

# Environmental literacy in Madeira Island (Portugal): The influence of Demographic Variables

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## **Abstract**

Demographic factors are among those that influence environmental literacy and, particularly, environmentally responsible behaviours, either directly or due to an aggregation effect dependent on other types of variables. Present study evaluates a set of demographic variables as predictors for environmental literacy among 9th grade students from Madeira Island (Portugal). Through a survey involving 491 students, gender, place of residence (rural and urban), 8<sup>th</sup> grade Natural Sciences discipline performance, participation in school's environmental activities and, indirectly, socio-economic status were evaluated in their association to environmental literacy and, particularly, to each of its three main components: knowledge, attitude and behaviour. The results confirm three stronger environmental literacy predictors: rural or urban residence, depending on the components considered, higher marks in 8th grade Natural Sciences discipline and higher socio-economic status; and two weaker: female and participation in school's environmental activities. Our findings found support in previous studies and underline the need to center socio-demographic factors in environmental education practices. Considering demographic variables as the reflex of environmental, economic and socio-cultural contexts, our results corroborate an environmental literacy's construction framework on the light of Vygotsky's socio-cultural theory of human learning, in which real learning contexts play a fundamental role. In fact, also in environmental literacy, learning occurs through the interaction with the social environment and, to be effective, needs real learning contexts. Demographic variables confirmed as being predictors for environmental literacy in Madeira Island students seems to mirror the effects of the above framework and show strong evidences of linkage with socioeconomic status.

**Keywords:** Environmental Education, Environmental Literacy predictors, Demographic Variables, Madeira Island

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## **Introduction**

Environmental literacy has a long way as the environmental education main purpose and is also an important prerequisite to maintain and improve the quality of the environment (Disinger & Roth, 1992). However, increasing environmental literacy in a target population is a very hard task since it's a process where a profusion of different factors act in an interdependently and complex way and the outcome results are difficult to predict (Hollweg et. al., 2011). Despite there is a lack of empirical research addressing the pathway through which environmental literacy is formed, as also on the effectiveness of environmental education (Keene & Blumstein, 2010), several models and frameworks have been proposed to explain environmental literacy and the adoption of environmental friendly behaviours (Hsu, 1997).

Disinger and Roth (1992) suggested that environmental literacy was essentially the capacity to perceive and interpret the relative health of environmental systems and

take appropriate action to maintain, restore, or improve the health of those systems. Later, Wilke (1995, pp. 5-6) defined four clusters of environmental literacy components: cognitive dimensions (knowledge and skill), affective dimensions, additional determinants of environmentally responsible behaviour, and personal and/or group involvement in environmentally responsible behaviour.

Nowadays, is of common understanding that environmental literacy must include knowledge and understanding of environmental concepts, problems, and issues, a set of cognitive and affective dispositions, and a set of cognitive skills and abilities, together with the appropriate behavioural strategies to apply such knowledge and understanding in order to make sound and effective decisions in a range of environmental contexts (Hollweg et. al., 2011). As a simple definition, environmental literacy could be seen as a domain of four interrelated components: knowledge, dispositions, competencies, and environmentally responsible behaviour (Hungerford & Volk, 1990; Hollweg et. al., 2011).

Evaluating environmental literacy in a population is the best strategy to assess the efficiency of the environmental education efforts, as also to address the needs for better strategies. However, there is a lack of evaluation, especially with before-after or treatment-control designs, and some authors even identify a “bunker mentality” to explain the resistance of the environmental community on evaluating projects and strategies on the field (Blumstein & Saylan, 2007). Additionally, environmental literacy has a complex structure that makes difficult include all their components in any single assessment, being of fundamental importance identify the essential elements to be addressed in the survey. In order to overcome this problem, several authors identified knowledge, attitude and environmentally responsible behaviour as the major components of the environmental literacy to be included in the surveys (Krnel & Naglič, 2009; McBeth & Volk, 2010; Kuhlemeier, et. al., 1999).

Besides evaluating environmental literacy levels among specific young or adult groups, identifying the variables that behave as predictors for overall and specific dimensions of environmental literacy is critical since they could enlighten the process underneath its construction (Palmer, 1999). Demographic factors are among those that influence environmental literacy and, particularly, environmentally responsible behaviours, not only through a direct influence but specially due to an aggregation effect dependent from other types of variables (Kollmuss & Agyeman, 2002).

Several categorical and demographic variables, such as age, gender, income, residence and parental education level, have been commonly investigated and found to be predictors for environmental literacy levels (Erdoğan, 2009). Older (Tikka et al., 2000), higher grade (Kellert, 1985; Shin et al., 2005), males (Gifford et al., 1982/83), urban residence (Kellert, 1985), and higher income and parental higher levels of education (Shin et al., 2005) tend to predict higher environmental knowledge. However, a better environmental attitude has been linked to younger (Bogner & Wiseman, 1997), female (Gifford et al., 1982/83), urban residence (Bogner & Wiseman, 1997), higher socioeconomic status (SES) (Lyons & Breakwell, 1994) and parental higher levels of education (Shin et al., 2005). For environmentally responsible behaviour, younger, female and higher income are the most frequently associated to better results (Hines et al. (1986/87).

Few studies evaluated environmental literacy among Portuguese students, or in other specific groups and overall population (Author, 2014). These studies address mostly knowledge and attitude toward the environment and some considers also the influence of categorical and demographic variables as predictors for environmental literacy (Almeida & Azeiteiro, 2011; Cordeiro, 2010; Pedro, 2009; Câmara, 2014). Despite with some limitations on the analysis and statistics, especially because they didn't apply

significance tests to statistically support their findings, these studies showed that, among 12th grade students of some specific mainland Portuguese schools, higher environmental knowledge tends to be associated to female in a urban school (Cordeiro, 2010) and to male in a rural (Almeida & Azeiteiro, 2011), to parental higher education levels (Cordeiro, 2010; Almeida & Azeiteiro, 2011), to rurality (Almeida & Azeiteiro, 2011), and to the participation on environmental activities in a urban school (Cordeiro, 2010). Female in 2 urban schools (Cordeiro, 2010; Almeida & Azeiteiro, 2011), lower parental education level in both urban (Cordeiro, 2010) and rural schools (Almeida & Azeiteiro, 2011), and rural schools (Almeida & Azeiteiro, 2011) has been associated to better attitude levels toward the environment on these 12th grade Portuguese students.

In Madeira Island (Portugal) the studies on environmental literacy are even scarcer. Using the New Ecologic Paradigm (NEP) Scale, an instrument widely used and validated in the measure of pro-environmental orientation (Dunlap et. al., 2000), Freitas (2007) found that, in Madeira Island overall population, younger individuals, from urban areas and with higher education and SES tend to show a higher pro-NEP attitude. Also, the same study concluded that energy and water saving behaviours were most prevalent among individuals with lower education and SES and, in opposition, waste segregation for recycling and green consumption were associated to highest education and SES. Recently, for the first time, studies on the environmental literacy level among 9th grade students from Madeira Island were developed showing, in general, good levels of knowledge, a satisfactory pro-NEP attitude but low prevalence of environmentally responsible behaviours (Author, in press). However, no significantly better results were found for those students engaged in Eco-Schools Program, an international environmental education project in place in the majority of the educational establishments from Madeira Island, being an important next step in this approach the evaluation of categorical and demographic variables in order to address their influence as predictors for environmental literacy.

### **Research Questions**

Since previous studies among Madeira Island 9th grade students showed that the levels of environmental literacy found doesn't depend necessarily on the environmental education project "Eco-Schools Program" (Author, in press), other variables need to be evaluated as a contribution to better understand the pathway through which environmental literacy develops in the specificities of Madeira Island context. In this sense, present study addresses the following research questions:

Are gender, learning achievement levels on the 8th grade Natural Sciences discipline, area of residence (urban or rural) and participation in environmental activities predictors of environmental literacy for 9th grade students from Madeira Island (Portugal)? And what are its specific influences in each of the three considered dimensions of environmental literacy, namely knowledge, attitude and behaviour?

Therefore, we hypothesized that:

- 1- Female students show better knowledge, attitude and behaviours toward the environment;
- 2- Students with better marks in 8th grade Natural Sciences discipline show better knowledge, attitude and behaviours toward the environment;
- 3- Students from urban areas show better knowledge, attitude and behaviours toward the environment;
- 4- Students that participate in school's environmental activities show better knowledge, attitude and behaviours toward the environment.

## Methodology

The survey design was based in others published elsewhere but adjusted to local specificities (Kuhlemeier, et. al., 1999; Krnel & Naglič, 2009; McBeth & Volk, 2010). It was anonymous with close-ended questions consisting of a header and three main sections, each one measuring and assessing: knowledge (10 questions), attitude (15 questions) and environmentally responsible behaviour (15 questions) (questionnaire available upon request). The questionnaire header includes gender, marks in 8th grade Natural Sciences discipline and participation in environmental activities. Urban or rural residence was taken from the school location since student lives around. Data on student's social support and parental education levels were used to characterize the SES of the 9th grade students from the biggest school involved on the present research. Knowledge section addressed the 3 main themes developed in environmental education activities on Portuguese schools: water (3 questions), energy (3 questions), and wastes (4 questions); each one going along 3 main aspects: cause of problems, regional context and behaviour options. To measure pro-environmental attitude the questionnaire included the New Ecologic Paradigm (NEP) Scale, an instrument widely validated in the measure of pro-environmental orientation (Dunlap et. al., 2000; Trobe & Acott, 2000; Kostova et. al., 2011; Shoukry et. al., 2012). The environmentally responsible behaviours were assessed through statements spanning across the 3 main themes already selected for knowledge: water (4 statements), energy (6 statements) and wastes (5 statements). Each statement addressed specific everyday behaviours and students were asked to select their frequency in a Likert-type scale ranging from 1 (never) to 5 (always). A special care was taken to overcome potential social desirability bias that could overcome in self-reported assessments (Nederhof, 1985). In order to obtain an internal validity indicator, two redundant questions ["a) I put paper, glass bottles and plastic bags in different containers" and j) "I put all kind of wastes in the same container"] were added. The questionnaire was pre-tested and the final version was applied to all sample students between April and May 2013, after informed consent from each school board.

The sample included 491 9th grade students from 5 elementary schools from Madeira Island (Portugal). Data collected in the survey was analyzed with SPSS (version 20) statistical software. Firstly, reliability (the Cronbach's Alpha score was 0.705 for the entire measuring instrument) and validity (confirmed by factor analysis and internal validity indicator questions that show a significant positive correlation [ $r=0.641$   $p=0.000$ ]) were evaluated followed by a set of descriptive statistics.

Variables (gender, marks in Natural Sciences, participation in environmental activities and place of residence) were compared for each of the three data domains: knowledge, attitude and behaviour. To test our hypothesis, significance was addressed through one sample z-test of proportions (1-tailed) with a confidence level of 95%.

## Results

The 491 9th grade students involved in this survey had a mean age of 15 years and males (51.3%) are slightly most prevalent than females (48.7%). More than two thirds (65%) are from an urban area (Funchal city) and the others (35%) from rural municipalities. Students with higher marks in 8th grade Natural Sciences discipline (4 or more, in a scale of five points) were most prevalent (52.1%) than the others (47.9%, with 3 or less) and only 20.6% admit to had been involved in school's environmental activities along past few years. Missing values account for 3.1% on total sample.

Ninth grade female students showed a better environmental knowledge, especially on wastes theme, and a slightly better attitude towards the environment, with a

significantly lower support of the Dominant Social Paradigm (DSP), and a higher prevalence of environmentally responsible behaviours, particularly for water savings (Table 1). Participation in school's environmental activities seems not to improve the prevalence of environmentally responsible behaviours but show significant positive influences in environmental knowledge, especially on wastes theme, and also in a higher support of the New Ecological Paradigm (NEP), particularly agreeing with the 'possibility of an eco-crisis' (Table1).

Despite gender and participation in environmental activities show some significant influences in environmental literacy, student's area of residence (rural or urban) and, especially, marks in 8th grade Natural Sciences discipline reveal to be important predictors for environmental literacy in Madeira Island 9th grade students (Table 1, Figures 1 and 2). In fact, rural students show significantly better knowledge for water and energy themes, and urban for wastes, and the environmentally responsible behaviours higher prevalence's appear in urban students for water savings and waste management, and in rural for energy savings (especially due to a significantly lower mobility in their parent's car, data not shown). Urban students show also a better attitude towards the environment with a significantly higher concordance with the New Ecological Paradigm (Table 1, Figure 1). However, it was among 9th grade students with better marks ( $\geq 4$ ) in 8th grade Natural Sciences discipline where present study found higher levels of environmental literacy. Students with better marks showed significantly better environmental knowledge and a higher level of concordance with the New Ecological Paradigm, including each one of its five NEP group items, as also a much lower concordance with the Dominant Social Paradigm. Also, better marks are associated to a significantly higher prevalence of water savings and waste management behaviours, the only exception being for energy savings where students with lower marks ( $\leq 3$ ) had significantly better results (Table 1, Figure 2). This lower prevalence for energy saving behaviours among students with higher marks results from a significantly higher mobility to school in their parent's car (data not shown). As an important result to understand this behaviour exception is the fact that students with better marks are significantly most prevalent among families with higher SES (Figure 3).

Table 1.

*Correct answers prevalence's for environmental knowledge (in total and for each theme: water, energy and wastes); Attitude orientation prevalence's towards the environment for pro New Ecological Paradigm (pro-NEP), pro Dominant Social Paradigm (pro-DSP) and Unsure; Pro-NEP attitude concordance prevalence's for each group item: limits to growth, anti-anthropocentrism, fragility of nature's balance, rejection of exemptionalism, possibility of an eco-crisis; environmentally responsible behaviors prevalence's in an 'always' plus 'very often' basis (in total and for each theme: water, energy and wastes), in 9<sup>th</sup> grade students from Madeira Island by area of residence (urban and rural), marks in 8<sup>th</sup> grade Natural Sciences discipline ( $\leq 3$  and  $\geq 4$ ), gender (F-female and M-male) and participation in school's environmental activities (EA- participating in environmental activities and NEA- without participation). Statistical significant differences in bold\*. Sig.- Significance.*

<i>Correct answers prevalence's (%) for environmental knowledge</i>												
<i>Themes</i>	<i>Rural</i>	<i>Urban</i>	<i>Sig.</i>	<i>3</i>	<i>4</i>	<i>Sig.</i>	<i>3</i>	<i>4</i>	<i>Sig.</i>	<i>A</i>	<i>EA</i>	<i>ig.</i>
<i>Water</i>	<b>9.9</b>	<b>3.8</b>	<b>.01</b>	4.3	6.6	.18	4.3	6.9	.15	8.0	4.8	.15
<i>Energy</i>	<b>5.7</b>	<b>0.9</b>	<b>.01</b>	<b>0.0</b>	<b>4.4</b>	<b>.00</b>	2.3	2.4	.48	2.3	2.1	.46
<i>Wastes</i>	<b>0.5</b>	<b>3.3</b>	<b>.00</b>	<b>0.6</b>	<b>4.3</b>	<b>.00</b>	<b>3.6</b>	<b>1.4</b>	<b>.01</b>	<b>4.2</b>	<b>2.1</b>	<b>.03</b>
<i>Total</i>	1.4	1.9	.27	<b>9.8</b>	<b>3.6</b>	<b>.00</b>	<b>2.5</b>	<b>1.2</b>	<b>.04</b>	<b>3.2</b>	<b>1.4</b>	<b>.03</b>
<i>Attitude orientation prevalence's towards the environment</i>												
<i>Orientation</i>	<i>Rural</i>	<i>Urban</i>	<i>Sig.</i>	<i>3</i>	<i>4</i>	<i>Sig.</i>	<i>3</i>	<i>4</i>	<i>Sig.</i>	<i>A</i>	<i>EA</i>	<i>ig.</i>
<i>Pro-NEP</i>	<b>8.5</b>	<b>0.8</b>	<b>.04</b>	<b>7.3</b>	<b>4.7</b>	<b>.00</b>	9.0	7.5	.10	<b>0.4</b>	<b>8.0</b>	<b>.05</b>
<i>Pro-DSP</i>	6.2	6.6	.34	<b>7.5</b>	<b>5.4</b>	<b>.01</b>	<b>7.4</b>	<b>9.6</b>	<b>.01</b>	8.2	8.4	.44
<i>Unsure</i>	<b>5.3</b>	<b>2.6</b>	<b>.01</b>	<b>5.2</b>	<b>9.9</b>	<b>.00</b>	3.6	3.0	.27	<b>1.4</b>	<b>3.7</b>	<b>.03</b>
<i>Pro-NEP attitude concordance prevalence's (%)</i>												
<i>NEP group items</i>	<i>Rural</i>	<i>Urban</i>	<i>Sig.</i>	<i>3</i>	<i>4</i>	<i>Sig.</i>	<i>3</i>	<i>4</i>	<i>Sig.</i>	<i>A</i>	<i>EA</i>	<i>ig.</i>
<i>Limits to growth</i>	<b>2.8</b>	<b>8.1</b>	<b>.00</b>	<b>1.2</b>	<b>3.2</b>	<b>.00</b>	4.7	8.3	.17	8.2	6.2	.55
<i>Anti-anthropocentrism</i>	2.4	2.1	.46	<b>0.8</b>	<b>5.6</b>	<b>.04</b>	4.6	0.1	.06	4.9	3.3	.62
<i>Fragility of nature's balance</i>	7.9	0.2	.20	<b>5.8</b>	<b>4.1</b>	<b>.00</b>	0.5	8.7	.46	4.4	2.6	.59
<i>Rejection of exemptionalism</i>	1.2	0.5	.41	<b>8.4</b>	<b>4.9</b>	<b>.02</b>	2.6	9.9	.31	8.6	7.8	.79
<i>Possibility of an eco-crisis</i>	0.6	2.1	.30	<b>8.6</b>	<b>6</b>	<b>.00</b>	2.6	0.5	.42	<b>5.5</b>	<b>8</b>	<b>.02</b>
<i>Environmentally responsible behavior prevalence's (%) (always + very often)</i>												
<i>Themes</i>	<i>Rural</i>	<i>Urban</i>	<i>Sig.</i>	<i>3</i>	<i>4</i>	<i>Sig.</i>	<i>3</i>	<i>4</i>	<i>Sig.</i>	<i>A</i>	<i>EA</i>	<i>ig.</i>
<i>Water</i>	<b>4.9</b>	<b>1.9</b>	<b>.00</b>	<b>6.7</b>	<b>4.3</b>	<b>.00</b>	<b>1.9</b>	<b>7.6</b>	<b>.03</b>	9.6	0.0	.44
<i>Energy</i>	<b>8.1</b>	<b>1.5</b>	<b>.00</b>	<b>5.8</b>	<b>0.9</b>	<b>.00</b>	9.6	7.4	.10	9.5	8.3	.29
<i>Wastes</i>	<b>1.0</b>	<b>5.1</b>	<b>.03</b>	<b>1.7</b>	<b>7.0</b>	<b>.01</b>	5.3	2.5	.08	4.0	4.2	.47
<i>Total</i>	7.6	8.1	.35	7.3	9.1	.07	<b>9.2</b>	<b>6.7</b>	<b>.02</b>	8.4	8.0	.39



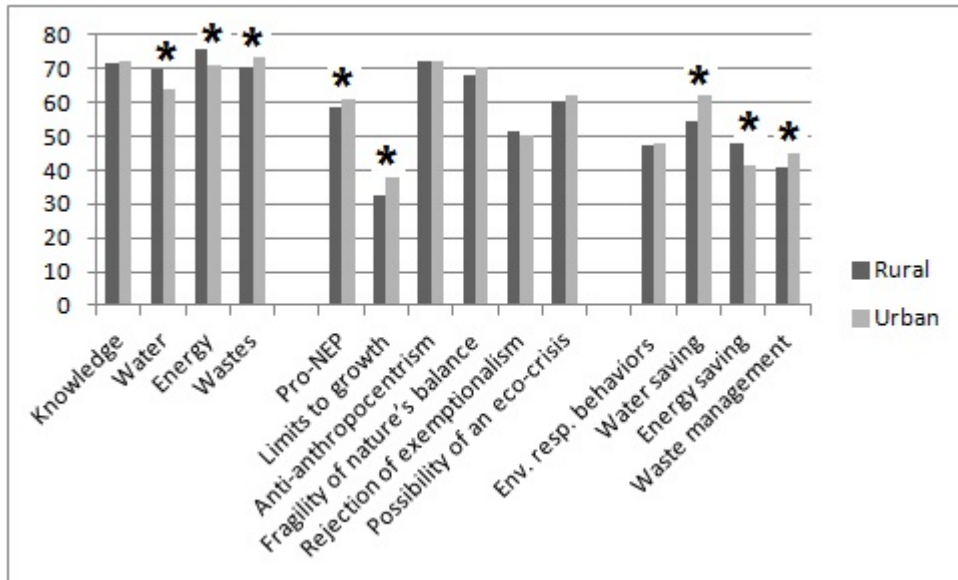


Figure 1. Correct answers prevalence's for environmental knowledge (in total and for each theme: water, energy and wastes); Pro-NEP (pro New Ecological Paradigm) attitude concordance prevalence's in total and for each group item: limits to growth, anti-anthropocentrism, fragility of nature's balance, rejection of exemptionalism, and possibility of an eco-crisis; and environmentally responsible behaviour prevalence's in 'always' plus 'very often' basis (in total and for each theme: water, energy and wastes), in 9th grade students from Madeira Island by area of residence (urban and rural). Statistical significant  $p \leq 0.05$  signalled with \*.

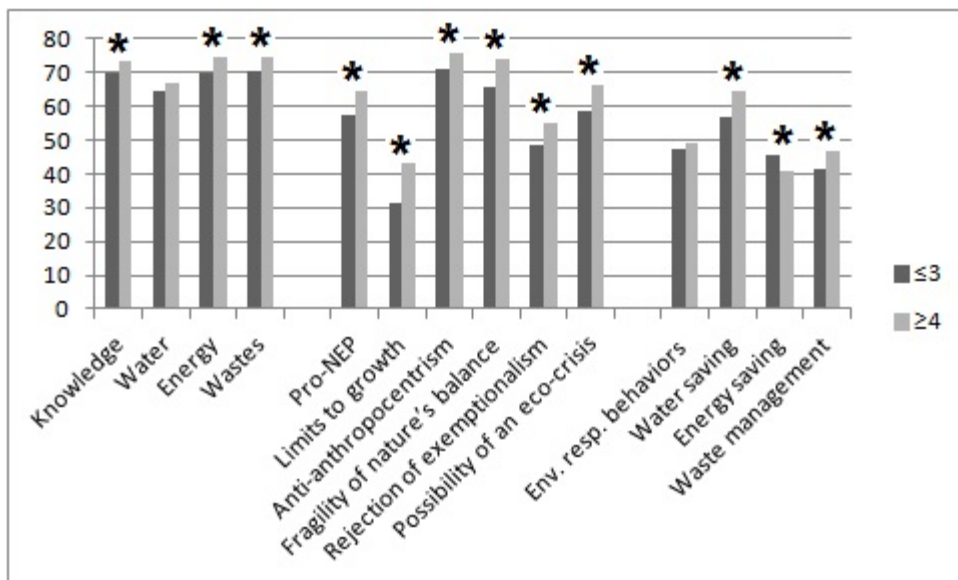


Figure 2. Correct answers prevalence's for environmental knowledge (in total and for each theme: water, energy and wastes); Pro-NEP (pro New Ecological Paradigm) attitude concordance prevalence's in total and for each group item: limits to growth, anti-anthropocentrism, fragility of nature's balance, rejection of exemptionalism, and possibility of an eco-crisis; and environmentally responsible behaviour prevalence's in 'always' plus 'very often' basis (in total and for each theme: water, energy and wastes), in 9th grade students from Madeira Island by marks in 8th grade Natural Sciences discipline (≤3 and ≥4). Statistical significant  $p \leq 0.05$  signalled with \*.

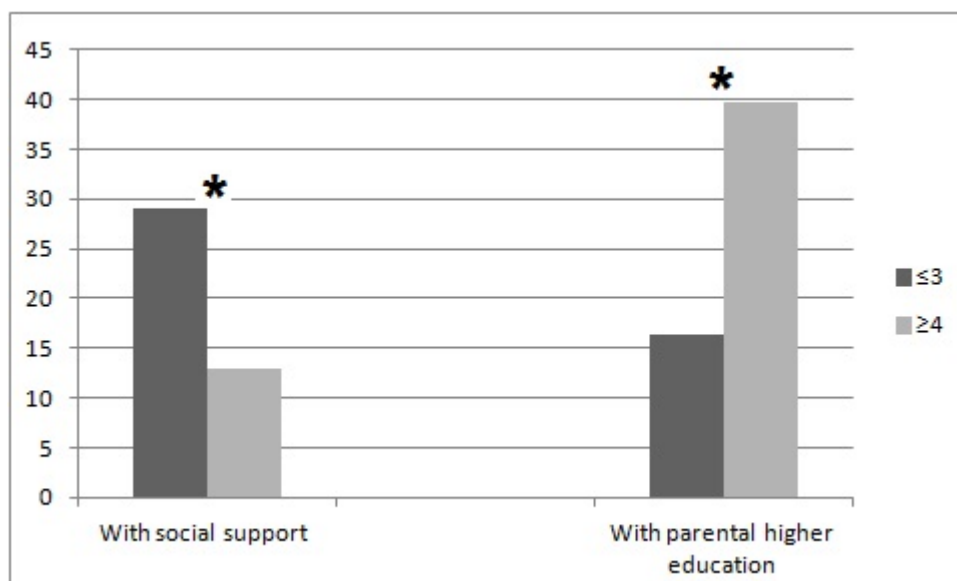


Figure 3. Relationship between socioeconomic indicators (social support and parental higher education) and marks in the 8th grade Natural Sciences discipline ( $\leq 3$  and  $\geq 4$ ) for 196 9th grade students from an urban school included in present study. Statistical significant  $p \leq 0.05$  signalled with \*.

## Discussion

The results of present study were successful in identifying strong predictors for overall environmental literacy, as well for each one of its components evaluated (knowledge, attitude and behaviour). Consistently with previous studies, female, participation in environmental activities, rural residence for some aspects and urban for others and higher marks in 8th grade Natural Sciences discipline were positively associated to higher levels of environmental literacy in 9<sup>th</sup> grade students from Madeira Island (Portugal).

The relationship between education and environmental literacy is well established and a greater understanding of science has been associated to a higher identification with a pro-environmental paradigm (Hamilton, 2008; Shin et al., 2005), which is consistent with the higher environmental literacy levels among students with better performance in Natural Sciences. However, the positive influence of the 8<sup>th</sup> grade Natural Sciences discipline performance could be an indirect effect of its strong linkage with SES, demonstrated in present study (Figure 3) and elsewhere (Coleman, 1966). In fact, as income and occupational status increase environmental concern tends to be greater (Van Liere & Dunlap, 1980; Shin et al., 2005; Lyons & Breakwell, 1994; Hines et al., 1986/87), in the assumption of a hierarchy of needs in which environmental concerns arise only when basic needs are met (Maslow, 1970). This strong influence of the student's SES had been emphasized by Taylor and colleagues (2009, p. 4) with a very clear statement: "wealthy 'middle class' people have the luxury of the 'privilege of concern', because they have the financial ability to look beyond their own livelihood, explore global issues, and make the connections between the environmental and wealth generations. In contrast, people from lower socioeconomic groups do not have the option of such 'luxury', and it is only when they are involved in a practical and direct way with their local environment that they too can go on to make such connections". Nevertheless, it is of much importance underline that, despite the higher availability for an environmental concern from those who had solved their survival questions, this not always results in environmentally responsible behaviours since the easier access to



resources due to their higher SES implies, frequently, higher consumption levels and, consequently, a heavier ecological footprint. Our results support this analysis since, despite their better levels of environmental literacy, these students from families with higher income tend to consume more energy, especially due to a most frequent car use. Despite an exception on this positive association, the higher car use among students with better marks supports the link between environmental literacy and SES, since we can assume that this unsustainable behaviour could be mostly dependent on the financial resources available in the family than in a lack of the student's environmental motivation. In fact, reducing car use was considered to be subject to high behavioural costs and influenced by strong constraints, namely those with non-environmental motivations such as affective and symbolic factors (Bamberg & Schmidt, 2003; Hunecke et al., 2001). Besides that, in the present situation, the car use among 9<sup>th</sup> grade students is obviously most dependent on their parent's options than their own, which could explain the incongruence with the general tendency for higher levels of environmental literacy among students with better Natural Sciences marks and higher SES. Still, we can argue that, since Natural Sciences curriculum includes environmental education contents (Tracana et al., 2012), this positive influence on the environmental literacy could be a direct contribution of this particular discipline. An influence in the opposite direction is another way of seeing it, being the higher environmental literacy that influences better marks in Natural Sciences discipline as it was previously demonstrated (Lieberman & Hoody, 1998).

Interestingly are the non linear influences of the student's residence area. The weight of economic and socio-cultural context on this variable could be the reason for the positive effects that both urban and rural residence exerts on environmental literacy, depending on the components we are considering. For example, rural students show a higher prevalence on energy saving behaviours, which is mostly due to a significantly lower mobility depending on their parent's car (e.g. using parents as their chauffeurs to go to school: 31.4% for rural students against 50.8% for urban, in a 'always' and 'very often' basis,  $p=0.00$ ). A similar effect was found with the lowest marks in Natural Sciences discipline, which is also dependent on a lower socio-economic status (see above). Knowing that the results of present study reveals that urban students had significantly better marks in Natural Sciences discipline than rural (marks  $\geq 4$ : 55.2% for urban students against 43.7% for rural,  $p=0.013$ ), this similar effect could be in fact, again, a direct influence of SES, especially if we take in account that average family income tends to be lower in urban areas. However, socio-economic status shouldn't be the only influence on energy saving behaviours, namely in mobility, since rural students also show a significantly better knowledge in this same specific theme, which can't be explained through the linkage 'better socio-economic status - higher marks' because rural showed lower marks than urban. Another example supporting the idea that the predictor 'area of residence' could be in fact a pool of contexts that differently influence the components of the environmental literacy, are the results obtained for waste knowledge and behaviours. In this specific theme, both knowledge and environmentally responsible behaviours are most prevalent among urban students, which could be explained with the fact that Funchal city has a better and most dynamic system on waste management. In fact, Funchal, since the middle of the 1990s, put in place consistent environmental campaigns and a waste management system with three-stream collection for recycling, which could be the driver for today's urban students be more informed and participative. Also, the incongruent influence of urban and rural residence on water theme, with better knowledge for rural students but a higher prevalence of water saving behaviours among urban, could have been driven by the higher water prices in the city or by the fact that this rural areas are rainy. The balanced influence of rural and urban residence in different aspects of the environmental literacy is consistent with previous studies that reported a tendency for

better performance in urban residence, supposedly due to their poor environmental conditions that could lead to greater levels of environmental concern, but also variations dependent on the type of environmental concern tested (Van Liere & Dunlap, 1980). Also, a narrowing in urban/rural differences seems to be in place and over time. rural residents are catching up urban and showing higher environmental concern (Jones et al., 2003). Our results reveal that female students tend to show better knowledge, attitude and behaviours towards the environment, a result consistent with existent literature (Gifford et al., 1982/83; Hines et al. 1986/87; Cordeiro, 2010; Almeida & Azeiteiro, 2011). These results, rather than an outcome of a gender intrinsic/biologic influence, could be a consequence of the specific socio-cultural context that encompasses female condition in our society. In fact, gender, being subject to stereotypes, represents an important component of socio-cultural context with strong influences in the learning outcomes (Igbo et al., 2015). Also, since female students show significantly better marks in Natural Sciences discipline (marks  $\geq 4$ : 56% for female students against 48.1% for male,  $p=0.043$ ) this tendency to present a better performance in environmental literacy could be an influence of the curriculum itself as also of the SES, despite we didn't found signs of a higher SES through a significantly higher car use (e.g. using parents as their chauffeurs to go to school: 46.4% for female students against 43.9% for male, in a 'always' and 'very often' basis,  $p=0.29$ ). Despite lacking empirical support, Van Liere and Dunlap (1980) hypothesized that when men have a lower level of environmental concern it could be because of competing interests, meaning that men's higher concern with economic issues comes at the expense of environmental concern. Later, Davidson and Freudenburg's (1996) also attempts to explain gender differences in environmental concern (Davidson & Freudenburg, 1996). Among those with more empirical support, they stated that women are more concerned about the environment when the risks involve issues of health or safety and, since there is a negative association between institutional faith and environmental concern, because they are less trusting of institutional structures. Despite our study does not attempt to explain gender differences, it is interestingly to note that the profound changes that women experienced in their social and economic role along the past decades seems not to have blurred the gender effect in environmental literacy. However, the above explanations for gender differences need to be carefully considered in the analysis of present results, since our subjects were constituted by young people with average age of 15 years, which, obviously, were not yet be fully integrated in their adulthood. Also, accordingly to Price and Bohon (2012), gender shouldn't be considered alone in their association to environmental literacy since male and female could be differently influenced by socio-demographic characteristics. For example, Price and Bohon (2012) found that women more educated increases their concern for the environment in opposition to a decrease found in men. Thus, to better understand gender influence on environmental literacy levels among students from Madeira Island (Portugal), future studies need to be done in which other variables defined by literature should be included and an evaluation between gender and socio-demographic characteristics should be considered. Also, the important role that gender plays in environmental literacy outcomes should be taken in consideration on environmental education projects and campaigns. The higher commitment with the environment, especially through their behaviours, found in present and previous studies among female students suggest that environmental education should use this empathy to bring male students closer to the environmental concerns, namely through groups that include both genders and are committed to solve specific environmental problems (Stevenson et. al., 2013).

On concordance with previous studies (Brody & Storksdieck, 2013), our results show that the participation on school's environmental activities is also an important predictor for higher levels of environmental literacy, especially for environmental knowledge and

concordance with the New Ecological Paradigm but with no relevant effect on environmentally responsible behaviours. Since only 20.6% of the 9th grade students from Madeira Island assume to have participated in school's environmental activities in the past few years, and considering its importance for environmental education performance, a higher dynamism is needed in order to integrate the school community in most practical activities. Unfortunately, stocked between walls, children have been increasingly sidelined from a nature contact and interaction, a reality with concerning effects on their physical and mental health (Louv, 2005). Besides that, the loss of contact with the outside environment also weakens the physical and emotional connections with the natural world, which leads to a lower willingness to actively participate in its protection (Louv, 2005).

When, considering previous (Author, in press) and present results, consistent environmental education projects, such as EcoSchools, are less determinant in the development of environmental literacy than the socioeconomic context in which students are entered, it is clear that the effectiveness in environmental education implies a partnership with the surrounding community and a higher fluidity well beyond the limits imposed by the school walls. Thus, socio-demographic variables need to be centred in the environmental education process, especially understanding it as the reflex of an environmental, economic and sociocultural context in which learning outcomes are maximized. In fact, Lucas (1979) considers that the context to develop environmental literacy needs to be the environment itself in which students could be involved in the implementation of environmental protection measures. In other words, environmental education should be based in learning with the environment and to the environment. Other authors agree with this and argues that students should had the opportunity to solve, actively and democratically, local environmental problems as a way to understand the relationship with their lives as well to feel motivated by the success of their one actions (Uzzell et al., 1995). So, the environmental literacy, cultivated by the environmental education, found a fertile ground in the context of Vygotsky's (1978) socio-cultural theory of human learning. In fact, also in environmental literacy, learning occurs through the interaction with the social environment and, to be effective, needs real learning contexts. For that reason, environmental literacy tends to be higher when a direct contact with nature is promoted as well when the interaction with the environment and its problems is mediated by an adult role model (Brody & Storksdieck, 2013). Therefore, the predictors for environmental literacy evaluated on present study, as also many others, could mirror the effects of this framework.

## **Conclusions**

Evaluating environmental literacy and identifying their predictors in different populations is an important contribution to better understand the pathway through which environmental education could be more effective. Besides the determinant influence of SES, present study identified two strong environmental literacy predictors among 9th grade Madeira Island students: rural or urban residence and higher marks in 8th grade Natural Sciences discipline; and two weaker: female and participation in school's environmental activities. Environmental education programs and strategies in Madeira Island (Portugal), as well as elsewhere, need to consider the fact that students and schools economic and socio-cultural contexts exert an important influence on environmental literacy achievements and, that way, a better integration with local community is needed. In fact, predictors included in present study, and commonly used on several others, seem to be pools of economic and socio-cultural contexts that strongly influence environmental literacy. However, new evaluations and studies need to be done with Madeira Island students not only to include different age groups but also to better understand the effects of the social and environmental contexts in the

development of the environmental literacy and, especially, to evaluate the specific influence of SES. Also, gender association with environmental literacy needs to be refined and linked to socio-demographic characteristics in order to better understand its relationship with socio-cultural contexts. Present and future enlightenments will be helpful to design most effective environmental education programs and strategies suited not only for Madeira Island but also for any other specific context.

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### Biographical statement

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# Madeira Adası (Portekiz)'nda Çevre Okuryazarlığı: Demografik Değişkenlerin Etkisi

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## Özet

Demografik faktörler çevre okuryazarlığını ve özellikle çevreye karşı davranışları doğrudan ve çeşitli değişkenlerle dolaylı olarak etkilemektedir. Bu çalışma Madeira Adası (Portekiz)'ndan 9. Sınıf öğrencilerinin çevre okuryazarlıkları üzerine bir dizi demografik değişkenin yordamasını ölçmektedir. 491 öğrencinin cinsiyet, yaşadığı yer (kırsal ve şehir), 8. Sınıf Doğa Bilimleri dersi başarıları, okuldaki çevre etkinliklerine katılımları ve dolaylı olarak sosyo-ekonomik düzeylerinin çevre okuryazarlığı ve özellikle üç temel boyut: Bilgi, tutum ve davranış üzerine etkisi ölçülmüştür. Sonuçlar çevre okuryazarlığının üç temel (yaşadığı yer, 8. Sınıf doğa bilimleri dersi başarı düzeyinin yüksekliği ve yüksek sosyo-ekonomik düzey); iki tane de zayıf (kızlar ve okuldaki çevre etkinliklerine katılım) yordayıcı olduğunu göstermektedir. Araştırmanın bulguları, önceki araştırmalar gibi çevre eğitimi etkinliklerinde sosyo-demografik faktörlerin merkezde bulundurulması ihtiyacını göstermektedir. Demografik değişkenleri çevresel, ekonomik ve sosyo-kültürel içeriği yansıtması açısından çalışmanın bulguları çevre okuryazarlığının Vygotsky'nin gerçek öğrenme içeriklerinin öğrenmede temel rol oynadığını savunan sosyo-kültürel teorisi ışığında desteklediği belirlenmiştir. Ayrıca çevre okuryazarlığı sosyal çevreyle etkileşim ve etkili gerçek öğrenme içeriklerine ihtiyaç duymaktadır. Demografik değişkenlerin Madeira Adası'ndaki öğrencilerin çevre okuryazarlığında sosyo-ekonomik düzeylerle güçlü ilişkisi vardır.

**Anahtar Kelimeler:** Çevre eğitimi, Çevre okuryazarlığı yordayıcıları, demografik değişkenler, Madeira Adası.