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DEVELOPMENT OF MICROPLASTIC POLLUTION AWARENESS SCALE FOR PROSPECTIVE SCIENCE AND BIOLOGY TEACHERS*

(Research article)

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Abstract

The objective of this study is to develop a scale to measure science and biology teacher candidates' awareness of micro-plastic pollution. The sample group consists of 586 participants from 4 universities who are currently enrolled in science and biology teaching programmes. “Microplastic Pollution Awareness Scale (MPAS)" used as data collection tool developed by the researcher. EFA was applied to the data obtained from the application, it was determined that the scale had a 3-factor structure, and that the factors made up 49.57% of the total variance in general. DFA was applied to verify the obtained factor structure. According to the DFA results; χ2/df is perfect harmony; RMSEA, SRMR, CFI, GFI and NNFI are good/perfect harmony; AGFI and NFI are acceptable harmony. The overall reliability coefficient of the scale was determined as 81, the value of which is considered to be of high level reliability. MKFÖ, which is a likert scale, consists of a total of 14 items, including 5 negative and 9 positive items. The maximum score that can be obtained from the scale is determined as 28, and the score obtained from the scale is in direct proportion with the level of awareness of the individual about microplastic pollution.

Keywords: microplastics, microplastic pollution, awareness, scale development

1. Introduction

Today, rapid population growth, and thereupon the increasing industrialization upset nature's balance. Population growth has increased the domestic and urban waste generated as a result of consumption, and therefore environmental pollution has reached gigantic proportions. One of the most common causes of environmental pollution is litter. In the studies conducted, it has been determined that the most common type of litter is plastic (Vişne & Bat, 2015). Plastics are often preferred not only because of their relative cheapness, but also because they are flexible, strong, waterproof, lightweight and easy to clean. Plastics are widely used in packaging, automotive and electrical and electronic industries, textile products and sports equipment. Plastics, which have been around for about 70 years, cause an accumulation of waste since they take long to decompose in nature due to the additives and polymers they contain (Murphy, 2003; SAPEA, 2019, p. 24). Because of this increase in the amount of plastics and microplastics, scientists have named the present era “Plastic Era” (Waters et al., 2016).

Sun-rays and intense winds cause large-sized plastics to break down and form minuscule particles (nano-meso-micro) (Andrady, 2011; Song et al., 2017). Particularly, the particles called “microplastics" can enter the circulatory system from the stomach and intestines of organisms and can accumulate in various organs. Therefore, microplastics have become one of the main pollutants today with trophic transfer (Law & Thompson, 2014). Since they might cause bioaccumulation, this makes microplastics even more dangerous. Microplastic pollution, which is defined as a "risk on a global scale" by Kramm and Völker (2018) has socio-ecological significance, is one of the current environmental problems the effects of which on living beings are not yet fully known. The first international conference on microplastic pollution was held in 2008 at the University of Washington Tacoma with the support of the National Oceanic and Atmospheric Administration (National Oceanic and Atmospheric Administration). Participants from various countries agreed on plastic particles smaller than 5 millimeters being called "microplastics" (Betts, 2008). Microplastics are present in water (Ceylan, 2017; Gündoğdu, 2017; Gürbüz, 2017; Tang et al., 2018; Watkins et al., 2019), on land (He et al., 2018) and even in the air (Yurtsever et al., 2017). Kinds of microplastics that we are exposed to in our day-to-day lives can be listed as car tires (%42), plastic-based textile products (%29), synthetic polymers found in house dust (19%) and personal care products (%10)(Siegfried et al., 2017).

The first research on the effects of minuscule plastic waste on living beings was conducted by Teuten, et al. (2007). Following this research, Browne et al. (2008) discovered that the decrease of plastic particles' size increases their potential to accumulate in living beings' bodies. From planktons (Cole et al., 2013; Desforges et al., 2015) to sea mammals (Fossi et al., 2012; Lusher et al., 2016) many organisms consume these microplastics and these microplastics, accumulating, are transferred all the way to the predators through the food chain. The presence of microplastics in some species belonging to the Mammalia, Reptilia, Actinoptergii classes also proves that microplastics are transmitted by trophic transfer to what is considered to be more advanced creatures (Bravo Rebolledo et al., 2013; De Witte et al., 2014; Tourinh et al., 2010; van Cauwenberghe & Janssen, 2014).

It has been proven that various chemicals absorbed by plastics are present in human blood, urine, and breast milk (Talsness et al., 2009). Microplastics that enter the blood stream are transmitted to many tissues and organs through the circulatory system. Microplastics might also move from mother to fetus via blood through the umbilical cord (Galloway, 2015). Therefore, it is detected that the organisms might be exposed to microplastics in more than one of their organ systems, yet, since there is not enough research in this area, there is no clear information on what the impacts of microplastics on human health are (Lusher et al., 2017; Smith et al., 2018).

According to the research, the presence of microplastics in North Pacific Ocean (Lebreton et al., 2018), North Atlantic (Law et al., 2010), Northeast Atlantic (Lusher et al., 2014), Northwest Atlantic (Law et al., 2010), Equatorial Atlantic (do Sul et al., 2013), South Atlantic (Lima et al., 2014), Caribbean Sea (Law et al., 2010), North Sea (Fries et al., 2013), Arabian Sea (Jayasiri et al., 2013), Indian Ocean (Ogata et al., 2009), Baltic Sea (Setälä et al., 2014), Salish Sea (Lindborg et al., 2012), The Venetian Lagoon (Vianello et al., 2013), Blacksea (Esenyurt et al., 2018; Şentürk et al), Mediterranean Sea (Greenpeace Akdeniz, 2019; Gündoğdu, 2017), Aegean Sea (Greenpeace Akdeniz, 2019), and in Marmara Sea (Greenpeace Akdeniz, 2019; Gürbüz, 2017) has been proven. This demonstrates that microplastics follow a large-scale distribution in aquatic ecosystems.

Current research demonstrates that microplastics are present in tap water, bottled water, canned drinks, sparkling water, beer, seafood, conserved products, packaged food (chicken etc.), honey, sugar, tabel salt, teabags and rice (Dessì et al., 2021, Hernandez et al., 2019; Karami et al., 2018; Kedzierski et al., 2020; Kosuth et al., 2018; Mühlschlegel et al., 2017; Peixoto et al., 2019; Schymanski et al., 2018; Senathirajah et al., 2021; Shruti et al., 2020; Zhou et al., 2021).

Organisms need nature to survive. Therefore, humans need to protect nature and prevent factors which may pose a threat in the future. At this point, raising public awareness is the most important step to be taken. To reduce the amount of microplastics and to minimize its effects, it is necessary to inform stakeholders to raise their awareness on the issue (Khan et al., 2017). In the literature review, we determined that field research is more intensively made, and that quantitative research methods are used more frequently. Additionally, it is necessary to note the lack of educational work on microplastic pollution. This study, which intends to compensate for the deficiency in research in this regard, aims to raise public awareness on microplastic pollution. There is a general lack of information about microplastic pollution and this should be solved by raising awareness on a global scale. The priority in raising awareness should be the younger generations. Raising their awareness can only be achieved thruhgh education. For this reason, teachers have the biggest responsibility. Through their influence on the future generations, teachers can increase their awareness on protecting the nature. Therefore this study aims to develop a valid and reliable scale to determine the awareness on microplastic pollution which is still a new concept.

2. Research Method

2.1. Research Model

In this study, screening model (descriptive, survey) was employed being one of the quantitative research methods. The screening model aims to elucidate situations that have existed or the ones that are currently at hand (Karasar, 2014, s. 77).

2.2. The Sample Group

The sample group consists of 586 participants from 4 universities who are currently enrolled in science and biology teaching programmes in Turkey. We determined that 86% (n=504) of the teacher candidates who made up the study group were women and 14% (n=14) were men.

2.3. Data Collection Tools

In this study, the "Microplastic Pollution Awareness Scale (MPAS)" was employed which was developed by the researcher.as data collection tool having passed the validity and reliability tests. MPAS has a 3-factor structure consisting of 5 negative and 9 positive items which makes a total of 14 (Appendix 1). The scale, which is of a likert characteristic, consists of ”No“ (0 Points), ”Not sure“ (1 Point) and ”Yes" (2 Points) options. The maximum score that can be obtained from the scale is determined as 28 points. The increase in the score obtained from scale is in line with the participant's awareness on microplastic pollution.

2.3.1. The Development of the Measuring Tool

To designate the items of the scale, we made a literature review scanning the national and international indexes, and we determined the expressions which could be used in the awareness scale. An item pool of 50 items was created after a synthesis of information gathered after the screening. As for the scope validity, the draft form was prepared after considering the opinions of 9 domain experts, 2 measurement and evaluation experts, and 1 Turkish educational specialist making a total of 12 experts in the field. Each item has been evaluated by experts either as "Appropriate", "Appropriate, but should be corrected" or "Inappropriate". As a result of the evaluations received from the experts, each item had a content validity ratio (CVR). CVR values were evaluated according to the criterion ranges (Güldüren, 2015, qtd. from Veneziano and Hooper) and one item that remained below its minimum value has been removed from the scale. The scale consists of 49 items as of its last update, 31 positive and 18 negative items. For the sake of reducing accidental errors, positive and negative items have been placed in the scale uniformly. The scale, which is of a likert characteristic, consists of the options ”No“, ”Not sure“ and ”Yes". In the evaluation of the scale; 0 points were given for “No”, 1 for “Not sure” and 2 points for “Yes”. The scale has been named “Microplastic Pollution Awareness Scale” and abbreviated as “MPAS”.

2.4 Data Collection

586 science and biology teacher candidates enrolled in the teaching programmes of four universities in 2019-2020 Spring semester filled the MPAS scale. The scales were distributed to teacher candidates who were asked to answer the questionnaire individually. It was requested from the teacher candidates that they do not leave any space blank. It took students approximately 20 minutes to fill the scale.

2.5 Data Analysis

The sample group was randomly split into two groups and Exploratory Factor Analysis (EFA) was applied to one group (n1=315) while Confirmatory Factor Analysis (CFA) was applied to the other group (n2=271). In order to perform EFA, the sample size must be at least 300 or more (Seçer, 2013, p. 119). In this research, 315 people identified for pre-application provide the necessary conditions for EFA. The measurement tool must be valid and reliable for scale development. Accordingly, validity and reliability analyses were carried out for the scale. Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity were used for the appropriateness of factor analysis. EFA was performed using Varimax rotation for the construct validity of the MPAS. The reliability of the scale was determined by Cronbach's alpha coefficient. Item test correlations were calculated for item validity. The factor structure determined by EFA was tested with DFA and it was seen that sufficient harmony was achieved.

3. Findings and Discussion

3.1. Validity of Research Findings

In order to perform EFA, the sample size must be at least 300 or more (Seçer, 2013, p. 119). In this research, 315 people identified for pre-application provide the necessary conditions for EFA. The KMO value of the data obtained from the pre-application was calculated to be 79. If the KMO value is between 0.60 and 0.70 it is considered mediocre, if it is between 0.70 and 0.80 it is considered good, if it is between 0.80 and 0.90 it is considered great, and if it is over 0.90 it is considered to be superb (Karagöz, 2016). According to Çokluk et al.(2014), the KMO value is considered to be miserable between 0.50-0.60, weak between 0.60-0.70, moderate between 0.70-0.80, good between 0.80-0.90 and excellent over 0.90. Şencan (2005, p. 384) and Özdamar (2017, p. 51) reported that the KMO value is adequate for factor analysis if it is over 0.50. Generally, the literature states that the KMO value should be greater than 60 (Çokluk et al., 2010, p. 207; Seçer, 2013, p. 119). According to Karagöz (2016), the CVR (Content Validity Ratio) value determinedfor MPAS is good; whereas according to Çokluk et al. (2014), it is at a moderate level which shows that the scale data are suitable for factor analysis (Büyüköztürk, 2019, p. 136; Çokluk et al., 2010, p. 207; Özdamar, 2017, p. 51; Seçer, 2013, p. 119; Şencan, 2005, p. 384). According to the analysis made, the result of Barlett's test of sphericity was found to be statistically appropriate (p=0.00). The fact that the results from Barlett's test of sphericity was p<,05 indicates that it is effective in terms of measuring the lower dimensions of the scale (Özdamar, 2017, p. 148). Drawing from these results, the data were found to be suitable for factor analysis.

Initially, drawing from the results of the EFA, it was determined that the items fell under 17 factors, and the total variance disclosure ratio of these factors was 60.37%. In this study, Varimax was chosen as one of the vertical rotation techniques. Based on the factor loading after the application of Varimax, some items have been ruled out taking into account that some were insignificant in the scale (minimum 0.40). And despite Varimax considering certain two factors significant, since they showed cyclical item characteristics because of the difference between them being below 0.10, and since the criterion of at least 3 items in a factor was not fulfilled. Şencan (2005, p. 390) states that the factor load should be a minimum of 40 for each item, but if the researcher deems it necessary, they can reduce the factor load to a minimum of 30. According to the commonly held opinions, the factor load of an item should be at least 30 (Çokluk et al., 2010, p. 194). We see that using the minimum of 0.40 as a measure to discard certain items from MPAS is in line with the criteria mentioned by Şencan (2005) and Çokluk et al. (2010). EFA was re-done after each item was discarded. The data obtained from EFA are demonstrated in Table 1.

Table 1. *Factor load values and common variance*

	Item No	Items	Factor 1*	Factor 2*	Factor 3*	Common Variance
Awareness on Preventing Microplastic Pollution	I40	In order to fight microplastic pollution, plastic packaging should be disposed of in recycling bins.	,75			,58
	I46	In order to reduce the negative effects of microplastics, alternative materials should be chosen.	,71			,54
	I43	Microplastics pose a serious threat to bio-organisms.	,65			,49
	I32	Environmental awareness can help prevent microplastic pollution.	,63			,51
	I45	Awareness should be raised to reduce plastic footprint.	,61			,46
Awareness on Preventing Microplastic Pollution	I24	Since microplastics damage living tissues, it can lead to mutations in the future.		,69		,51
	I20	Microplastics can accumulate inside many marine creatures, such as mussels, shrimp etc.		,65		,45
	I23	Microplastics that are invisible to the eye cause diseases such as cancer, since they are present in food and beverages.		,64		,48
	I22	Microplastics are a major pollutant for aquatic ecosystems.		,60		,51
	I13	Microplastics have no influence on the development of humans.		,53		,40
Awareness on the Effects of Microplastic Pollution on Human Health	I30	It is not a frightening situation since the effects of microplastics on humans are not yet fully known.			,71	,56
	I10	Microplastics do not pose a great danger as of now.			,67	,47
	I36	The effects of microplastics on organisms are insignificant, since microplastics cannot reach humans through the food chain.			,63	,52
	I35	Microplastics are not used as shelf life extender in packaging to increase the durability of food and beverages.			,63	,47
		Eigenvalue	2,65	2,22	2,07	
		Explained Variance	18,93	15,85	14,79	
		Total Explained Variance		**49,57**		

*The values under 0.40 are not shown in the figure.

When we examine Table 1, we can observe that the eigenvalues of the determined factors are respectively 2.65, 2.22 and 2.07, and that the scale follows a 3-factor structure. Factor 1 factor loads include 5 items ranging from 0.61 to 0.75, Factor 2 factor loads include 5 items ranging from 0.53 to 0.69, and Factor 3 factor loads include 4 items ranging from 0.63 to

0.71. Taking into account the criteria according to the factor load values (Bursal, 2017, p. 177)

- in factor 1, 2 items score at an excellent level (40, 46), 2 items score at a very good level (43, 32) and 1 item scores at a good (45) level.
- In terms of factor 2, 3 items score at a very good level (20, 23, 24), 1 item scores at a good level (22) and 1 item scores at a moderate (13) level.
- In terms of factor 3, 1 item scores excellent (30) and 3 items (30, 35, 36) score at a very good level.

Factor 1 makes up 18.93% of the total variance and has been named "Awareness on Preventing Microplastic Pollution". Factor 2 makes up 15.85% of the total variance and has been named "Awareness on the Effects of Microplastic Pollution on Organisms". Factor 3 makes up 14.79% of the total variance and has been named "Awareness on the Effects of Microplastic Pollution on Humans". The factors combined explain 49.57% of the total variance. The lower limit of the given variance ratio is considered to be 40% in multi-factoral structures (Karagöz, 2016). Therefore the total variance ratio meets the necessary requirements. According to the results obtained, the current scale consists of 14 items and 3 factors. According to the results obtained, the relation between the 3 determined sub-dimensions was tested and the correlation coefficients between the factors were demonstrated in Table 2.

Table 2. *The correlation coefficients between the sub-dimensions of the scale*

Sub-Dimensions	Factor 1	Factor 2	Factor 3
Awareness on Preventing Microplastic Pollution	1,00	,51*	,44*
Awareness on the Effects of Microplastic Pollution on Organisms		1,00	,40*
Awareness on the Effects of Microplastic Pollution on Human Health			1,00

*p<,01

According to the data obtained from the correlation test, it was determined that the correlation coefficients for the sub-dimensions of the scale ranged from 0.40 to 0.51 and ranged at 0.01 significantly.

According to the results of EFA, DFA was applied to the given 3-factor structure, and it was observed that the model was appropriate according to the determined Critical N (CN) value (263.43) (Byrne, 2009; p. 83). The model and standardized values obtained for the MPAS are shown in Figure 1.

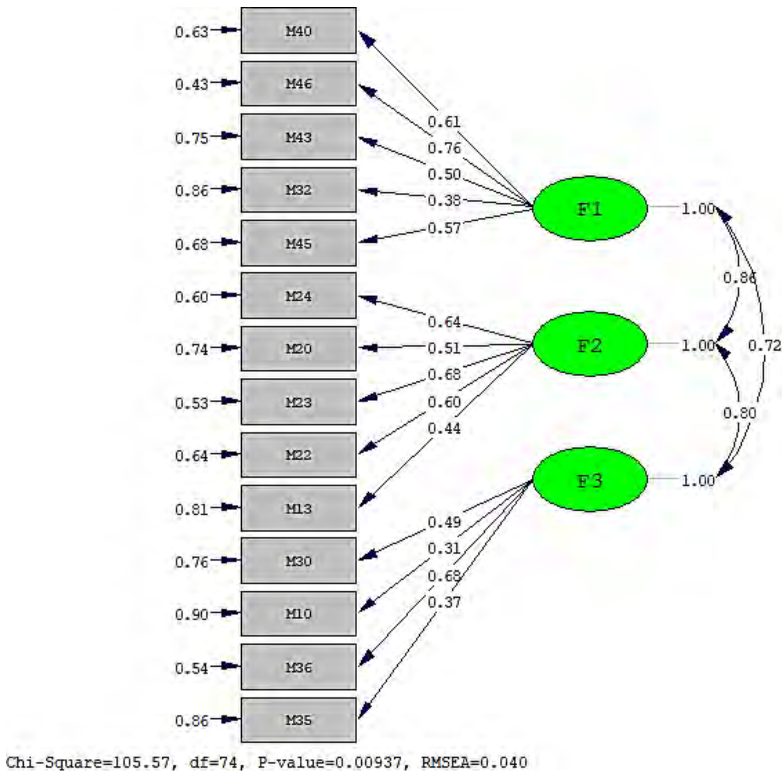

Figure 1. The path diagram for the MPAS

For model data fit, following values were examined: $\chi2$ /df (Chi-Square/Degree of Freedom), RMSEA (Root Mean Square Error of Approximation), CFI (Comparative Fit Index), GFI (Goodness of Fit Index), NFI (Normed Fit Index), SRMR (Standardized Root Mean Square Residual), NNFI (Non-Normed Fit Index) and AGFI (Adjusted Goodness of Fit Index). It was found that the ratio of the Chi-Squared ($\chi2$) value to the degree of freedom ($\chi2$ /df) was 1.42. The value determined in this model is considered excellent/superb since it is below 2 according to the criteria. The model data fit indices in the results of this analysis were determined as RMSEA=0.04 CFI=0.98, GFI=0.95, NFI=0.94, SRMR=0.04, NNFI=0.98 and AGFI=0.92. The standardized criterion value "≤0.08" for RMSEA and SRMR indicates that this value is adequate, while ≤0.05 indicates good/excellent adequacy (Browne & Cudeck, 1993; Schermelleh-Engel et al., 2003). According to the values obtained in this model, RMSEA and SRMR are in good/excellent agreement. For CFI, GFI and AGFI, the standardized criterion value "≥0.90" indicates that this value is acceptable, and ≥0.95 indicates good/excellent agreement (Hu & Bentler, 1999; Schermelleh-Engel et al., 2003). In this model, CFI and GFI fit well/perfectly, while AGFI is an acceptable fit. If the NFI value is ≥0.90, it represents acceptable agreement (Marsh & Grayson, 1995; Schumacker & Lomax, 1996). Consequently, the NFI value in this model shows acceptable agreement. The standard acceptable index value for NNFI was determined as ≥0.95 and if it is ≥0.95, the model is accepted to agree perfectly (Jöreskog & Sörbom, 1993). In this model, the NNFI value index shows a good/excellent fit. When the indices obtained after the DFA were examined, we see that the MPAS was applicable which consists of 14 items showing a good/excellent fit.

3.2. Findings on Item Analysis and Reliability

We performed reliability analyses to determine the internal consistency of the scale. Primarily, the item-total correlation and the distinctiveness of the scale were examined. After that, to determine the internal consistency of the scale concerning its reliability, the Cronbach alpha internal consistency coefficient of the scale as a whole and of its sub-dimensions were examined. The results obtained from the analyses are shown in Table 3. According to the results obtained, the overall reliability coefficient of the scale was determined as 0.81. This value shows high degree of reliability. Besides, it shows that the scale can be used safely in community surveys related to the global phenomenon of microplastic pollution, and in the formation of scientific attitudes (Özdamar, 2017, p. 112). The Cronbach alpha coefficients of the sub-dimensions of the scale were determined as 0.74 for factor 1, 0.68 for factor 2 and 0.65 for factor 3. The values determined for the sub-dimensions demonstrate that it has a high degree of reliability for factor 1 and has a adequate level of reliability for factors 2 and 3 (Özdamar, 2017, p. 112).

Table 3. *Item-total correlations of scale items and their Cronbach alpha coefficients*

Factors and Items	$\bar{X}$	S	Item-Total Correlation*	Cronbach alpha when the item is removed
Factor 1: Awareness on Preventing Microplastic Pollution (α=0.74)				
I40	1,92	,02	,55	,70
I46	1,87	,02	,54	,69
I43	1,82	,03	,49	,71
I32	1,85	,02	,53	,69
I45	1,77	,03	,50	,71
Factor 2: Awareness on the Effects of Microplastic Pollution on Organisms (α=0.68)				
I24	1,83	,02	,46	,61
I20	1,77	,02	,39	,65
I23	1,88	,02	,48	,61
I22	1,87	,02	,48	,61
I13	1,83	,03	,37	,66
Factor 3: Awareness on the Effects of Microplastic Pollution on Human Health (α=0.65)				
I30	1,70	,03	,48	,56
I10	1,51	,04	,35	,65
I36	1,68	,03	,47	,56
I35	1,43	,03	,45	,58

*: n=315

The item-total correlation being greater than 0.30 is a criterion that ensures the validity of the scale (Nunnally and Bernstein, 1994). Consequently, the total item correlation was determined to be below 0.20 and 2 items were removed from the scale. In the final case, we see that the total correlation of the items in Factor 1 ranges between (r=0.49) and (r=0.55). We observe that the total correlation of the items in factor 2 ranges between (r=0.37) and (r=0.48), and that the total correlation of the items in factor 3 ranges between (r=0.35) and (r=0.48). This shows that the validity of the items in the scale is high. Hence, the items have been determined as tools to measure the same property. To determine whether an item present in the scale distinguishes between individuals who have high levels of awareness and those who do not, end groups (an upper group of 27% and a lower group of 27%) were identified according to the total scores taken from the scale. After that, the item point averages of these groups were calculated. The upper group represents individuals who are considered to have a high level of awareness, and the lower group represents individuals who have a low or zero level of awareness. Whether the difference between the item averages of these groups was significant or not was checked by t-value test on independent groups (Table 4).

Table 4. *Item analysis for MPAS, t-values for 27% (n=85) of the lower and upper groups*

Item No		x̄	S	df*	t
40	Subgroup	1,79	,47	168	3,86**
	Supergroup	1,99	,11		
46	Subgroup	1,66	,57	168	5,25**
	Supergroup	1,99	,11		
43	Subgroup	1,45	,65	168	7,90**
	Supergroup	2,00	,00		
32	Subgroup	1,59	,62	168	5,83**
	Supergroup	1,99	,11		
45	Subgroup	1,39	,69	168	7,90**
	Supergroup	1,99	,11		
24	Subgroup	1,59	,60	168	6,29**
	Supergroup	2,00	,00		
20	Subgroup	1,60	,56	168	5,69**
	Supergroup	1,96	,19		
23	Subgroup	1,66	,52	168	6,00**
	Supergroup	2,00	,00		
22	Subgroup	1,68	,56	168	5,22**
	Supergroup	2,00	,00		
13	Subgroup	1,54	,68	168	5,97**
	Supergroup	1,99	,11		
30	Subgroup	1,26	,69	168	9,33**
	Supergroup	1,98	,15		
10	Subgroup	1,02	,71	168	11,88**
	Supergroup	1,96	,19		
36	Subgroup	1,07	,77	168	11,15**
	Supergroup	2,00	,00		
35	Subgroup	,94	,60	168	14,20**
	Supergroup	1,94	,24		

**: n=315; n1=n2=85 **: p<,00*

According to the results obtained, 1 item that was determined to have no significant difference between the upper and lower groups was removed from the scale. In the final instance, when t-values are examined, we see that the t-values of the difference between the upper and lower groups of the item scores range between 3.86 and 14.20 and that they are significant ($p<0.01$). The average scores of the items range between 0.94 and 2.00. Hence, the scale items help determine the differences between individuals, in the sense that they allow distinguishing between individuals who have higher level of awareness and from those who have lower awareness level.

After certain items were removed, all validity and reliability analyses were re-made, and the updated values were presented in all analysis tables. After all analyses were completed for MPAS, in its current case it has become a 3-factor scale consisting of 5 negative (2, 5, 7, 10, 12), and 9 positive (1, 3, 4, 6, 8, 9, 11, 13, 14) items. Items were re-numbered and sorted homogeneously (Table 5). In the last instance, Factor 1 encompasses the items numbered 1, 6, 9, 11 and 14, Factor 2 encompasses the items numbered 3, 4, 8, 12 and 13, and Factor 3 encompasses the items numbered 2, 5, 7 and 10.

Table 5. *Change made in item numbers in the final version of the MPAS*

Initial Item Number	Latest Status Item Number	Factor Number	Status
43	1	Factor 1	Positive item
35	2	Factor 3	Negative item
22	3	Factor 2	Positive item
20	4	Factor 2	Positive item
36	5	Factor 3	Negative item
40	6	Factor 1	Positive item
10	7	Factor 3	Negative item
23	8	Factor 2	Positive item
32	9	Factor 1	Positive item
30	10	Factor 3	Negative item
46	11	Factor 1	Positive item
13	12	Factor 2	Negative item
24	13	Factor 2	Positive item
45	14	Factor 1	Positive item

4. Discussion and Conclusion

Recently, with the population increase and industrialization, environmental pollution has exceeded estimations. This also brought about an increase in environmental pollution studies. Nevertheless, it was reported in a study that university students believed studies to prevent environmental pollution to be insufficient in Turkey (Karahan et al., 2017). Environmental pollution is divided into many sub-categories, such as water pollution, soil pollution, air pollution, noise pollution, light pollution, plastic pollution and microplastic pollution. Unfortunately, the awareness ratio decreases more and more with the privatization of the issue of environmental pollution. Given the current research and statistics, it is safe to state that plastic pollution poses the biggest threat regarding the future. Plastic particles that are too small to be seen, namely microplastics, are an invisible dimension of this threat. These particles, even the existence of which has just been discovered, are present all over the Earth, accumulating rapidly at certain points. Studies have shown that microplastics are present in air, water and soil, therefore organisms are exposed to microplastics in all these environments. In this regard, the number of organisms who have died because of microplastics clearly shows the layers of the microplastic danger. When we take into account the amount of microplastics found in everyday products such as water, mineral water, fruit juice, tea, salt, sugar, rice, chicken, seafood and honey, the amount of microplastics a human is exposed to annually exceeds estimations. Although there are not enough studies yet regarding this issue, current studies show that microplastics can enter many systems in an organism, and most importantly, microplastics can also be transferred from mother to the fetus through the umbilical cord. After considering that even a baby inside the placenta is exposed to microplastics, the seriousness of the situation is better understood. Therefore, it is necessary to take urgent measures for microplastic pollution, which has been declared a global issue. In this regard, necessary legal regulations should be taken, single-use plastics should be banned, plastic production should be limited, and there should be incentives and awards for recycling plastic waste. Karagözoğlu (2020) states that the sample group consisting of different professions and age groups believe the solution of environmental problems to be environmental education activities (40%), increasing state control and providing criminal sanctions (19%), and increasing NGOs and their activities (9%). It is necessary to make the necessary legal arrangements and to encourage good practices in terms of environmental protection and preventing pollution. One of the most effective steps to fight microplastic pollution is raising public awareness. In this regard, to reduce the amount of microplastics and to minimize its effects, it is necessary to inform stakeholders to raise their awareness on the issue (Khan et al., 2017). In the study conducted with a sample group consisting of 170 people, Karagözoğlu (2020) found that the most important cause of environmental problems is lack of education/ lack of sensibility (42%). The participants were asked about the environmental problems they face in the place where they live, and the most frequent answers were littering (21%), air pollution (19%) and water pollution (15%). Following is how one participant answered this question:

"*I think littering is the biggest problem we are facing. I am examining the amount of microplastics in a project I am currently working at in the Water Purifying Installation at Yozgat. The results of the measurement show that there is an excessive use of plastic in Yozgat. The majority of them are plastic bottles, toothpastes, nylon bags. Polluted waters have an adverse effect on human, plant and animal health.*"

These statements indicate that the participant in question is aware of the microplastic pollution, and the layers of this pollution owing to the project they work on. This provides an example of the limitations on the target audience of awareness on microplastic pollution. Microplastic pollution, which has come about as a concept worthy of attention only recently, is still an unknown concept for most people. However, studies have exposed several dimensions of microplastic pollution. It is now known that microplastic pollution constitutes a serious amount of environmental pollution, and if urgent measures are not taken soon, it might lead to irreversible consequences.

Teachers and teacher candidates are the anchors of education. A teacher is someone who educates not only an individual, but also the society. Therefore, a great responsibility falls upon teachers in raising public awareness. In literature review, no tool to measure the awareness on microplastic pollution has been found. Due to this deficiency in the literature, an awareness scale has been developed in this study, especially for science and biology teacher candidates that give courses on environment. MPAS, after the validity and reliability analyses have been made, has become a 3-factor scale consisting of a total of 14 items, including 5 negative, 9 positive. The contents of the items in the factors were examined, and each sub-dimension was given a name appropriate to its content. MPAS aims to measure the microplastic pollution awareness level of science and biology teacher candidates. To plan the necessary training for the candidates, it is important to determine the current awareness about microplastic pollution. Overall, we conclude that MPAS will contribute greatly to the literature, and will be a pioneer in similar studies in the future.

5. Recommendations

It is considered that the development and application of such measurement tools for different sample groups at the secondary and even elementary school levels is also important for determining the goals and route of education.

MPAS developed for this study should also be applied to different sample groups and examined for variables, and microplastic pollution education should be given to groups that are determined to have lower awareness levels.

Microplastic pollution should be included in undergraduate education curriculum and books regarding environmental pollution. To fight pollution on a global scale, education on this issue should start at a very young age. Therefore, microplastic pollution should be included not only in undergraduate curriculum, but also in primary and secondary education curricula.

References

Andrady, A. L. (2011). Microplastics in the marine environment. *Marine Pollution Bulletin, 62*(8), 1596-1605.

Betts, K. (2008). Why small plastic particles may pose a big problem in the oceans. *Environmental Science & Technology*, *42*(24), 8995.

Bravo Rebolledo, E. L., van Franeker, J. A., Jansen, O. E., & Brasseur, S. M. (2013). Plastic ingestion by harbour seals (*Phoca vitulina*) in The Netherlands. *Marine Pollution Bulletin*, *67*(1), 200-202.

Browne, M. A., Dissanayake, A., Galloway, T. S., Lowe, D. M., & Thompson, R. C. (2008). Ingested microscopic plastic translocates to the circulatory system of the mussel, *Mytilus edulis* (L.). *Environmental Science & Technology*, *42*, 5026-5031.

Browne, M. W. & Cudeck, R. (1993). Alternative ways of assessing model fit. In: Bollen,

Bursal, M. (2017). *SPSS ile temel veri analizleri*. Ankara: Anı.

Büyüköztürk, Ş. (2019). *Sosyal bilimler için veri analizi el kitabı-İstatistik, araştırma deseni SPSS uygulamaları ve yorum*. Ankara: Pegem Akademi.

Byrne, B. M. (2009). *Estructural equation modelling with AMOS*. Routledge, New York, NY: Basic Concepts, Applications and Programming.

Ceylan, B. (2017). *Atık sulardaki mikroplastik kirliliğinin incelenmesi*. Yüksek Lisans Tezi, Sakarya Üniversitesi Fen Bilimleri Enstitüsü, Sakarya.

Cole, M.,Lindeque, P., Fileman, E., Halsband, C., Goodhead, R., Moger, J., & Galloway,

Combined Effects of UV Exposure Duration and Mechanical Abrasion on Microplastic Fragmentation by Polymer Type. *Environmental Science & Technology, 51*(8), 4368-4376.

Çokluk, Ö., Şekercioğlu, G. ve Büyüköztürk, Ş. (2010). *Sosyal bilimler için çok değişkenli istatistik SPSS ve LISREL uygulamaları*. Ankara: Pegem Akademi.

Çokluk, Ö., Şekercioğlu, G., & Büyüköztürk, Ş. (2014). *Sosyal Bilimler için çok değişkenli istatistik SPSS ve LISREL uygulamaları*. Ankara: Pegem Akademi.

De Witte, B., Devriese, L., Bekaert, K., Hoffman, S., Vandermeersch, G., Cooreman, K., & Robbens, J. (2014). Quality assessment of the blue mussel (*Mytilus edulis*): Comparison between commercial and wild types. *Marine Pollution Bulletin*, *85*(1), 146-155.

Desforges, J. P., Galbraith, M., & Ross, P. S. (2015). Ingestion of microplasticsby zooplankton in the Northeast Pacific Ocean. *Archives of Environmental Contamination and Toxicology*, *69*(3), 320-330.

Dessì, C., Okoffo, E. D., O'Brien, J. W., Gallen, M., Samanipour, S., Kaserzon, S., ... & Thomas, K. V. (2021). Plastics contamination of store-bought rice. *Journal of Hazardous Materials*, 125778.

do Sul, J. A. I., Costa, M. F., Barletta, M., & Cysneiros, F. J. A. (2013). Pelagic microplastics around an archipelago of the Equatorial Atlantic. *Marine Pollution Bulletin*, *75*(1-2), 305-309.

Esenyurt Şahin, F. B., Karacan, F., & Aytan, Ü. (2018). Güneydoğu Karadeniz Rize

Sarayköy Plajında plastik kirliliği. *Aquatic Research, 1*(3), 127-135.

Fossi, M. C., Panti, C., Guerranti, C., Coppola, D., Giannetti, M., Marsili, L., & Minutoli,

Fries, E., Dekiff, J. H., Willmeyer, J., Nuelle, M. T., Ebert, M., & Remy, D. (2013). Identification of polymer types and additives in marine microplastic particles using pyrolysis-GC/MS and scanning electron microscopy. *Environmental Science: Processes & Impacts*, *15*(10), 1949-1956.

Galloway, T. S. (2015). Micro-and nano-plastics and human health. In M. Bergmann, L. Gutow & M. Klages (Eds.), *Marine anthropogenic litter* (pp. 343-366). Cham, Germany: SpringerOpen.

Greenpeace Akdeniz. (2019). *Mikroplastikten kurtul oltaya gelme. Rapor: Türkiye'deki deniz canlılarında mikroplastik kirliliği*. İstanbul: Greenpeace Akdeniz.

Güldüren, C. (2015). *Yükseköğretim kurumlarındaki öğretim elemanlarının bilgi güvenliği farkındalık düzeylerinin değerlendirilmesi*. Doktora Tezi, Ankara Üniversitesi Eğitim Bilimleri Enstitüsü, Ankara.

Gündoğdu, S. (2017). High level of micro-plastic pollution in the Iskenderun Bay NE Levantine coast of Turkey. *Ege Journal of Fisheries And Aquatic Science, 34*(4), 401-408.

Gürbüz, Ö. (2017). *Marmara Denizi mikroplastik karakterizasyonu ve dağılımı*. Yüksek Lisans Tezi, İstanbul Üniversitesi Deniz Bilimleri ve İşletmeciliği Enstitüsü, İstanbul.

He, D., Luo, Y., Lu, S., Liu, M., Song, Y., & Lei, L. (2018). Microplastics in soils: Analytical methods, pollution characteristics. *Trends in Analytical Chemistry, 109*, 163-172.

Hernandez, L. M., Xu, E. G., Larsson, H. C., Tahara, R., Maisuria, V. B., & Tufenkji, N. (2019). Plastic teabags release billions of microparticles and nanoparticles into tea. *Environmental Science & Technology*, *53*(21), 12300-12310.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 1-55.

J. (2018). Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic. *Scientific Reports*, *8*(1), 1-15.

Jayasiri, H. B., Purushothaman, C. S., & Vennila, A. (2013). Quantitative analysis of plastic debris on recreational beaches in Mumbai, India. *Marine Pollution Bulletin*, *77*(1-2), 107-112.

Jöreskog, K. G. & Sörbom, D. (1993). *Lisrel 8: Structural equation modeling with the SIMPLIS command language*. Lincolnwood, IL: Scientific Software International.

K. A. & Long, J. S. (Eds.) *Testing Structural Equation Models* (pp. 136-162). Beverly Hills, CA: Sage.

Karagöz, Y. (2016). *SPSS 23 ve AMOS 23 uygulamalı istatistiksel analizler*. Ankara: Nobel Akademik.

Karagözoğlu, N. (2020). Causes and solution proposals for environmental problems: Yozgat example. *International Journal of Geography and Geography Education (IGGE), 42*, 356-373.

Karahan, M., Görgün, B. & Oktay, A. (2017). Üniversite öğrencilerinin yeşil pazarlama ve çevre farkındalık düzeyleri: Fırat Üniversitesi örneklemi. *Fırat Üniversitesi Harput Araştırmaları Dergisi*, *4*(2), 57-76.

Karami, A., Golieskardi, A., Choo, C. K., Larat, V., Karbalaei, S., & Salamatinia, B. (2018). Microplastic and mesoplastic contamination in canned sardines and sprats. *Science of the Total Environment*, *612*, 1380-1386.

Karasar, N. (2014). *Bilimsel araştırma yöntemi*. Ankara: Seçkin.

Kedzierski, M., Lechat, B., Sire, O., Le Maguer, G., Le Tilly, V., & Bruzaud, S. (2020). Microplastic contamination of packaged meat: Occurrence and associated risks. *Food Packaging and Shelf Life*, 24, 100489.

Khan, F. R., Mayoma, B. S., Biginagwa, F. J., & Syberg, K. (2017). *Microplastics in Inland African Waters: Presence, sources, and fate.* In M. Wagnet & S. Lambert (Eds.), Freshwater Microplastics (pp. 101-124). Cham, Switzerland: Springer Nature.

Kosuth, M., Mason, S. A., & Wattenberg, E. V. (2018). Anthropogenic contamination of tap water, beer, and sea salt. *PloS One*, *13*(4), 1-18.

Kramm, J., & Völker, S. (2018). *Understanding the risks of microplastics: A social-ecological risk perspective*. In M. Wagnet & S. Lambert (Eds.), Freshwater Microplastics (pp. 223-238). Cham, Switzerland: Springer Nature.

Law, K. L., & Thompson, R. C. (2014). Microplastics in the seas. *Science, 345*(80), 144- 145. http://dx.doi.org/10.1126/science.1254065

Law, K. L., Morét-Ferguson, S., Maximenko, N. A., Proskurowski, G., Peacock, E. E., Hafner, J., & Reddy, C. M. (2010). Plastic accumulation in the North Atlantic subtropical gyre. *Science*, *329*(5996), 1185-1188.

Lebreton, L., Slat, B., Ferrari, F., Sainte-Rose, B., Aitken, J., Marthouse, R., ... & Reisser,

Lima, A. R. A., Costa, M. F., & Barletta, M. (2014). Distribution patterns of microplastics within the plankton of a tropical estuary. *Environmental Research*, *132*, 146-155.

Lindborg, V. A., Ledbetter, J. F., Walat, J. M., & Moffett, C. (2012). Plastic consumption and diet of Glaucous-winged Gulls (*Larus glaucescens*). *Marine Pollution Bulletin*, *64*(11), 2351-2356.

Lusher, A. L., Burke, A., O'Connor, I., & Officer, R. (2014). Microplastic pollution in the Northeast Atlantic Ocean: Validated and opportunistic sampling. *Marine Pollution Bulletin*, *88*(1-2), 325-333.

Lusher, A., Hernandez-Milian, G., Berrow, S., Rogan, E., & O'Connor, I. (2016). Microplastics and marine mammals: Studies from Ireland. *MICRO 2016*, *Fate and Impact of Microplastics in Marine Ecosystems*, 37.

Lusher, A., Hollman, P., & Mendoza-Hill, J. (2017). Microplastics in fisheries and aquaculture: Status of knowledge on their occurrence and implications for aquatic organisms and food safety. *FAO Fisheries and Aquaculture Technical Paper*. Rome: Food and Agriculture Organization of the United Nations.

Marsh, H. W. & Grayson, D. (1995). Latent variable models of multitrait-multimethod data. In R. Hoyle (Ed.), *Structural equation modeling: Concepts, issues and applica-tions* (pp. 177-198). Thousand Oaks, CA: Sage.

Murphy, J. (2003). *Additives for plastics handbook.* Oxford/ New York: Elsevier Advanced Technology.

Mühlschlegel, P., Hauk, A., Walter, U., & Sieber, R. (2017). Lack of evidence for microplastic contamination in honey. *Food Additives & Contaminants: Part A*, *34*(11), 1982-1989.

Nunnally, J. C., & Bernstein, I. (1994). *Psychometric theory*. New York: McGraw-Hill

Ogata, Y., Takada, H., Mizukawa, K., Hirai, H., Iwasa, S., Endo, S., ... & Thompson, R. C. (2009). International Pellet Watch: Global monitoring of persistent organic pollutants (POPs) in coastal waters. 1. Initial phase data on PCBs, DDTs, and HCHs. *Marine Pollution Bulletin*, *58*(10), 1437-1446.

Özdamar, K. (2017). *Eğitim, sağlık ve davranış bilimlerinde* ölçek *ve test geliştirme yapısal eşitlik modellemesi-IBM SPSS, IBM SPSS AMOS ve MINITAB uygulamalı*. Eskişehir: Nisan.

Peixoto, D., Pinheiro, C., Amorim, J., Oliva-Teles, L., Guilhermino, L., & Vieira, M. N. (2019). Microplastic pollution in commercial salt for human consumption: A review. *Estuarine, Coastal and Shelf Science*, *219*, 161-168.

R. (2012). Are baleen whales exposed to the threat of microplastics? A case study of the Mediterranean Fin whale (*Balaenoptera physalus*). *Marine Pollution Bulletin*, *64*, 2374-2379.

SAPEA, Science Advice for Policy by European Academies. (2019). *A scientific perspective on microplastics in nature and society*. Berlin: SAPEA.

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Test of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research-Online*, *8*(2), 23-74.

Schumacker, R. E. & Lomax, R. G. (1996). *A beginner's guide to structural equation modeling*. Mahwah, NJ: Lawrence Erlbaum Associates.

Schymanski, D., Goldbeck, C., Humpf, H. U., & Fürst, P. (2018). Analysis of microplastics in water by micro-Raman spectroscopy: release of plastic particles from different packaging into mineral water. *Water Research*, *129*, 154-162.

Seçer, İ. (2013). *SPSS ve LISREL ile pratik veri analizi-Analiz ve raporlaştırma*. Ankara: Anı.

Senathirajah, K., Attwood, S., Bhagwat, G., Carbery, M., Wilson, S., & Palanisami, T. (2021). Estimation of the mass of microplastics ingested-A pivotal first step towards human health risk assessment. *Journal of Hazardous Materials*, 404, 124004.

Setälä, O., Fleming-Lehtinen, V., & Lehtiniemi, M. (2014). Ingestion and transfer of microplastics in the planktonic food web. *Environmental Pollution*, *185*, 77-83.

Shruti, V. C., Pérez-Guevara, F., Elizalde-Martínez, I., & Kutralam-Muniasamy, G. (2020). First study of its kind on the microplastic contamination of soft drinks, cold tea and energy drinks-Future research and environmental considerations.

Science of The Total Environment, 726, 138580.

Siegfried, M., Koelmans, A. A., Besseling, E., & Kroeze, C. (2017). Export of microplastics from land to sea. A modelling approach. *Water Research, 127*, 249- 257.

Smith, M., Love, D. C., Rochman, C. M., & Neff, R. A. (2018). Microplastics in seafood and the implications for human health. *Current Environmental Health Reports*, *5*(3), 375-386.

Song, Y. K., Hong, S. H., Jang, M., Han, G. M., Jung, S. W., & Shim, W. J. (2017).

Şencan, H. (2005). *Sosyal ve davranışsal ölçümlerde güvenilirlik ve geçerlilik.* Ankara: Seçkin.

Şentürk, Y., Esensoy, F. B., Öztekin, A., & Aytan, Ü. (2020). Microplastics in bivalves in the southern Black Sea. In Ü. Aytan, M. Pogojeva & A. Simeonova (Eds.), *Marine Litter in the Black Sea* (pp. 303-313). Istanbul, Turkey: Turkish Marine Research Foundation (TUDAV) Publication.

T. S. (2013). Microplastic ingestion by zooplankton. *Environmental Science & Technology*, *47*(12), 6646-6655.

Talsness, C. E., Andrade, A. J., Kuriyama, S. N., Taylor, J. A., & Vom Saal, F. S. (2009). Components of plastic: Experimental studies in animals and relevance for human health. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1526), 2079-2096.

Tang, G., Liu, M., Zhou, Q., He, H., Chen, K., Zhang, H., …. Cai, M. (2018). Microplastics and polycyclic aromatic hydrocarbons (PAHs) in Xiamen coastal areas: Implications for anthropogenic impacts. *Science of the Total Environment, 634*, 811-820.

Teuten, E. L., Rowland, S. J., Galloway, T. S., & Thompson, R. C. (2007). Potential for plastics to transport hydrophobic contaminants. *Environmental Science & Technology*, *41*, 7759-7764.

Tourinho, P. S., Ivar do Sul, J. A., & Fillmann, G. (2010). Is marine debris ingestion still a problem for the coastal marine biota of southern Brazil?. *Marine Pollution Bulletin*, *60*(3), 396-401.

Van Cauwenberghe, L., & Janssen, C. R. (2014). Microplastics in bivalves cultured for human consumption. *Environmental Pollution*, *193*, 65-70.

Vianello, A., Boldrin, A., Guerriero, P., Moschino, V., Rella, R., Sturaro, A., & Da Ros, L. (2013). Microplastic particles in sediments of Lagoon of Venice, Italy: First observations on occurrence, spatial patterns and identification. *Estuarine, Coastal and Shelf Science*, *130*, 54-61.

Vişne, A., & Bat, L. (2015). Deniz çöplerinin değerlendirilmesi üzerine deniz stratejisi çerçeve direktifi ve Karadeniz'deki mevcut durum. *Journal of Aquaculture Engineering and Fisheries Research, 1*(3), 104-115.

Waters, C. N., Zalasiewicz, J., Summerhayes, C., Barnosky, A. D., Poirier, C., Gałuszka, A., ... & Wolfe, A. P. (2016). The Anthropocene is functionally and stratigraphically distinct from the Holocene. *Science, 351*(6269).

Watkins, L., McGrattan, S., Sullivan, P. J., & Walter, M. T. (2019). The effect of dams on river transport of microplastic pollution. *Science of the Total Environment, 664*, 834-840.

Yurtsever, M., Ünlü, Y. S., Yılmaz, M., & Kartal, A. H. (2017). *İç ve dış ortam havasındaki mikroplastikler'in incelenmesi: Bir Kampüs Örneği*. 13. Ulusal Tesisat Mühendisliği Kongresi'nde sunulmuş bildiri, Sakarya Üniversitesi, Sakarya.

Zhou, X. J., Wang, J., Li, H. Y., Zhang, H. M., & Zhang, D. L. (2021). Microplastic pollution of bottled water in China. *Journal of Water Process Engineering*, 40, 101884.

Appendix 1. Micro-plastic Pollution Awareness Scale (MPAS)

Mikroplastik Kirliliği Farkındalık Ölçeği	**Evet**	**Fikrim Yok**	**Hayır**
1. Mikroplastikler canlıların yaşamı için ciddi bir tehdit oluşturmaktadır.			
2. Yiyecek ve içeceklerin dayanıklılığını arttırmak ve raf ömrünü uzatmak için kullanılan ambalajlarda (kompozit) mikroplastik **bulunmaz**.			
3. Mikroplastikler, sucul ekosistemler için önemli bir kirleticidir.			
4. Midye, karides gibi birçok deniz canlısı mikroplastikleri bünyelerinde biriktirirebilir.			
5. Besin zinciri ile insanlara kadar ulaşması mümkün olmayan mikroplastiklerin, canlılar üzerindeki etkileri önemsizdir.			
6. Mikroplastik kirliliği ile mücadele için plastik ambalajlar geri dönüşüm kutularına atılmalıdır.			
7. Mikroplastik kirliliği henüz ciddi tehlikeler **oluşturmamaktadır**.			
8. Gözle görülemeyecek boyuttaki mikroplastikler, yiyecek ve içeceklerde bulunabildiği için kanser gibi hastalıklara neden olur.			
9. Mikroplastik kirliliği, çevre bilincinin kazanılması ile önlenebilir.			
10. Mikroplastiklerin insan sağlığı üzerindeki etkisi henüz bilinmediği için korkulması gereken bir durum **yoktur**.			
11. Mikroplastiğin olumsuz etkilerinin azaltılması için plastiğin yerine kullanılabilecek alternatif malzemeler tercih edilmelidir			
12. Mikroplastiklerin insanların gelişimi üzerinde etkisi **yoktur**.			
13. Mikroplastikler canlı dokulara zarar verdiği için gelecekte çeşitli mutasyonlara yol açabilir.			
14. Plastik ayak izinin azaltılmasına yönelik bilinçlendirme yapılmalıdır.			