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**INVESTIGATION OF PRESERVICE TEACHERS'
BIODIVERSITY LITERACY**

*ÖĞRETMEN ADAYLARININ BİYOÇEŞİTLİK OKURYAZARLIKLARININ
İNCELENMESİ*

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Abstract

The aim of this study was to investigation of department of biology, physics and chemistry pre-service teachers' biodiversity literacy (BL) according to several variables. Sampling of research is pre-service teachers from, fourth and fifth graduate students (N=228), faculty of Education Department of Biology, Physics and Chemistry at Atatürk University in Erzurum, in Turkey. This study is made with the survey research model. The data collected with 3-point likert-type scale. BLS consisted of 25 items, 11 were regarding *Threats to biodiversity* (α :.72), 8 were about *Biodiversity concepts*(α :.76) and 6 regarding *Importance of biodiversity*(α :.81). The BLS has three choices: "I agree", "I do not agree" and "I am not sure".

Research findings showed that a statistically significant difference only in subscale of *Importance of biodiversity* was founded in favor of the females. But, the mean scores of females were founded higher than mean scores of males in all of the subscales. Pressed sources were used mostly by

pre-service teachers. Electronic sources were not frequently used by pre-service teachers and a statistically significant difference was found in favor of pressed sources.

The mean scores of taking EEC were found higher than not taking. Furthermore, biology pre-service teachers had higher scores than Physics and Chemistry in subscales of *Treats to biodiversity and Importance of biodiversity*; but in subscale of *Biodiversity concepts*; Chemistry has higher score than Physics and Biology.

Key words: Environmental education, biodiversity, pre-service teachers, literacy.

Öz

Bu çalışma eğitim fakültesi biyoloji, fizik ve kimya öğretmenliği bölümüne devam eden öğretmen adaylarının biyoçeşitlik okuryazarlıklarını cinsiyet, çevre eğitimi konusundaki bilgi kaynağı, çevre eğitimi dersi alma ve bölümlerine göre incelemek amacıyla yapılmıştır. Çalışmaya dördüncü ve beşinci sınıfa devam eden öğrenciler (N= 228) dâhil edilmiştir. Tarama modeliyle yapılan çalışmada üçlü likert tipi ölçek kullanılmıştır. 25 maddeden oluşan ölçek üç faktöre sahiptir. Ölçeğin 11 maddesi biyoçeşitliği tehdit unsurlarını ($\alpha: .72$), 8 maddesi biyoçeşitlik kavramı ($\alpha: .76$) ve 6 maddesi biyoçeşitliğin önemini ($\alpha: .81$) belirlemeye yönelik olarak hazırlanmıştır. 'Katılıyorum', 'katılmıyorum' ve 'karasızım' seçeneklerinden oluşmaktadır. Çalışma neticesinde, cinsiyete göre biyoçeşitliği tehdit unsurları alt boyutunda istatistiksel yönde anlamlı farkın bayanların lehinde çıktığı ve bununla birlikte ölçeğin bütün alt boyutlarda bayanların ortalama puanlarının erkeklerden daha yüksek olduğu tespit edilmiştir. Bilgi kaynağı olarak anlamlı farkın basılı kaynaklar lehinde olduğu ve elektronik kaynakların bilgi kaynağı olarak tercih edilmediği tespit edilmiştir. İstatistiksel olarak anlamlı farkın basılı kaynaklar lehinde çıktığı görülmüştür.

Çevre eğitimi konusunda ders alıp almama durumlarına göre anlamlı farkın çevre eğitimi dersi alanlar lehinde bir sonuç elde edildiği görülmüştür. Bölümlere göre yapılan analizler neticesinde biyoçeşitliği tehdit unsurları ve biyoçeşitliğin önemini konusundaki alt boyutlarda biyoloji öğrencilerinin lehinde istatistiksel olarak anlamlı bir farkın tespit edildiği; ancak biyoçeşitlik kavramı konusundaki alt boyutunda kimya öğrencilerinin lehinde anlamlı bir farkın tespit edildiği görülmüştür.

Anahtar kelimeler: Çevre eğitimi, biyoçeşitlik, öğretmen adayları, okuryazarlık

Introduction

There is an inseparable relationship with nature and humankind. This interaction with human and nature direct effects humankind life and ecosystem. It should be noted that this process is all through history of humankind is (Barraza and Cuarón, 2004; Kassas, 2002). Biodiversity creates the foundation for healthy ecosystems and sustainable development. If an adverse effect occur in biodiversity, it will cause change in all of the life and ecosystem. (UNESCO, 2012). That is way scientists, politicians and environmental educators pay attention to the concept of biodiversity (Dreyfus, Wals and Weelie, 1999). We depend on biodiversity, because it provides people with food, energy, materials, medicines, other goods and promotes national economies benefits and the basis of civilization has been founded on it (NTSA, 2007; CBD, 2009). With increasing population and economic development leading to environmental changes, and biodiversity was affected from this situation (UNESCO, 2012).

Biodiversity loss is affected by habitat loss, especially due to agriculture, overexploitation of species, especially due to fishing and hunting, human population growth, aspirations for better living conditions, the spread of invasive species or genes, climate change, inadequate valuation of biodiversity, poor governance (WWF, 2008; UNESCO, 2010; Mandal,

2011). A negative effect on biodiversity and ecosystem causes extinction of some species; however, this affects leads to an increase of some species (Demir, 2009). It should be noted that evaluation of species have taken millions of years and protection of biodiversity by humankind will have their own interests. (CBD, 2009; UNESCO, 2011). This problems are reached dangerous level because of humankind using nature brutally and extinction is occurring at an unnaturally rate (Abdullah and Halim, 2010; Mandal, 2011). Because of importance of biodiversity for humankinds and all of the other creatures, it is understood the importance of environmental education, particularly biodiversity modules for the training of awareness individuals (Weelie ve Wals, 2002). Only one way to reduce this situation educates students about the necessity an importance of biodiversity (Dor-Haim, Amir and Dodick, 2011). “The value of biodiversity is not obvious to many people. This is especially true for students who lack real life experience with nature. Their under-appreciation of biodiversity is problematic because efforts to conserve biodiversity require broad public support. Therefore it is important to have an informed and scientifically literate populous with a conceptual understanding of why biodiversity is valuable, both economically and ethically” (McCoy, McCoy and Levey, 2007). The science teachers play an important role for improves students’ awareness regarding biodiversity conservation and the problem of reduce extinction of biodiversity (Gayford, 2000). Teachers’ attitudes and belief about animals directly affect students’ generation in life such as if a teacher has negative belief about some animal, they use only animal, loving by teacher, in examples (Wagler, 2010). The solution of the environmental problems can solve with science education because of it relate with science and effective environmental policies play important role to improve students’ environmental knowledge (Trumper, 2010; Barraza and Cuarón; 2004).

The studies conducted in the environmental education are generally about environmental problems and environmental literacy, there is not enough study regarding biodiversity (Barraza and Cuaron, 2004; Negev, Garb, Biller, Sagy ve Tal, 2010; Salmon, 2000; Stables, 1998).

Lindemann-Matthies and et al. (2009) in their study aimed to investigation place of biodiversity education in pre-service education of primary school teachers showed that all aspects of biodiversity education were integrated mostly in the natural science modules, not enough information given in modules and adequately dealt with relationship between biodiversity conservation, economics, ethics, social and political concerns. In a similar study Gayford (2000) showed that pre-service teachers, taken biodiversity education, were well informed about biodiversity. Uzun, Özsoy and Keleş (2010) found that pre-service teachers’ knowledge regarding biodiversity focused on concepts of species, ecosystem and ecology and their information was limited.

Purpose

The aim of this study was to investigation of department of biology, physics and chemistry pre-service teachers’ biodiversity literacy according to several variables.

Research problems

With this research was aimed to seek answers to the following question: Are there statistically differences between groups according to;

1. gender,

2. information source about environmental education,
3. taking environmental education course (Taking EEC),
4. departments.

Method

This study is made with the survey research model. This model is a useful model for research that aims to describe a situation, in past or at the moment (Karasar, 2010).

Sampling

Sampling of research is pre-service teachers from, fourth and fifth graduate students (N=228), faculty of Education Department of Biology, Physics and Chemistry at Ataturk University in Erzurum, in Turkey.

Table 1. *The demographic characteristics of pre-service teachers*

Departments	Gender					
	f	%	Female		Male	
<i>Biology</i>	96	42.1	f	%	f	%
<i>Physics</i>	63	27.6	147	64.5	81	35.5
<i>Chemistry</i>	69	30.3				
Total	228	100.0				

As can be seen from **Table 1**, There were 96 (42.1%) Biology, 63 (27.6%) Physics and 69 (30.3%) Chemistry pre-service teachers. According the gender, there were 147 (64.5%) females and 81 (35.5%) males.

Date collection

The data collected with 3-point likert-type scale. Biodiversity Literacy Scale (BLS) used in this research was developed by Gürbüz, Derman and Çakmak (2012). The first part of scale included demographic questions dealing with department, gender, information sources about biodiversity and teking EEC or not. BLS consisted of 25 items, 11 were regarding *Threats to biodiversity* (α :.72), 8 were about *Biodiversity concepts*(α :.76) and 6 regarding *Importance of biodiversity*(α :.81). The BLS has three choices: "I agree", "I do not agree" and "I am not sure". At tests of significance between the groups is based on α =.05

Data analysis

The date was evaluated by using SPSS (*Statistical Package for the Social Sciences*) package program. Independent samples t test analysis was used for gender, information source and Taking EEC or not. According to department of pre-service teachers, LSD-ANOVA analysis was used.

Findings

Research findings were analyzed in order of research problems.

Problem 1: *Are there statistically differences between groups according to Gender?*

Table 2. Results of t-test analysis of pre-service teachers' BL according gender

Subscales	Gender	N	X	SS	SD	t	p
<i>Threats to biodiversity</i>	Female	147	2.59	.19	226	1.54	.126
	Male	81	2.55	.22			
<i>Biodiversity concepts</i>	Female	147	2.69	.27	226	1.53	.127
	Male	81	2.63	.34			
<i>Importance of biodiversity</i>	Female	147	2.50	.36	226	2.49	.001*
	Male	81	2.38	.31			

*p<.05

The results of subscales of *Treats to biodiversity* indicated that there was not a statistically significant difference between the mean scores of participants according gender [$t(226) = 1.54$; $p > .05$], and a statistically significant difference in subscale of *Biodiversity concepts* was not found [$t_{226} = 1.53$; $p > .05$]. However, a statistically significant difference in subscale of *Importance of biodiversity* was founded in favor of the females [$t_{226} = 2.49$; $p < .05$]. Furthermore, the mean scores of females were founded higher than mean scores of males in all of the subscales (Table 2).

Problem 2: Are there statistically differences between groups according to information sources about environmental education?

Table 3. Results of t-test analysis of pre-service teachers' BLS according information source

Subscales	Information source	N	X	SS	SD	t	p
<i>Threats to biodiversity</i>	Electronic	126	2.50	.19	226	7.38	.000*
	pressed	102	2.68	.17			
<i>Biodiversity concepts</i>	Electronic	126	2.60	.32	226	4.06	.000*
	pressed	102	2.76	.25			
<i>Importance of biodiversity</i>	Electronic	126	2.31	.30	226	7.60	.000*
	pressed	102	2.63	.32			

*p<.05

Analysis of information source for *Treats to biodiversity* [$t_{226} = 7.38$; $p < .05$], *Biodiversity concepts* [$t_{226} = 4.06$; $p < .05$] and *Importance of biodiversity* [$t_{226} = 7.60$; $p < .05$] showed statistically significant differences were founded in favor of pressed source. The mean

scores of participants using pressed source was higher than the mean scores of electronic source. Pressed sources were used mostly by pre-service teachers. Electronic sources were not frequently used by pre-service teachers. It can be said that formal sources used mostly by pre-service teachers than in formal sources (Table 3).

Problem 3: Are there statistically differences between groups according to taking environmental education course (Taking EEC)?

Table 4. Results of t-test analysis of pre-service teachers' BLS according taking environmental education course(EEC)

Subscales	EEC	N	X	SS	SD	t	p
<i>Threats to biodiversity</i>	<u>Taking</u>	96	2.67	.17	226	5.80	.000*
	<u>Not taking</u>	132	2.52	.20			
<i>Biodiversity concepts</i>	<u>Taking</u>	96	2.71	.29	226	1.47	.142
	<u>Not taking</u>	132	2.65	.31			
<i>Importance of biodiversity</i>	<u>Taking</u>	96	2.64	.34	226	7.54	.000*
	<u>Not taking</u>	132	2.32	.29			

*p<.05

As determined by independent samples t test, there were statistically significant differences between taking EEC and Not taking EEC in subscale of *Treats to biodiversity* [$t_{226}=5.80$; $p<.05$], and *Importance of biodiversity* [$t_{226}=7.54$; $p<.05$]. These findings showed that a statistically significant difference was in favor of taking EEC. But in subscale of *Biodiversity concepts* [$t_{226}=1.47$; $p>.05$], there were not statistically significant differences between taking EEC and Not taking EEC. However, the mean scores of taking EEC were founded higher than mean scores of not taking EEC in all of the subscales (Table 4).

Problem 4: Are there statistically differences between groups according to Departments?

Table 5. The mean scores of the subscales for Departments

Subscales	Departments	N	Mean	SD
<i>Threats to biodiversity</i>	Physics	63	2.55	.24
	Chemistry	69	2.49	.17
	<u>Biology</u>	96	2.67	.17
<i>Biodiversity concepts</i>	Physics	63	2.58	.34
	Chemistry	69	2.72	.27
	<u>Biology</u>	96	2.71	.30
<i>Importance of biodiversity</i>	Physics	63	2.29	.37
	Chemistry	69	2.36	.20
	<u>Biology</u>	96	2.65	.35

Analysis of the subscales of BLS regarding *Departments* showed that the mean scores of department of Biology pre-service teachers had higher score than Physics and Chemistry in subscales of *Treats to biodiversity and Importance of biodiversity*; but in subscale of *Biodiversity concepts*, Chemistry had had higher score than Physics and Biology (Table 5).

Table 6. Results of LSD-ANOVA analysis for *Departments*

Subscales		Sum of Squares	df	Mean Square	F	p
<i>Threats to biodiversity</i>	Between Groups	1.382	2	.691	18.843	.000*
	Within Groups	8.251	225	.037		
	Total	9.633	227			
<i>Biodiversity concepts</i>	Between Groups	.848	2	.424	4.666	.010*
	Within Groups	20.450	225	.091		
	Total	21.298	227			
<i>Importance of biodiversity</i>	Between Groups	5.887	2	2.944	29.536	.000*
	Within Groups	22.424	225	.100		
	Total	28.311	227			

* p<.05

According to the LSD-ANOVA analysis, there were statistically significant differences among the mean scores of *Departments* in all of the scales.

Results of LSD test indicated that in subscales of *Treats to biodiversity and Importance of biodiversity*, a statistically significant difference was founded in favor of Biology pre-service teachers; but in subscale of *Biodiversity concepts*, a statistically significant difference was founded in favor of Chemistry pre-service teachers.

Conclusion and Discussion

The aim of this study was to investigate Pre-service teachers' Biodiversity literacy (BL) according to several variables, gender, information source about environmental education, taking environmental course and departments.

Pre-service teachers' BL according gander results showed that a statistically significant difference only in subscale of *Importance of biodiversity* was founded in favor of the females. But, the mean scores of females were founded higher than mean scores of males in all of the subscales; for *Treats to biodiversity*, females (X=2.59) and males (X=2.55); *Biodiversity concepts*, females (X=2.69) and males (X=2.63); *Importance of biodiversity*, females (X=2.50) and males (X=2.38) We can say from these results, females are more literacy than males. These findings showed similarity in other studies conducted on environmental education. Similar research findings showed that the females' attitudes, sensitive and awareness toward the environment founded higher than males, males showed negative attitude toward environment and affected by gender, and according to females, unplanned urbanization, using insecticide in agriculture cause extinction many species in the future and can't buy thing which harm the environment (Ekici, 2005; Davidson and Freudenberg, 1996; Kahyaoğlu and Özgen, 2011; Tikka, Kuitunen and Tynys, 2000; Gürbüz,

Çakmak and Derman, 2013). According to Davidson and Freudenberg (1996), women were express more concern toward environmental risk than men, because female children can not separate from the world around her, and define her as a part of the environment; but male can't see himself as a part of the world around him.

Pre-service teachers' BL according to information sources about environmental education;

The mean scores of participants using pressed sources were higher than the mean scores of electronic sources and a statistically significant difference was found in favor of pressed sources. Pressed sources were used mostly by pre-service teachers. Electronic sources were not frequently used by pre-service teachers. Analysis of information source for *Treats to biodiversity* [$t_{226}=7.38$; $p<.05$], *Biodiversity concepts* [$t_{226}=4.06$; $p<.05$] and *Importance of biodiversity* [$t_{226}=7.60$; $p<.05$]. It can be said that formal sources used mostly by pre-service teachers than others. Gürbüz, Çakmak and Derman (2013) research about biology student attitude toward sustainable environment findings showed that pressed sources used mostly by biology students. However, Kışoğlu and et al. (2010) stated that printed and visual media, magazine-newspaper, television-radio and internet effect of their knowledge about green house effect. Liarakou, Athanasiadis and Gavrilakis (2011) showed that, in contrast to our study, television was mostly used as information source.

Pre-service teachers' BL according to taking environmental education course (Taking EEC) or not and departments;

The analysis of research showed that pre-service teachers taking EEC more literacy than not taking and the mean scores of taking EEC were found higher than not taking. In addition, biology pre-service teachers had higher scores than Physics and Chemistry in subscales of *Treats to biodiversity and Importance of biodiversity*; but in subscale of *Biodiversity concepts*; Chemistry had had higher score than Physics and Biology. From these results, it can be said that environmental education had effect on students' attitude and knowledge. Because the mean scores of taking EEC were founded higher than mean scores of not taking EEC in all of the subscales, particularly in chemistry and biology education pre-service teachers had courses about environmental education; that is way the mean scores of biology and chemistry showed high score. Tikka, Kuitunen and Tynys (2000) stated that biology students positive attitudes and had positive correlation between knowledge and attitude. As we said above, biology students had taken a lot of course about environmental education such as ecology, environmental health and modules about environment in other course books. According to Pedro and Pedro (2010), environmental education plays important role in the solution of environmental problems. Because sustainable development achieves with environmental education (Blum, 2008).

Importance of biodiversity should be given in environmental education and other courses. Students must be understood importance of biodiversity on life and ecosystem.

REFERENCES

- ABDULLAH, S. S. I. S. & HALIM, L. (2010). Development of instrument measuring the level of teachers' Pedagogical Content Knowledge (PCK) in environmental education, *Procedia Social and Behavioral Sciences*, 9, 174–178.
- BARRAZA, L. & CUARÓN, D. A. (2004). How values in education affect children's environmental knowledge, *Journal of Biological Education*, 39:1, 18-23.
- BLUM, N. (2008). Environmental education in Costa Rica: Building a framework for sustainable development,?, *International Journal of Educational Development*, 28, 348–358. www.sciencedirect.com 08.09.2012
- Convention on Biological Diversity (CBD) (2009). Secretariat of the Convention on Biological Diversity Sustaining, Life on Earth. 06.09.2012
- DAVIDSON, D. & FREUDENBERG, W. (1996). Gender and environmental risk concerns: a review of available research. *Environment and Behavior*, 28, 302–339.
- DREYFUS, A., WALS, J.E.A. and WEELIE, D. (1999). Biodiversity as a Postmodern Theme for Environmental Education, *Canadian Journal of Environmental Education*, 4, 155-176.
- DOR-HAİM, S., AMİR, R. & DODİCK, J. (2011). What do Israeli high school students understand about biodiversity? An evaluation of the high school biology programme, 'Nature in a World of Change', *Journal of Biological Education*, 45:4, 198-207
- EKİCİ, G. (2005). Lise öğrencilerinin çevre eğitimine yönelik tutumlarının incelenmesi. *Eğitim Araştırmaları*. 18, 71-83
- GAYFORD, G. (2000): Biodiversity Education: A teacher's perspective, *Environmental Education Research*, 6:4, 347-361
- GÜRBÜZ, H. ÇAKMAK, M. and DERMAN, M. (2013). Biyoloji Öğretmen Adaylarının Sürdürülebilir Çevreye Yönelik Tutumları, *Türk Bilimsel Derlemeler Dergisi 6 (1): 144-149*. www.nobel.gen.tr
- GÜRBÜZ, H. DERMAN, M. and ÇAKMAK, M. (2012). Biyoçeşitlik Okuryazarlığı Ölçeği: Geliştirme, Geçerlik ve Güvenirliği, X.Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, pp. 43, Niğde
- KAHYAOĞLU, M. and ÖZGEN, N. (2011). Kırsal kesimde yaşayan ilköğretim öğrencilerinin çevre yönelik tutumlarının çeşitli değişkenler açısından değerlendirilmesi ve çevre sorunlarına yönelik görüşleri, *Çukurova Üniversitesi Eğitim Fakültesi Dergisi*, 3(40), 102-115
- Karasar, N. (2010). Bilimsel Araştırma Yöntemi. Ankara: Nobel Yayın Dağıtım.
- KASSAS, M. (2002). Environmental education: biodiversity, *The Environmentalist*, 22, 345–351.
- KIŞOĞLU, M., Gürbüz, H., Erkol, M., Akar, S. M. and Akıllı, M. (2010). Prospective Turkish elementary science knowledge level about the greenhouse effect and their views on

- environmental education in university, *International Electronic Journal of Elementary Education*, 2(2), 218-236.
- LIARAKOU, G., ATHANASIADIS, I. and GAVRILAKIS, C. (2011). What Greek secondary school students believe about climate change?, *International Journal of Environmental Science & Education*, 6(1), 79-98.
- LİNDEMANN-MATTHIES, P. and et al. (2009). The integration of biodiversity education in the initial education of primary school teachers: four comparative case studies from Europe, *Environmental Education Research*, 15:1, 17-37
- MANDAL, B. F. (2011): Human Behavior and Biodiversity Loss: A Theoretical Analysis, *Journal of Human Behavior in the Social Environment*, 21:6, 601-605
- MCCOY, M. W., MCCOY, A. K. and LEVEY, J. D. (2007). Teaching Biodiversity to Students in Inner City & Under-Resourced Schools, 69(8):473-476. <http://www.bioone.org/doi/full/10.1662/0002-7685%282007%2969%5B473%3ATBTSII%5D2.0.CO%3B2>
- NEGEV, M., Garb, Y., Biller, R., Sagy, G. ve Tal, A. (2010). Environmental Problems, Causes, and Solutions: An Open Question. *The Journal of Environmental Education*. 41(2), 101–115.
- NSTA (2007). Biodiversity: Resources for Environmental Literacy http://learningcenter.nsta.org/product_detail.aspx?id=10.2505/9781933531168 05.09.2012.
- PEDRO, S. A. and PEDRO, M. V. (2010). Developing sustainable environmental behavior in secondary education students (12-16) Analysis of a didactic strategy, *Procedia Social and Behavioral Sciences* 2, 3568–3574, www.sciencedirect.com 08.09.2012
- TRUMPER, R. (2010). How do learners in developed and developing countries relate to environmental issues?, *Science Education International*, 21(4,), 214-240, [Online] <http://www.icaseonline.net/seiweb/> 05.09.2012
- SALMON, J. (2000): Are We Building Environmental Literacy?. *The Journal of Environmental Education*. 31(4), 4-10.
- STABLES, A. (1998). Environmental Literacy: functional, cultural, critical. The case of the SCAA guidelines. *Environmental Education Research*. 4(2), 155-164.
- TİKKA, P. M., KUITUNEN, M. T. & TYNYS, S. M. (2000). Effects of educational background on students' attitudes, activity levels, and knowledge concerning the environment. *The Journal of Environmental Education*, 31(3), 12–19
- UNESCO (2010). Biodiversity is life, is our life. <http://www.unesco.org/new/en/natural-sciences/special-themes/biodiversity-initiative/> 02.09.2012
- UNESCO(2011). Biodiversity Initiative. 06.09.2012 <http://www.unesco.org/new/en/natural-sciences/special-themes/biodiversity-initiative/biodiversity-education/>
- UNESCO (2012). Biodiversity and Education, <http://www.unesco.org/new/en/natural-sciences/special-themes/biodiversity-initiative/biodiversity-education/> 02.09.2012
- UZUN, N., ÖZSOY, S. and KELEŞ, Ö. (2010). Öğretmen Adaylarının Biyolojik Çeşitlilik Kavramına Yönelik Görüşleri, *Biyoloji Bilimleri Araştırma Dergisi* 3 (1): 93-99,

- WAGLER, R. (2010). The association between preservice elementary teacher animal attitude and likelihood of animal incorporation in future science curriculum, *International Journal of Environmental Science & Education*, 5(3), 353-375
- WEELIE, D. V. ve WALSH, A. (2002). Making biodiversity meaningful through environmental education. *International Journal of Science Education*. 24(11), 1143-1156.
- WWF (2008). Living Planet Report. http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/ 05.09.2012.