of academics, workers, and officials were not investigated. In future studies, more powerful results can be obtained if the hazards outside campuses, the social and cultural structure of universities and cities (social capital, sense of community, etc.) are included in the research to estimate students' perception of risk.

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