



SLOVAKIAN AND TURKISH STUDENTS' FEAR, DISGUST AND PERCEIVED DANGER OF INVERTEBRATES

SLOVAK VE TÜRK ÖĞRENCİLERİNİN OMURGASIZ HAYVANLARA İLİŞKİN ALGILANAN TEHLİKE, KORKU VE NEFRETLERİ

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ABSTRACT: Human perceives invertebrates less positively than vertebrates because they are small and behaviourally and morphologically unfamiliar. This cross-cultural research focused on Slovakian (n=150) and Turkish (n=164) students' fear, disgust and perceived danger regarding 25 invertebrates [including 5 disease relevant adult insects, 5 ectoparasites, 5 endoparasites, 5 disease irrelevant adult insects and 5 insect larvae/earthworm]. A subsample of Slovakian children was asked for taxonomic identification of these animals. It was found that Turkish students rated higher in all three dimensions fear, disgust and dangerousness, compared with Slovakian students. Gender difference favouring higher score of females were found only among Slovakian students and these differences were observed for potentially harmful animals. This implies that females were able to distinguish between more and less dangerous animals. It was neither detected any effects of owning animals on students' ratings, nor found any correlation between identification skills and rating scores.

Key words: invertebrates, perceived danger, disgust, fear, biology education

ÖZET: İnsanoğlu omurgasız hayvanları omurgalı hayvanlara göre daha az olumlu algılamaktadır. Çünkü bu hayvanlar davranış ve morfolojik yapı olarak çok alışılmamışlardır. Bu kültürlerarası çalışma Slovak (n=150) ve Türk (n=164) öğrencilerin 25 omurgasız canlı ile ilgili algılanan tehlike, korku ve nefretlerini araştırmaktadır. Türk öğrencilerden farklı olarak, Slovak öğrencilere bu canlıların sınıflandırmaları üzerine sorular sorulmuştur. Slovak öğrencileri ile karşılaştırıldığında, Türk öğrencileri daha yüksek düzeyde korku, nefret ve tehlike algısına sahiptirler. Kızlar lehine cinsiyet farkı sadece Slovak öğrenciler arasında ve potansiyel olarak tehlikeli olan canlılar için gözlemlenmiştir. Bu durum kız öğrencilerin tehlikeli hayvanları az veya çok ayırt edemediğini göstermiştir. Herhangi bir ev hayvanına sahip olma ile öğrencilerin görüşleri arasında bir ilişki bulunamamıştır. Ayrıca, sınıflandırma becerileri ile öğrencilerin görüşleri arasında da bir ilişki bulunamamıştır.

Anahtar Kelimeler: omurgasız hayvanlar, algılanan tehlike, nefret, korku, biyoloji eğitimi

1. INTRODUCTION

Culture is defined as sets of practises, ideas, values, inventions, artifacts and attitudes that characterize groups of people (Gangestad, Haselton & Buss, 2006; Jeronen, Jeronen & Raustia, 2009). Many specific cross-cultural differences are correlated with attitude and associated with meteorological, as well as economic variables (e.g., Cohen 2001; Van de Vliert, 2009; Preczewski, Mittler & Tillotson, 2009). Current research, however, has revealed that environments with high pathogen prevalence favour xenophobia (negative attitudes toward others) and ethnocentrism (positive attitudes toward one's own cultural in-group) (Schaller & Murray, 2008). It is assumed that cross-cultural differences in personality, such as extraversion and openness to experience (e.g. Schaller & Murray, 2008), or differences in religion diversity (Fincher & Thornhill, 2008) arise as a response to evolutionary selective pressures, especially pathogen prevalence.

According to this theory, personality traits should be different especially in zones with different pathogen threat. Tropical zones in which pathogen prevalence is higher than in temperate zones (e.g. Guernier et al., 2004), should point to higher avoidance of objects or subjects that possess pathogen threat. The same can be applied to animals that serve as vectors of infectious diseases and/or on animals that pose risk of injury or death. For example, black South African children living in environment with high number of spider species that are historically perceived dangerous by people

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(e.g. Davey, 1994), have greater fear of spiders than Slovakian children historically living in 'safe' environment with fewer spider species (Prokop et al., 2010b).

Although research on affective domain has been long neglected in the science education literature (Alsop & Watts, 2003), there are several arguments why children's emotions deserve greater attention from the humane education perspective. First, children's cognitive domain in their perception of animals, as inseparable part of humane education, is preceded as changes in affective and emotional variables (6 – 9 years of age) (Kellert 1985). There is therefore a serious possibility that children attitudes toward animals would be influenced by their early experiences with them. Martín-López, Montes and Benayas (2007), for example, found that people's willingness to financially support nature protection programmes was influenced by their attitudes toward animals. They provided less financial supported for less popular animals (like snakes). Therefore, emotional involvement in animals that is developed during schooling age seems to be crucial determinant of human behaviour towards animals and their protection. Second, the literature revealed that children's emotions and feelings influence their academic achievement in biology education (Morgan, 1992; Randler, Ilg, & Cern, 2005;). This means that learning outcomes regarding animals are significantly influenced by their "like" or "dislike" of a given animal (Randler et al., 2005; Dervisoglu, Menzel, Soran & Boegeholz, 2009). Supporting to this idea, Prokop and colleagues found that the correlation between attitude toward and knowledge on animals were observed more strongly when the animal poses lower risk of danger. For example, correlation between attitudes and knowledge regarding birds and bats (Prokop, Kubiátko & Fančovičová, 2008; Prokop, Fančovičová, & Kubiátko 2009a) was stronger than correlation between attitudes and knowledge of spiders or snakes (Prokop & Tunnicliffe 2008; Prokop, Özel, & Usak 2009b) that are generally considered more dangerous. In addition, correlation between these variables was less among South African children compared to Slovakian children, in whom the risk of being seriously injured by the spider is lower (Prokop et al., 2010b).

In the present study, schoolmate children's emotional (fear and disgust) and cognitive (perceived danger) responses on various invertebrates within two countries laying in different geographical zones: Slovakia (temperate zone) and Turkey (Mediterranean zone), were examined. Invertebrates were chosen as target animals, because human dislike them more than vertebrates, most probably because they are small and behaviourally and morphologically unfamiliar to humans (Davey, 1994; Kellert, 1993; Wilson, 1987). We therefore assume that these animals deserve greater attention. Slovakia and Turkey were chosen because historical records reveal that Turkey poses more parasitic diseases than Slovakia (Murray and Schaller, 2010), thus differences within children emotions are expected. Furthermore, how children's fear, disgust and perceived danger differ with regard to gender and owning animals is also investigated. This is because females typically express greater fear of (unpopular) animals than boys (Bjerke et al., 2003; Gerdes, Uhl & Alpers, 2009; Prokop et al., 2009 a, b), and having animals at home was found to be associated with more positive attitudes toward them (Prokop et al., 2009b; Prokop & Tunnicliffe, 2010). It is suggested that gender differences can be explained by higher investments of females in protecting the next generation (Fessler & Navarrete, 2003; Curtis et al., 2004). Finally we examined participants' abilities to identify invertebrates, because our current knowledge in this field is concerned mostly on vertebrates (Randler, 2008; Prokop & Rodák, 2009), but little is known about children abilities to identify invertebrates. Moreover, the role of insects in ecosystems is typically unprized and misunderstood by children (Strommen, 1995; Snaddon et al., 2008). Since knowledge on invertebrates is associated with attitudes toward them (Kellert, 1993), it is assumed that more knowledgeable children will have more positive attitudes toward invertebrates. The following predictions are investigated;

1. Turkish children have greater fear, disgust and perceived danger of invertebrates than Slovakian children,
2. Males demonstrate lower fear, disgust and perceived danger of invertebrates compared with females,
3. Gender difference is most pronounced in responses to potentially more dangerous animals (like vectors of infectious diseases),
4. Animal owners show lower fear, disgust and perceived danger of invertebrates compared with non-animal owners, and

5. Abilities to identify invertebrates is negatively related with children's fear, disgust and perceived danger.

2. METHOD

2.1. Sample

The sample of the study consisted elementary schools in both Turkey and Slovakia (85 females and 65 males from Slovakia and 72 females and 92 males from Turkey). Selection of participants was not intentional, but was based on teachers' willingness to participate on the research in accessible schools ($n=4$) in which the authors had personal contacts with directors. If the teacher agreed, the questionnaire was administered to all participants in selected classes irrespective of the participants' attitudes towards animals.

Participants were required to respond to four personal information; namely, (1) their age/grade, (2) gender, (3) whether they had pets (or farm animals), and, (4) if yes, what kind of animal they had as pets (or farm animals).

2.2. Measuring the Level of Disgust, Fear and Perceived Danger

25 coloured pictures were presented to the participants in lecture halls (see Fig. 2 for full list of species) in a similar way of what Gerdes et al. (2009) did. The first three groups of animals were harmful to human and the latter two groups served as controls. Disease irrelevant adult insects were control for disease relevant adult insects and ectoparasites, and insect larvae/earthworm were control for endoparasites. Picture sizes were adjusted to a standard body length of the selected animals. Pictures had similar contrast and brightness. The pictures were presented in random order. Each picture was presented for about 1 min. During this time, for each picture presented, participants were required to rate fear, disgust and how dangerous they thought the animal was in nature, each on a 5 point scale (1 = not at all, 5 = extremely dangerous/disgusting). Reliability of children responses were observed to be quite consistent Cronbach's alpha (α) reliability coefficient of pooled data from both countries were found 0.94 (Fear), 0.90 (Disgust) and 0.94 (Perceived Danger), respectively (Prokop et al., 2010a).

2.3. Measuring of Children Abilities to Identify Invertebrates

After students' rating of fear, disgust and danger regarding presented animals was measured, a subsample of Slovakian children (61 females and 41 males) was presented all pictures in a similar manner again and asked for identification (taxonomic classification) of each animal. However, the same procedure was not performed with a sub-sample of Turkish students since this procedure required extra research skills, extra consent from both school and parents, and time. Obtained data from sub-sample of Slovakian children were then binomially coded as correct (score 1) or incorrect (score 0).

3. RESULTS

3.1. Effects of Country and Gender on Children's Fear, Disgust and Perceived Danger

Overall mean scores for each participant's fear, disgust and perceived danger were defined as dependent variables whereas country and gender as independent variables. Both of these independent variables showed significant effects on children rating scores (country: Wilk's $\lambda = 0.20$, $F(3,308) = 402.99$, $p < 0.001$, partial $\eta^2 = 0.79$; gender: $\lambda = 0.82$, $F(6,616) = 10.92$, $p < 0.001$, partial $\eta^2 = 0.10$). All these differences were also observed significant when individual univariate results for each factor were inspected. As illustrated in Figure 1, this result indicated that Turkish children showed greater fear of animals. They rated these animals as more dangerous and more disgusting. After comparing mean scores of each of 25 animals in all three dimensions, it was found that only three animals (the grasshopper, ladybird beetle and the damselfly) consistently showed the mean score lower than 3.0 (referring to positive rating) among Turkish children. On the other hand, the mean score lower than 3.0 was found for 8 – 13 animals in all three dimensions among Slovakian children. Except for the three animals reported by Turkish children, Slovakian children positively rated also housefly, meatfly, earthworm, butterfly, and rhinoceros beetle. These animals were positively rated in all three

dimensions. In contrast, Medina worm, tapeworm, lice and tick scored highest in all three dimensions among Slovakian children. Among Turkish students, tick, Medina worm and flea scored highest in perceived danger, swallowtail, butterfly larvae and leech scored highest in disgust and tick, tapeworm and earthworm scored highest in fear.

Females scored higher than males for all three dimensions. However, male-female difference was significant for only Slovakian children.

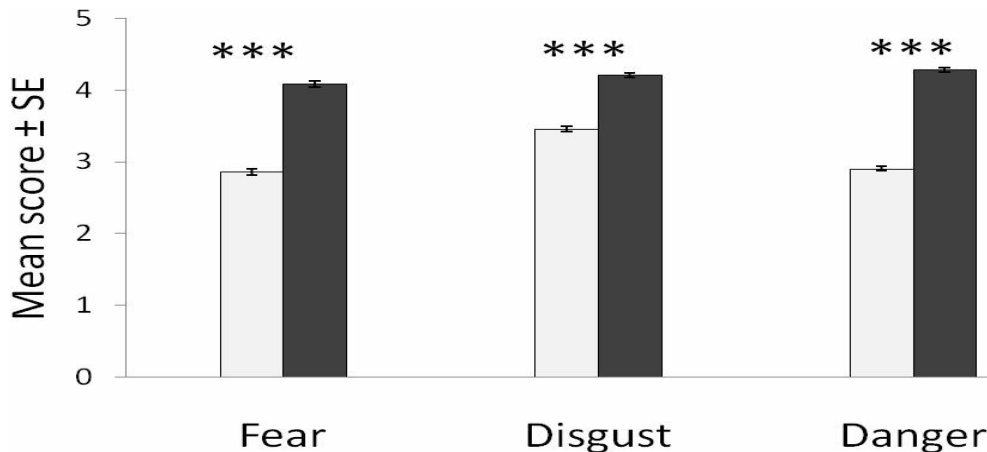


Figure 1. Mean rating scores of fear, disgust and perceived danger of 25 animals in Slovakia (open bars) and Turkey (grey bars). Asterisks (***) mean that differences between Turkish and Slovakian children are statistically significant at $p < 0.001$.

3.2. Effect of Owning Animals on Children's Fear, Disgust and Perceived Danger

Owning any kind of animals had no significant effect on mean score of fear, disgust and perceived danger in neither country (Slovakia: Wilk's $\lambda = 0.98$, $F(6,290) = 0.54$, $p = 0.77$, partial $\eta^2 = 0.01$); Turkey: Wilk's $\lambda = 0.96$, $F(3,160) = 1.86$, $p = 0.14$, partial $\eta^2 = 0.04$). Notably, Turkish children reported having more animals than Slovakian children (mean $\pm$ SE: 2.87 ± 0.11 vs. 1.46 ± 0.11 , respectively, $t(312) = 9.20$, $p < 0.001$). Main quantitative differences in owning pets were found in the distribution of typical farm animals and pets between two countries. While 47 % ($n=224$ out of 474) of reported animals in Turkey were typical farm animals like horses, pigeons or hens, 87 % ($n=189$ out of 217) of animals reported by Slovakian children were typical pets like dogs, cats, fish or tortoises. This difference was statistically significant (Chi-square test, $\chi^2(1) = 72.82$, $p < 0.001$).

3.3. Gender Difference

As noted above, no gender difference was observed within Turkish children's ratings for all three dimensions. Detailed analysis of means of each animal as a result of series of independent t-tests supported above mentioned findings. Slovakian participants showed, however, great variability in perception of 25 animals. In the category of fear, ratings of 16/25 animals were significantly different between males and females in favor of females. After categorising animals into five animal groups (ecto and endoparasites, disease relevant and irrelevant adult insects, and insect larvae) and comparing frequency of distribution of significant and insignificant animals with respect to gender, no difference was found (Pearson Chi-square test, $\chi^2(4) = 7.64$, $p = 0.11$). However, insect larvae resemble to worm-like parasites and children do not distinguish between disease-irrelevant larvae and parasites (Prokop et al., 2010a; Prokop & Fančovičová, 2010). Thus, after pooling data from three disease relevant groups of invertebrates and insect larvae and comparing them against disease irrelevant adult insects, gender difference were found in 15/20 animals from the former group, but only in 1 of 5 animals of the latter group. The difference was significant (Fisher exact test, $p = 0.04$). The same method resulted in identical result for the category of Disgust (15/20 vs. 1/5, $p = 0.04$). In summary, females showed greater fear and disgust of animals that possess disease threat or look like these

animals. Very similar, but non-significant trend, was found for the category of perceived Danger where 11/20 animals of the former group of animals showed significant gender difference. The same was true again only for 1/5 of animals in the latter group (Fisher exact test, $p = 0.32$).

3.4. Identification of Invertebrates

As shown in Figure 2, taxonomic identification of about half of invertebrate species was correctly done by more than half of Slovakian children. Overall mean success with identifying invertebrates was low ($M = 0.51$, $SE = 0.009$), insignificantly different with respect to gender (U -test, $U = 1044.0$, $p = 0.16$). There was no correlation between mean identification success and mean score of fear, disgust or perceived danger (partial correlations controlled for effect of gender ranged -0.04 - 0.1 , all p 's > 0.32).

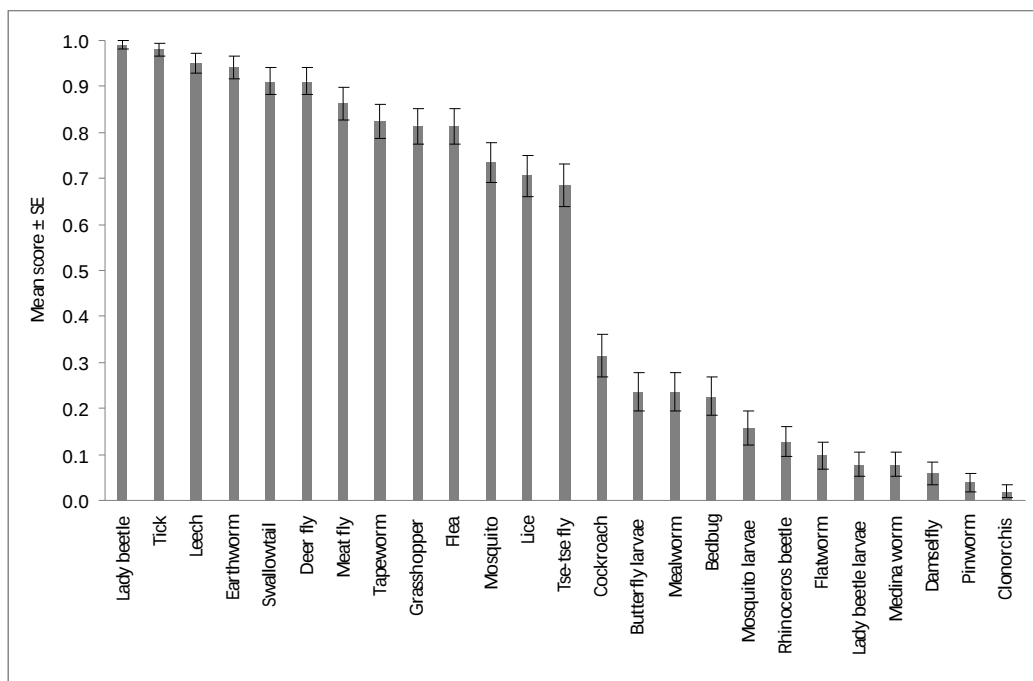


Figure 2. Slovakian children ($n = 102$) success at identification of various invertebrates.

4. DISCUSSION

This study revealed that culture (79% of total variance of results) and gender (10% of total variance of results) together play crucially important role in children emotional (fear and disgust) and cognitive (perceived danger) responses on various invertebrates to large extend. The high level cultural effect on students emotional and cognitive perception could be due to differences in school curricula, information sources, science textbooks, human-made environment, media (visual and written) and direct experience in the natural environment. Three out of five predictions were supported.

The first prediction that received strong empirical support in this study predicted that Turkish children would have greater fear, disgust and perceived danger of various invertebrates than Slovakian children. Because pathogen prevalence is higher in Turkey (Prokop et al., 2010a), this supports that human personality is influenced by pathogen threat (e.g. Schaller & Duncan, 2007, Schaller & Murray, 2008) and/or that attitudes toward animals are mediated by the presence of potentially dangerous animals in a given country (Prokop et al., 2010b). This finding provides new insight for humane education theories and practise. Formal as well as non-formal humane education strategies focused on improving children interest in animals (see e.g., Žoldošová & Prokop, 2007), must take into account cultural differences and the presence of specific animals in a given country (Prokop et al., 2010). Especially, planning activities with disease-relevant invertebrates and, larvae that resembling to parasitic worms, should be designed according to the status of these animals in particular country. For

example, children's perception of mosquitoes that do not pose serious disease threat in temperate zone may be very different in zones (especially tropical) with the prevalence of malaria or filariae, because mosquitoes are major vectors of these serious diseases (Sachs & Malaney, 2002).

The second and third predictions focused on gender differences in perception of invertebrates. Females scored higher than males, which mean that females had greater fear of invertebrates than males did. This difference was more explicit in emotional dimensions (fear and disgust), while the difference was not significant in cognitive dimension (perceived danger). This suggests that females are more cautious than males and that females' avoidance of animals is not generalised, but directed toward animals that are really harmful to humans. Notably, gender difference was only found among Slovakian children, probably because ratings were generally high among Turkish children. These results indirectly support the notion that males prefer wild animals (Lindemann – Matthies, 2005) and less popular animals compared to females (Prokop et al., 2009a,b, 2010b; Snaddon & Turner, 2007). These finding imply that females should receive special attention by science teachers during practical works with animals. Two research studies demonstrated that males' and females' knowledge and interest in less popular animals such as amphibians or spiders merge after participation in outdoor ecological programmes (Randler et al., 2005, Prokop et al., 2007), but little is known whether such programmes influence emotional perception (such as fear and disgust) of controversial animals. Future research in this area is needed in order to reveal students' fear and disgust of such animals.

The fourth and fifth predictions dealt with the effect of owning animals, and children abilities to identify them, on perception of invertebrates. The former hypothesis was failed despite the fact that owning animals was previously found to be associated with more positive attitudes toward animals (Prokop et al., 2009b). There are at least two explanations for this phenomenon. First, previous researches of Prokop and colleagues was either focused mainly on vertebrates or used different methods for identifying attitudes toward animals (mostly with cognitive items). These results should not be therefore considered as opposite. Second, one proposed way of how owning animals could influence people's attitudes toward wild animals, is transformation and generalization of people's experiences and involvement to other animals (Prokop et al., 2009b). However, schooling children only rarely (Prokop et al., 2008), or never (this study) reported owning any invertebrates. Considering that the level of human empathies toward animals increases with phylogenetical relatedness between human and an animal (Herzog & Burgardt, 1988), the "generalization of the experiences" can hardly be applied. The explanation why the latter hypothesis was not supported is somewhat harder because it was assumed that knowledge of invertebrates correlate with attitudes toward them (Kellert, 1993). It would be suggested that children were simply unable to identify invertebrates (overall mean score was low), thus poor knowledge is responsible for this result. However, some animals like damselfly were poorly identified, but received low score (i.e., were perceived positively) in terms of fear, disgust or perceived danger. Another animals like ticks were notoriously well known, but perceived negatively. Overall, children correctly identified mainly invertebrates typically presented in media (see also Snaddon & Turner, 2007). Further, in-depth research examining other aspects of children knowledge of invertebrates is necessary.

5. CONCLUSION AND FUTURE RESEARCH

Even though invertebrates are inseparable parts of ecosystems and science/biology teaching, their appreciation is generally low, but, as it is showed in the present study, this heavily depends on culture and gender. Making worms or parasites more attractive to children is, without doubt, hard task, thus further research examining whether, for example, children's participation in outdoor programmes focusing on invertebrates in various countries are effective is needed. It is questionable and needed to investigate why having pets in Turkey is much less popular than in Slovakia, and whether keeping invertebrates in classrooms could improve children attitudes toward them. Our results showed that Slovakian children had poor abilities with identifying invertebrates and, it is questionable what they know about their importance in nature or about life cycles (see Shepardson, 2002). Parasites are historically (also among biologists) viewed as "bad side" of animal kingdom, but this view has recently dramatically changed among biologists. Unique life histories of parasites, their abilities to manipulate with host physiology and behaviour should be taught from modern point of view, despite

our innate aversion toward them. How science teachers perceive and present parasites to children, and how children understand the life cycles of parasites, remains to be studied. Finally, we need more details about how children's emotions influence learning outcomes in biology. Both experimental and correlational studies along with qualitative inquiry in this field are required to obtain in depth insight and understanding about students' emotional and cognitive perceptions.

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Genişletilmiş Özet

Fen eğitimi alanında duyuşsal alana yönelik araştırmalar uzun süredir ihmal edilmesine rağmen, çocukların fen konularına yönelik tutum ve duygularının belirlenmesine yönelik çalışmalar insan eğitimi açısından ihtiyaç duyulduğunu gösteren birçok tartışma yer almaktadır. Örneğin, çocukların hayvanlar ile ilgili algılarına yönelik bilişsel alan yeterlilikleri onların duyuş ve duygularındaki değişikliklerden sonra gelişmektedir. Sonuç olarak, çocukların hayvanlara yönelik tutumlarını onların erken yaşlardaki deneyimlerini etkileyen birçok araştırma bulunmaktadır. Martín-López, Montes ve Benayas (2007) bireylerin hayvanlara yönelik programları destekleme konusunda gönüllü olmaları onların olumlu tutumlarından etkilenmektedir. Dolayısı ile bireylerin okul çağındayken hayvanlara yönelik göstermiş oldukları duygusal yönelimleri, hayvanlar ve onların korunmasına yönelik davranış geliştirilmesinde önemli bir yere sahiptir. Bunların yanında, biyoloji eğitimine yönelik alan yazın, çocukların duyuş ve hislerinin onların biyoloji başarılarını olumlu yönde etkilediğini göstermektedir (örn. Prokop, Kubiátko & Fančovičová, 2008; Prokop, Fančovičová, & Kubiátko 2009a). Örneğin öğrencilerin hayvanlar ile ilgili konulardaki bilgi ve kazanımları onların ilgili hayvana yönelik gösterdikleri sevgi ve nefretten etkilenmektedir. Alan yazında bu durumu destekleyen birçok bulgu yer almaktadır. Örneğin, kuşlar ve yarasalara yönelik bilgi ve tutum arasındaki korelasyon, daha tehlikeli olarak kabul edilen örümcek ve yılanlara yönelik bilgi ve tutum arasındaki korelasyondan daha yüksektir.

Buradaki çalışmada, iki farklı coğrafik bölgede yaşayan (Slovakya ve Türkiye) okul çağındaki çocukların çeşitli omurgasız hayvanlara yönelik duyuşsal (korku ve nefret) ve bilişsel (algılanan tehlike) tepkileri belirlenmeye çalışılmıştır. Araştırmada, omurgasız hayvanlar hedef canlı grubu olarak seçilmiştir ve aşağıdaki varsayımlar test edilmiştir;

- (1) Türk öğrenciler, Slovak öğrencilere göre, omurgasız hayvanlarla ilgili daha çok korku, nefret ve algılanan tehlikeye sahiptir.
- (2) Erkek öğrenciler, omurgasız hayvanlar ile ilgili daha az korku, nefret ve algılanan tehlikeye sahiptir.
- (3) Cinsiyet farklılığı, potansiyel olarak daha çok tehlikeli olan hayvanlarda daha çok görülecektir.
- (4) Herhangi bir hayvana sahip olan öğrenciler, omurgasız hayvanlar ile ilgili daha düşük korku, nefret ve algılanan tehlike duymaktadırlar göstermektedir.
- (5) Öğrencilerin omurgasız hayvanları sınıflandırma / tanımlama yetenekleri, onların korku, nefret ve tehlike algıları ile ters orantılıdır.

Çalışmanın örneklemini 150 Slovak ve 164 Türk ilköğretim okulu öğrencileri oluşturmaktadır. Öğrencilerin yaş ortalaması 11.79'dur. Yaş ortalaması açısından iki ülke öğrencileri arasında anlamlı

bir fark yoktur (Mann-Whitney U-test, $U = 10968.50$, $p = 0.10$). Öğrencilerin omurgasız hayvanlar ile ilgili nefret, korku ve algılanan tehlike düzeylerini belirlemek için üzerinde böcek, böcek larvaları ve solucan resminin olduğu 25 renkli resim kartı hazırlanmıştır. İlk üç gruptaki böcekler insana zararlı böcekler, son iki gruptaki böcekler, böcek larvaları ve solucanlar ise kontrol grubu olarak seçilmiştir. Her bir öğrenciden kendilerine verilen resimlerdeki böcekler ile ilgili korku, nefret ve doğal yaşamdaki tehlike durumlarını 5 li likert üzerinden puanlamaları istenmiştir (1 hiç korku verici, nefret verici ve tehlikeli değil – 5 son derece korku verici, nefret verici ve tehlikeli). Öğrencilerden elde edilen sonuçlar arasındaki tutarlılığı test etmek için iki ülke öğrencilerinden elde edilen veriler birleştirilmiş ve güvenilirlik analizi yapılmıştır. Cronbach's alfa değeri "Korku" boyutu için .94, "Nefret" boyutu için .90 ve "Algılanan Tehlike" boyutu için .94 olarak bulunmuştur. Öğrencilerin resimlerde yer alan omurgasız hayvanları tanımlama becerilerini test etmek için, hazırlanan böcek, böcek larvası ve solucan resimleri öğrencilere ilk uygulamadakine benzer şekilde gösterilmiş ve öğrencilerden bu resimleri temel bazı özelliklere göre sınıflandırılması istenmiştir.

Öğrencilerin her bir boyuttan (korku, nefret ve algılanan tehlike) almış oldukları toplam puanlar bağımlı değişken, cinsiyet ve ülke değişkeni ise bağımsız değişken olarak tanımlanarak iki yönlü çok değişkenli (2X2 MANOVA) varyans analizi gerçekleştirilmiştir. Bu analiz sonrasında cinsiyet ve ülke değişkeninin öğrencilerin seçilen omurgasız hayvanlar ile ilgili korku, nefret ve algılanan tehlike değişkenleri üzerine istatistiksel anlamlı fark gözlemlenmiştir (ülke: Wilk's $\lambda = 0.20$, $F(3,308) = 402.99$, $p < 0.001$, kısmi $\eta^2 = 0.79$; cinsiyet: $\lambda = 0.82$, $F(6,616) = 10.92$, $p < 0.001$, kısmi $\eta^2 = 0.10$). Türk öğrenciler seçilen omurgasız hayvanlar yönelik daha fazla korku göstermekte ve bu hayvanları daha fazla tehlikeli ve nefret verici bulmaktadırlar. Kızlar ile erkek öğrenciler arasındaki fark sadece Slovak öğrenciler arasında anlamlıdır ve kızlar lehinedir. Ancak anlamlı fark sadece korku ve nefret boyutlarında gözlemlenmiştir.

Herhangi bir hayvana sahip (evcil veya yabani) olmanın öğrencilerin korku, nefret ve algılanan tehlike durumlarına istatistiksel olarak anlamlı bir katkısı yoktur (Slovakya: Wilk's $\lambda = 0.98$, $F(6,290) = 0.54$, $p = 0.77$; Türkiye: Wilk's $\lambda = 0.96$, $F(3,160) = 1.86$, $p = 0.14$).

Seçilen omurgasız hayvanlardan yaklaşık olarak yarısı Slovak öğrenciler tarafından doğru olarak tanımlanmış ve sınıflandırılmıştır. Omurgasız hayvanların sınıflandırılmasında cinsiyet açısından herhangi bir anlamlı fark gözlemlenmemiştir (U-test, $U = 1044.0$, $p = 0.16$).

Bu araştırma kültür ve cinsiyetin birlikte, çocukların omurgasız hayvanlar ile ilgili duyuşsal ve bilişsel tepkilerini önemli oranda açıklayabileceğini ortaya koymaktadır. Kültürün, öğrencilerin duyuşsal ve bilişsel tepkilerine anlamlı etkisinin nedeni okul programlarındaki, bilgi kaynaklarındaki, fen ders kitaplarındaki, insan yapımı çevredeki, medyadaki ve doğal çevrede yaşanan direkt deneyimlerdeki farklılıklar olabilir.

Kız öğrenciler erkek öğrencilere göre seçilen omurgasız hayvanlardan daha çok korku ve nefret duymaktadırlar. Ancak algılanan tehlike konusunda kız-erkek öğrenciler arasında anlamlı bir fark yoktur. Bu sonuç, kız öğrencilerin seçilen hayvanlardan daha çok kaçındıklarını ortaya koymaktadır. Bu sonuç fen eğitimi açısından dikkate alınmalı ve kız öğrencilere omurgasız hayvanlar konusunda özel ilgi gösterilmelidir.

Bu çalışmada öğrencilerin duygu durumları ile biyoloji başarıları arasındaki ilişkiye bakılmamıştır. Birçok araştırma, bu ilişkinin varlığını ortaya koymaktadır. İleriki çalışmalarda öğrencilerin omurgalı hayvanlar ile ilgili duygu durumları ve bu konudaki bilgileri arasındaki ilişkiye bakılabilir. Deneyisel ve ilişkisel araştırmalar ve hatta nitel araştırmalar öğrencilerin duyuşsal ve bilişsel tepkilerini derinlemesine araştırmak için gereklidir.