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# Teachers' environmental knowledge and pro-environmental behavior: An application of CNS and EID scales

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## ABSTRACT

Environmental education's teachers are responsible to endow students with the knowledge, values, attitudes and skills necessary to protect and sustain the environment. The current study investigates Greek teachers' environmental attitudes, behavior and knowledge via Connectedness to Nature Scale (CNS) and Environmental Identity (EID) Scale. The approach combines applied methodological research like item analysis and Factor Analysis. Teachers' derived scores in both scales were high confirming their positive attitudes in terms of the environment. Furthermore, teachers have positive environmental attitudes, showing pro-environmental behavior but also a moderate level of environmental knowledge.

**Keywords:** Environmental attitudes; pro-environmental behavior; teachers; CNS; EID scale.

**JEL Codes:** I29; Q57; Q56.

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## **INTRODUCTION**

The global environmental crisis is an undeniable reality that forged through the irrational use of natural resources, water and air pollution, biodiversity loss, aforementioned scientific- technical rationality, climate change and plenty other environmental problems, due to industrialization, mass production of goods, consumerism society and globalization (Oskamp 2000; Halkos 2011, 2015; Halkos and Jones 2012). These evidences reflect a non-sustainable path to humanity, indicating the need to occur large scale individual and social changes, in order to succeed environmental sustainability (Wilson 2001).

Mankind will be able to overcome environmental crisis through an environmental conscious society that struggles on an ecologically balanced environment, a requirement that only environmental education can successfully fulfill (Phenice & Griffiore 2003; Saha & Maji 2013). This conclusion has its roots on the assumption of many researchers that people who are more knowledgeable about the environment should in turn be more aware of the environment and its problems and, thus, be more motivated to act positively towards the environment (Kollmus & Agyeman 2002; Fielding & Head 2012; Otto & Kaiser 2014). In addition, environmental knowledge is proved that plays an important role in peoples' environmental behavior (Dobson 2007; Mobley et al. 2010), even if knowledge does not lead directly to behavioral changes (Kaiser & Fuhrer 2003; Frick et al. 2004).

The purpose of environmental education and its relevant programs is to increase environmental knowledge, and in turn, pro- environmental attitudes and behavior (Duerden & Witt 2010; Salter et al. 2011). Teachers' role in environmental education is fundamental (Ekborg 2003). They are responsible to provide students the knowledge, values, attitudes, commitment and skills needed to protect and

improve the environment, as well as to encourage active participation in resolving environmental issues from a variety of perspectives - physical, biological, ethical (McKeown & Hopkins 2002; Esa 2010).

A successful development of environmental education requires environmental aware teachers with scientific knowledge of environmental issues, appropriate educational methodological approaches, scientific background and awareness of their social consequences (Carolan 2006; Carter 2007; Littledyke 2008) in order to produce environmentally literate students (Tuncer et al. 2009). Lack of proficiency in teachers' environmental knowledge, skills and commitment does not lead to environmental change in schools (Yavetz et al. 2014).

Concerning these reasons, the aim at this study is to investigate environmental attitudes, knowledge, and behavior- in combination with connectedness to nature and environmental identity- of teachers enrolled in Environmental Education. The prominence of this study in Environmental Education field arises from its innovative methodology, as there are no relative studies in Greek or international content, to our knowledge, using Connectedness to Nature Scale (CNS) and Environmental Identity Scale (EID) or other environmental scales as a research tool of sustainable attitudes-behaviors. The results of this work may be influential on the Environmental Education research that emphasizes in understudied areas, such as worldviews and belief systems linked with individual identities. In addition, the current study contributes to international literature regarding environmental concern and sustainable behavior by bringing into the surface the interrelationship between environmental variables such as attitudes, values and behavior and socio-demographic parameters.

## **2 Pro-environmental behavior, connectedness to nature and environmental identity**

In environmental psychology, researchers have studied fairly the function of psychosocial variables of pro-environmental behavior, including attitudes, behavioral control, intentions and moral norms (Dunlap et al. 2000; Bamberg & Möser 2007; Milfont & Duckitt 2010). Several social-psychological theories indicated that individuals with eco-friendly attitudes are more likely to be motivated to experience natural environments and behave in a more environmentally responsible manner (Luo & Deng 2008; Chiu et al. 2014). Different types of environmental knowledge and attitudes toward nature affect people's pro-environmental behavior, whereas attitudes have a much stronger influence on behavior than knowledge has (Roczen et al. 2014). In an attempt to set apart from the traditional method, some researchers focused on providing theories that could explain the development of different attitudes (Geng et al. 2015).

The first innovative attempt comes from Dunlap and Van Liere (1978) who developed the New Ecological Paradigm in order to examine the relationship between people and nature and present people as part of the natural environment. Schultz with his colleagues came to the conclusion that environmental attitudes and concerns are based on an individual's primitive belief they called connections with nature (Schultz et al. 2004). The connectedness to nature reflects the unique relationship between human and nature from a psychological perspective, and it is directly associated with one's environmental attitudes (Schultz & Tabanico 2007). According to other definitions, connectedness with nature is an individuals' affective connection to the natural world (Mayer & Frantz 2004), or an individual's beliefs and attitudes about their connection to nature (Perrin & Benassi 2009).

Psychologists developed a variety of tools measuring the connection with nature (Tam 2013; Restall & Conrad 2015). The most popular are the Implicit Associations Test (IAT) (Greenwald et al. 1998), Inclusion of Nature in Self (INS) (Schultz 2001), Environmental Identity Scale (EID) (Clayton and Opatow 2003), Connectedness to Nature Scale (CNS) (Mayer and Frantz 2004), Connectivity with Nature (Dutcher et al. 2007), Nature Relatedness (NR) (Nisbet et al. 2009) and Disposition to Connect with Nature scale (Brügger et al. 2011). Regardless of the measuring tool of connectedness, research consistently reveals a reliable relationship between connectedness to nature and self-reported environmentally responsible behavior (Dutcher et al. 2007; Davis et al. 2011).

On the other hand, measuring actual pro-environmental behavior is rather challenging due to the fact that it is mostly based on questionnaire scales that record people's daily habits such as electricity use (Trostle 2008; Geng et al. 2015). Smith-Sebasto (1995) measured environmentally responsible behavior considering civic action, educational action, financial action, legal action, persuasive action, and physical action. Thapa (2010) assessed pro-environmental behaviors using five factors: political activism, recycling, educational activities, green consumerism, and community activism (e.g. subscribe to environmental publications, recycle, watch environment-related programs, and buy products made from recycled materials).

Markle (2013) developed a new measure, the Pro-Environmental Behavior Scale (PEBS), a 19-item scale with four dimensions. The behaviors included in this scale are those identified by environmental scientists as having the greatest impact on the environment. In addition to pro-environmental attitudes and connections with nature, social identity has been considered an important predictor of pro-environmental behavior (Clayton and Opatow 2003).

In line with the theory of social identity, which argues that social identity is the part of an individual's self-concept derived from a perceived membership in a group or category of people, there is evidence that social identity influences pro-environmental behavior (Gatersleben et al. 2012; Dresner et al. 2015) and environmental attitudes (Bonaiuto et al. 2002).

### **3. Teachers' environmental awareness: a literature review**

A brief review of the international literature revealed only a few studies focusing on environmental awareness of in-service teachers, unlikely to surveys testing prospective teachers. Specifically, there are surveys on environmental knowledge, attitudes and behavior toward nature of primary, elementary and secondary teachers (Hsu & Roth 1998; Munoz et al. 2009; Kainth 2009; Liarakou et al. 2009; Oerke & Bogner 2010; Halkos and Matsiori 2012a,b, 2013, 2014; Clement et al. 2015). Teachers' training needs in environmental education are also the subject of various studies in Greek (Flogaitis et al. 2005; Mandrikas et al. 2012; Michail et al. 2007) and international literature (Omoogun & Omoogun 2013; Heidari & Heidari 2015).

Several researchers investigated environmental attitudes, knowledge and behavior of pre-service teachers around the world coming to similar or conflicting conclusions (Chapman & Sharma 2001; Stir 2006; Spiropoulou et al. 2007; Michail et al. 2007; Pe'er et al. 2007; Tuncer et al. 2009; Esa 2010; Boubonari et al. 2013). Level of teachers' knowledge or understanding and misconceptions regarding complex environmental issues such as the greenhouse effect and acid rain have been also studied (Dove 1996; Groves & Pugh 1999; Summers et al. 2001; Papadimitriou 2004; Daskolia et al. 2006; Liarakou et al. 2007; Taylor et al. 2007; C'akir et al. 2009).

### **3. METHODS**

#### *3.1. Research method, population and sample*

This is a descriptive study investigating attitudes, behaviour and knowledge of Greek teachers towards nature connectedness to nature and environmental identity are measured via CNS and EID scale with a combination of 5- type Likert questions revealing teachers' environmental knowledge- behaviour profile. The target population of the study was teachers that participate in environmental education programs in primary and secondary schools. The data was gained from 100 in-service teachers during March of 2015, applying simple random sampling, by using a list provided from Greek Ministry of Education, including the names of primary and secondary teachers involved in environmental education programs.

#### *3.2 Data collection tools*

A self-administered questionnaire consisting of three parts was constructed as data collection tool for the current study. The first section included a set of socio-demographic questions (age, gender, education level, expertise, years of experience), and the second one consisted of a) 20 questions on a 5-point scale (5 points were assigned to “strongly agree”, 4 to “agree”, 3 to “undecided”, 2 to “disagree”, 1 to “strongly disagree) regarding knowledge and attitudes that refer to biodiversity loss consequences, greenhouse effect, renewable resources, pro-environmental practices, sustainable development, global warming- climate change and b) a set of pro-environmental behavior statements focusing in daily practices like recycling or use of media transfer.

The third section consisted of Connectedness to Nature Scale (CNS) by Mayer & Frantz (2004) and Environmental Identity Scale (EID) by Clayton & Opatow (2003). CNS is a 5- type Likert scale composed of 14 items and measures



individuals' trait levels of feeling emotionally connected to the natural world (Mayer & Frantz 2004). EID scale is also a 5-type Likert scale composed of 24 items that measure the way people form their self-concept and their sense of connection to some part of the nonhuman natural environment (Clayton 2003, pp. 45-46).

Pro-environmental behavior questions were based on Yavetz et al. (2009) instrument which concerned pre-service teachers' environmental literacy and its modified version presented in Bobounari et al (2013). Both scales were translated into Greek and a test-retest study was conducted in order to confirm the reliability of the tool.

### 3.3. *Data analysis*

Data of both scales were subjected to exploratory factor analysis (EFA) using the Principal Components Analysis (PCA), while Varimax rotation was applied. To initiate the analysis, negative worded items- 4, 12 and 14 of CNS scale- were converted (Mayer & Frantz 2004). The K.M.O measure of sampling adequacy and Bartlett's test of sphericity (Sharma 1996) indicated the adequacy of the data analysis to the model. A reliability analysis was conducted using Cronbach's alpha coefficient indicating that internal consistency ratio was acceptable (George & Mallery 1995; Bord et al. 1998).

Kaiser's rule (1960) and Cattell's scree test (1966) indicated the number of the factors extracted from the PCA. The participants' mean scores were calculated using the structure of components extracted through exploratory factor analysis. Cronbach's a coefficient was also estimated at every single factor of both scales. Kolmogorov-Smirnov D test and Shapiro-Wilks W tests of normality were calculated due to normal or not normal distribution that variables demonstrated,

parametric or non-parametric tests shows correlations between the variables (Rosner 2000). Binary logistic re

gression performed in order to identify the factors that affect teachers' environmental knowledge.

#### 4. EMPIRICAL RESULTS

Table 1 presents the descriptive statistics of respondents' socio-demographic characteristics.

**Table 1:** Descriptive statistics of respondents' basic socio-demographic characteristics

	Observations	Mean	Standard deviation
Gender (%)	100	72% (Female)	
Age	100	46.12	9.004
Educational level (years)	100	16.37	3.21
Marital status	100	1.297	0.676
Experience (years)	100	17.43	8.262

##### 4.1 Respondents' environmental profile and reliability analysis

The results from teachers' evaluation of pro-environmental behavior and their environmental knowledge revealed that 96.0% of participants recycle in their daily lives, while 55.0% systematically uses public transportation. A significant amount of 74.0% buys products on an eco-friendly package; the majority (97.0%) seems to preserve water and 75.0% save energy by turning off the electric appliances after use. There are only a few teachers, 17.0%, that participate in environmental organizations.

Teachers' environmental knowledge about renewable natural resources, climate change and biodiversity definition is satisfied. Specifically, teachers are aware of definitions of renewable energy resources (91.4%,  $\pm 0.701$ ), biodiversity (85.8%,  $\pm 0.892$ ), climate change and its consequences (85.4%,  $\pm 0.913$ ). Teachers believe that human actions affect directly the physical environment (90.2%,  $\pm 0.732$ ) and understand that effective environmental protection will significantly improve the quality of life (86.8%,  $\pm 0.856$ ). Contrary, teachers seem to misunderstand the

definition of sustainable development (34.6%,  $\pm 1.294$ ) and greenhouse effect (62.2%,  $\pm 1.386$ ). Participants hold a misconception about biodiversity loss as they do not recognize the consequences of ecosystem functioning due to this complex environmental problem (33.2%,  $\pm 1.109$ ).

Reliability analysis of the scales revealed that Cronbach- $\alpha$  was 0.9 (EID scale) and 0.772 (CNS scale) (Tables 2 and 3). The PCA for CNS scale has extracted three factors explaining 55.009% of the fluctuation of the total variance and Cronbach- $\alpha$  for each factor was 0.768, 0.648 and 0.4 (Table 3)<sup>1</sup>. The PCA for EID scale has extracted six factors explaining 62.627% of total variance and Cronbach- $\alpha$  for each of factors was 0.804, 0.833, 0.747, 0.576, 0.469 and 0.403. The Kaiser–Meyer–Olkin (KMO) criterion for sampling adequacy was equal to 0.835 (CNS) and 0.837 (EID), while Bartlett’s test of sphericity was equal to 476.282 for CNS (with a P-value of 0.000 and 91 d.f.) and 1015.703 for EID scale (with a P-value of 0.000 and 276 degrees of freedom). The first factor of CNS scale identified by the respondents was the most important, explaining 36.179% of total variation in data and can be called “Interrelationship human-nature”.

Responders strongly believe in their connection to natural world and identify themselves with the environment. The first factor of EID scale identified by respondents was the most important, explaining 33.11% of total variation in the data and can be called “Appreciation of natural environment”. Teachers respect nature and recognize that people’s welfare depends on the physical environment. The high percentage of variance in these factors shows that they play the main role in teacher’s environmental identity and the connection they feel toward nature. The rest of factors’ names in both scales that were identified by the participants in the research are given in Tables 2 and 3.

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<sup>1</sup> Kaiser’s rule (1960) suggested the existence of three factors regarding CNS scale and six factors for EID scale, all with eigenvalues greater than 1 (Sharma 1996).

**Table 2: Rotated component matrix, EID scale**

	Components							
	Appreciation Of natural environment	Ideological Commitment to the environment	Belonging to the natural world	Attitudes to nature	Contact with nature	Environmental identity	Communalities	
Mean score= 97.08 ( $\pm$ 12.238)								
Q5. When I am upset or stressed, I can feel better by spending some time outdoors “communing with nature”	0.704						0.565	
Q6. Living near wildlife is important to me; I would not want to live in a city all the time	0.781						0.727	
Q10. I like to garden	0.644						0.534	
Q16. I would rather live in a small room or house with a nice view than a bigger room or house with a view of other buildings	0.756							
Q19. I would feel that an important part of my life was missing if I was not able to get out and enjoy nature from time to time	0.568						0.682	
Q7. I have a lot in common with environmentalists as a group		0.811					0.751	
Q8. I believe that some of today’s social problems could be cured by returning to a more rural life-style in which people live in harmony with the land		0.548					0.591	
Q17. I really enjoy camping and hiking outdoors.		0.481					0.655	
Q18. Sometimes I feel like parts of nature – certain trees, or storms, or mountains– have a personality of their own		0.597					0.626	
Q20. I take pride in the fact that I could survive outdoors on my own for a few days		0.431					0.550	
Q22. My own interests usually seem to coincide position advocated by environmentalist		0.873					0.792	
Q9. I feel that I have a lot in common with other species			0.515				0.597	
Q11. Being a part of the ecosystem is an important part of who I am			0.726				0.607	
Q13. Behaving responsibly toward the Earth – living a sustainable life-style– is part of my moral code			0.699				0.697	
Q14. Learning about the natural world should be an important part of every child’s upbringing			0.765				0.610	
Q2. Engaging in environmental behavior is important to me.				0.655			0.589	
Q12. I feel that I have roots to a particular geographic location that had a significant impact on my development.				0.731			0.652	
Q15. In general, being part of the natural world is an important part of my self-image				0.400			0.532	
Q1. I spend a lot of time in natural settings (woods, mountains, desert, lakes, ocean).					0.611		0.564	
Q23. I feel that I receive spiritual sustenance from experiences with nature).					0.476		0.667	
Q24. I keep mementos from the outdoors in my room, such as shells or rocks or feathers.					0.740		0.580	
Q4. If I had enough time or money, I would certainly devote some of it to working for environmental causes.						0.608	0.582	
Q9. I feel that I have a lot in common with other species.						0.513	0.597	
Q21. I have never seen a work of art that is as beautiful as a work of nature, like a sunset or a mountain range.						0.550	0.646	
Eigenvalues	7.946	1.796	1.573	1.406	1.256	1.053		
Cronbach’s a	0.804	0.833	0.747	0.576	0.469	0.403		
Total variance explained (%)	62.627							
Total Cronbach’s a	0.9							
K.M.O	0.837							
Barlett’s test of sphericity	$\chi^2= 1015.703, df= 276, Sig.= .000$							

**Table 3: Rotated component matrix, CNS scale**

Mean score= 57.24 ( $\pm$ 7.1592)	Components			Communalities
	Interrelationship Human-nature	Equality among human & other species	Human domination on nature	
Q1. I often feel a sense of oneness with the natural world around me.	0.529			0.593
Q2. I think of the natural world as a community to which I belong.	0.488			0.621
Q7. I feel as though I belong to the Earth as equally as it belongs to me	0.532			0.568
Q8. I have a deep understanding of how my actions affect the natural world.	0.743			0.625
Q9. I often feel part of the web of life	0.678			0.587
Q10. I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'	0.783			0.693
Q11. Like a tree can be part of a forest, I feel embedded within the broader natural world	0.696			0.505
Q14. My personal welfare is independent of the welfare of the natural world	0.605			0.495
Q3. I recognize and appreciate the intelligence of other living organisms		0.739		0.577
Q5. When I think of my life, I imagine myself to be part of a larger cyclical process of living		0.678		0.593
Q6. I often feel a kinship with animals and plants		0.653		0.508
Q13. I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees		0.539		0.426
Q4. I often feel disconnected from nature			0.702	0.521
Q12. When I think of my place on Earth, I consider myself to be a top member of a hierarchy that exists in nature.			0.613	0.490
Eigenvalues	5.065	1.394	1.242	
Cronbach's $\alpha$	0.768	0.648	0.400	
Total variance explained (%)	55.009			
Total Cronbach's $\alpha$	0.772			
K.M.O	0.835			
Barlett's test of sphericity	$\chi^2=476.28$ , $df=91$ , $Sig.=.000$			

Table 4 illustrates the results of Mann Whitney U test performed in order to describe whether there is a significant difference between CNS and EID scores of participants in terms of recycling and participation in environmental organization. There is no significant environmental behavioral (recycling or participating in environmental organizations) difference in teachers' scores in Interrelationship human- nature and Appreciation of natural environment factors ( $p>0.05$ ). However, there is significant difference between teachers' pro-environmental behavior in terms of HND and BNW scores ( $U=486.500$ ,  $p<.005$ ;  $U=78.000$ ,  $p<.005$ ).

**Table 4:** Differences in teachers' HDN<sup>3</sup>, IHN<sup>4</sup>, BNW<sup>5</sup> and ANE<sup>6</sup> scores based on recycling practice and participation in environmental organization

	P.E.O <sup>1</sup>	N	Mean Rank	Sum of Ranks	U	P		RC <sup>2</sup>	N	Mean Rank	Sum of Ranks	U	P
HDN <sup>3</sup>	Yes	19	65.39	1242.50	486.500	.013 <sup>8</sup>		Yes	96	51.69	4962.00	78.000	.043 <sup>7</sup>
	No	81	47.01	3807.50				No	4	22.00	88.00		
	Total	100						Total	100				
IHN <sup>4</sup>	Yes	19	48.29	917.50	727.500	.712		Yes	96	50.15	4814.00	158.00	.569
	No	81	51.02	4132.50				No	4	59.00	236.00		
	Total							Total					

<sup>1</sup>Environmental Organization, <sup>2</sup>Recycling, <sup>3</sup> Humans domination on nature, <sup>4</sup> Interrelationship human- nature, <sup>5</sup> Belonging to the natural world, <sup>6</sup> Appreciation of natural environment

The results of binary logistic regression indicated that teachers' degree of education and expertise does contribute to the model, or otherwise, these variables are related to teachers' environmental knowledge levels. The dependent variable of the binary model was a variable that reflected teachers' environmental knowledge taking into account their scores of knowledge questions (Table 5). Due to the fact that data did not demonstrate normal distribution Spearman correlation coefficient significance test was applied in order to find the total correlation between CNS and EID scale. As literature reveals (Olivos & Aragónes 2011), the CNS was positively associated with EID ( $r = .532, p=0 .001$ ).

**Table 5:** Results of binary logistic regression

Environmental Knowledge	B	S.E.	Wald	df	Sig.	Exp(B)
Degree of education	-2.041	.873	5.471	1	.019*	.130
Expertise	-.167	.077	4.651	1	.031**	.847
Constant	3.653	2.354	2.408	1	.121	38.605

a. Variable(s) entered on step 1: Gender, Education Level, Recycling, Degree of education, Expertise  
\*, \*\* p<0.05

## 5. DISCUSSION

According to the results teachers are environmental conscious as they are strongly connected with nature and have enhanced environmental identity based on their high CNS and EID mean scores (Tables 2 and 3). According to Mayer & Frantz (2004), a high score in CNS indicates a close relationship between human and nature confirmed by several studies (Frantz et al. 2005; Dutcher et al. 2007; Nisbet et al. 2008). In addition, high scores of EID scale to suggest that the participants identify themselves with the environment (Clayton 2003; Olivos et al. 2011). There are no other studies in the literature that examine teachers' environmental consciousness using CNS and EID scale at the same time, although there is one study that examines the psychometric properties of the CNS scale and compares it with EID (Olivos & Aragones 2011).

Both scales are referring to a type of closeness with the natural environment and the correlation between CNS and EID is positive ( $r=0.532$ ), as others also suggested (Olivos et al. 2011). Practically, both scales have acceptable levels of reliability and, on average, indicate a favorable tendency towards the environment (Perrin & Benassi 2009, Gosling & Williams 2010, Kiesling & Manning 2010). Both genders performed high scores on CNS and EID scales, so there was no difference in the female and male sample. Moreover, there were no gender differences in teachers' pro-environmental behavior either. Some studies argue that female teachers are environmentally more aware (Sabhlok 1995; Tikka et al. 2000; Chu et al. 2007; Çimen et al. 2011; Sadik & Sadik 2014) and others suggest that both genders have equal of environmental concern (Mc Ewen et al. 2015). Generally, although many studies have documented significant sex differences (de Leeuw et al. 2014), with women reporting greater eco-friendly intentions and behavior than men (Zelezny et al. 2000; Fielding & Head 2012; Cincera & Krajhanzl 2013), with

other studies having found no sex differences (Tindall et al. 2003; Hunter et al. 2004; Xiao & Hong 2010; Hadler & Haller 2011).

Teachers' scores in CNS factors *Humans domination on nature* and *Interrelationship human- nature* depend on their participation in environmental organization (Table 4), implying that those teachers who do not believe in human's superiority against other species and thus, connect with nature, are those who participate in environmental organizations. Nevertheless, teachers' scores in EID factors "*Belonging to the natural world*" and "*Appreciation of natural environment*" associated with pro-environmental behavior of recycling. Teachers that recycle had higher mean scores in the two EID factors mentioned above. This conclusion reflects a connection between environmental attitudes and pro-environmental behavior that previous research has also demonstrated (Stern et al. 1995; Jurowski et al. 1995; Milfont & Duckitt 2004; Perkins & Brown 2012; Collado et al. 2013; Wynveen et al. 2013; Kil et al. 2014).

Environmental identity is stronger in teachers who participate in environmental organizations and impress their love and care for nature effectively. Greek teachers respect nature and realize that human actions have a direct impact on natural environment, so they act pro-environmentally: the majority recycles (96%), buy eco-friendly products (74%) and turn off electric appliances after using them (75%). Moreover, teachers said that they use public transportation but not systematically (45%) and they conserve water (97%). Therefore, the study revealed that teachers' pro-environmental behavior encompass their positive environmental attitudes toward nature that derive from their strong connectedness to nature.

Several studies reveal that people who feel a high degree of connectedness with nature tend to develop more positive life attitudes and engage in more pro-environmental behaviors, or otherwise, connectedness promotes pro-environmental behaviors (Bruni & Schultz 2010, Howel et al. 2011). Thus, CNS confirmed its predictive validity of pro-environmental behavior (Mayer & Frantz 2004, Geng et al. 2015). Only few other studies



on perspective and in-service teachers came up to the same conclusion, that teachers' perform high pro-environmental behavior-mostly in an individual level (Liu et al. 2015), but there are several studies in an opposite direction (Goldman et al. 2006; Stir 2006; Yavetz 2007).

Regarding environmental knowledge, teachers are well informed on climate change, renewable natural resources and definition of biodiversity. In addition, teachers are confused with the context of sustainable development and impacts of biodiversity loss, while knowledge on greenhouse effect is very low. These results come along with those from previous studies that noted moderate to low levels of teachers' knowledge (Pe'er et al. 2007; Robinson et al. 2007) or misunderstanding and misconceptions regarding complex environmental issues such as the greenhouse effect and acid rain (Dove 1996; Groves & Pugh 1999; Summers et al. 2000; Taylor et al. 2007; Wise 2010; Dawson 2012; Borg et al. 2014; Herman et al. 2015).

In Greece, Spiropoulou et al. (2007) found that pre-service primary teachers have limited knowledge about the environment, resulting in a low rate of implementation of environmental programs in schools. The study of Michail et al. (2007) revealed that Greek primary school teachers held several environmental knowledge gaps and misconceptions about acid rain, the ozone layer depletion, and the greenhouse effect. Liarakou et al. (2009) revealed that although teachers were informed on renewable energy sources and well disposed toward these sources, they hardly expressed clear positions in several issues about wind and solar energy technologies. Boubonari et al. (2013) studied Greek pre-service teachers' level of ocean literacy and concluded that Greek pre-service primary teachers possess a relatively moderate level of knowledge of marine pollution issues, holding also some misconceptions.

Our study suggests that there is not a direct interrelationship between pro-environmental behavior and environmental knowledge, while teachers demonstrate eco-friendly behavior and moderate level of environmental knowledge. Other studies showed that pro-environmental behavior and knowledge are connected but not in a direct way, underlying that knowledge of ecosystem functioning forms the basis for behavior related to proximal knowledge types (action and effectiveness knowledge), which, in turn, has direct effects on pro-environmental behavior (Kaiser & Fuhrer 2003; Frick et al. 2004). Diaz- Siefer et al. (2015) found that human-environment knowledge is in a significant correlation with pro-environmental behavior.

According to several studies, favorable attitudes toward nature would be more related to lower pro-environmental behaviors, easier to perform- like recycling (Green-Demers et al. 1997; Stern 2000; Barr et al. 2005), but it is not the rule (Hidalgo et al. 2011). Environmental knowledge is actually affected by teachers' expertise and their degree of education. Social Science teachers were found to perform lower level of environmental knowledge than Physical Science teachers. These findings are in keeping with earlier researches that confirm the difference between science teachers and teachers of other specialties (Kainth 2009; Esa 2010). Pe'er et al. (2007) found that pre-service teaching students enrolled in environment-affiliated disciplines demonstrated significantly higher levels of environmental knowledge than students in non-environment-affiliated fields. Robinson and Crowther (2001) investigated the environmental literacy of biology and chemistry majors and pre-service science teachers in a university in western United States and found pre-service science teachers to be significantly more environmentally literate than chemistry majors but not biology majors.

Nevertheless, there are surveys on secondary pre and in-service science teachers noted an average to low environmental knowledge level of environmental issues like climate change (Wise 2010; Dawson 2012; Herman et al. 2015). Another study conducted by Graziani et al. (2013) showed a good level of knowledge on elementary teachers and a very good level of

knowledge on high school science teachers. Focusing on Tehran's elementary school teachers, Heidari & Heidari (2015) came to the conclusion that teachers don't possess an appropriate level on environmental knowledge, attitude and skill.

## **5. CONCLUSIONS**

This study's aim was mainly to identify teachers' environmental awareness by investigating their attitudes, behavior and knowledge towards nature. In other words, this study has attempted to measure teachers' connectedness to nature and their environmental identity. In particular, emphasis has been given in examining the attitudes of respondents to find out which socio-demographic and behavioral determining parameters affect their environmental manners and knowledge. Summarizing our findings, we may say that teachers are in connection with nature, they identify themselves with the environment and have moderate to low environmental knowledge, although they present eco-friendly behavior.

The current study revealed teachers' positive environmental attitudes above and beyond their poor environmental literacy. In these lines, further research is necessary to outline the environmental profile of teachers worldwide, so as to provide stronger evidence regarding their scientific environmental training and their didactic needs in Environmental Education. The contribution of this research in literature lies in further exploration of peoples' environmental concern in relation with their environmental behavior, attitudes and socio-demographic characteristics in general, using new methodologies including valid environmental scales.

Moreover, the present study contributes to research by explaining the links between humans' connectedness to nature, environmental identity, attitudes, knowledge and real pro-environmental behavior and defines the strength and direction among these variables. Thus, the results of the current study can be widely used by researchers in the fields of Environmental Education designing and Education of Sustainable Development.

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