International Journal of Business, Human and Social Sciences
ISSN: 2517-9411
Vol:6, No:6, 2012

Sustainable Development Contributions among University of Madeira (Portugal) Students

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***Abstract*—**Sustainable development is highly dependent on the implementation of environmental education programs, which has as its ultimate goal to produce environmentally literate citizens that undertake environmentally friendly actions. Efforts on environmental education along past years are now perceived on the increase of citizens awareness on European countries and, particularly, in Portugal. However, we still have a lack of information on the prevalence of specific behaviors that contributes to sustainability, influenced by a new attitude toward the environment. The determination of pro-environmental behaviors prevalence in higher education students is an important approach to understand to which extend the next leading generation is, in practice, committed with the goals of sustainable development. Therefore, present study evaluates the prevalence of a specific set of behaviors (water savings, energy savings, environmental criteria on shopping, and mobility) on the University of Madeira students and discusses their commitment with sustainable development.

***Keywords*—**Pro-environmental behaviors, sustainable development, environmental education, higher education students

I. Introduction

In 1987, World Commission on Environment and Development presented Our Common Future report, where sustainable development was defined as a development that meets the needs of the present without compromising the ability of future generations to meet their own needs [1]. This report was an important step to the success achieved on the Sustainable Development Summit in Rio de Janeiro, Brazil, in 1992, which spread all over the world a growing concern about global problems, namely ozone layer depletion, climate change, deforestation, biodiversity loss and pollution.

Before that, 3 international conferences in the 1970's launched education as the main path to achieve solutions to environmental problems and, consequently, to achieve a sustainable development. This important moments were the United Nations Conference on the Human Environment, held in Stockholm in 1972, the Belgrade Workshop in Environmental Education, in 1975, in which the Belgrade Charter was adopted, and the Intergovernmental Conference on Environmental Education, organized by UNESCO on Tbilisi in 1977 [2]. Tbilisi conference defined that the ultimate goal of environmental education is to produce environmentally literate citizens that undertake environmentally friendly actions [3-4]. In Portugal, since 1986, after the publication of a new educational system law, environmental thematic has been included in the extracurricular school activities [5].

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In consequence, an increasing work in environmental education has been done in elementary schools along the 1990s in a multidisciplinary approach, involving different institutions from the community. Saving tap water and lighting energy, as also promoting good practices in waste management, are among the main targets chosen on those environmental campaigns in order to increase environmental awareness among students and general public in Portugal.

However, some enquiries have shown that Portuguese are less concerned and less participative in this subject than other Europeans. Eurobarometer 2008 report shows that Portuguese are among the less informed about the environment and are not willing to pay more for environmentally friendly products. Other national enquiries, published in 1999 and 2001, shown a low participation level in environmental protection. More than 60% considered themselves with few or none of the information needed to contribute in the environmental protection. Positive environmental actions with higher prevalence among Portuguese are also associated with economic savings. Almost 58% always close tap water when brushing the teeth and 75% switch off unnecessary lighting, but only 30% uses public transports [6-7].

In their majority, current higher education students in Portugal belongs to the first generation involved in the environmental education programs of the elementary school. For that reason, and considering the fact that higher education students will probably play an important role in the next leading generation, it is important to know if, in their actions, they are really engaged with the sustainable development.

Madeira is a small archipelago that belongs to Portugal and is located in the Atlantic Ocean, almost 600 km from Morocco. Despite the small population (almost 270,000 inhabitants), Madeira has its own university with more than 3,000 students, the majority originating from the archipelago itself. In present study, we address the prevalence of practical contributions for a sustainable development among the students of the University of Madeira and discuss the results obtained in the light of the ultimate goal of environmental education, to produce environmentally literate citizens that undertake environmentally friendly actions.

II. Method

A. Research design

In order to evaluate the prevalence of pro-environmental behaviors in students of the University of Madeira (Portugal) we developed a questionnaire spanning over their individual and practical contributions for a sustainable development. Considering the Portuguese past efforts in environmental education, is expected that higher education students are able to distinguish between pro-environmental behaviors and those who are not.

This could lead them to choose, in a self reported behavior approach, to choose the environmentally correct answers instead of the real behaviors practiced. To avoid this, the questionnaire was developed to be, as much as possible, blind to their real purpose. Accordingly, the questionnaire was presented as a general assessment of the habits and concerns of students of the academic community and their questions carefully written in order to hide the environmental target. Because of that, the questionnaire is mainly constituted of indirect questions that allow us to infer about the prevalence of real behaviors and avoid politically correct answers.

To reduce the number of students unavailable to answer to our questionnaire, we selected only eight simple but highly informative questions, as follows:

The first question addresses the student's general concern on global problems and allows us to evaluate the relative position of the environmental concern. This question is also important to analyze if students choosing environmental problems as their biggest concern tends to show higher prevalence of pro-environmental behaviors: *1st question- What is your biggest concern right now? Choose one: Wars; Refugees; Poverty; Environmental problems; Economic crisis.*

The second question evaluate if students choose products considering its origin. Local goods tend to represent a more sustainable option due to energy savings in transportation and local farmers/producers support. At least, having a "No" for answer will mean that students, as consumers, don't consider choosing local products, the most sustainable option: *2nd question - Do you regard the origin of the products you buy? Choose one: Yes; No.*

The third question refers also to shopping behavior but now about a broader criterion than in the previous question. It intends to identify the prevalence of responders that confer to environmental criterion the biggest importance when choosing a product, in opposition to price or quality. It will also help us to infer if environmental criterion is the driving motion on students concern for the origin of products: *3th question - What is the most important criterion in your purchasing decisions? Choose one: Price; Quality; Environment.*

The fourth question is specific for individual mobility behaviors and is important to characterize one of the most important everyday actions that have a biggest impact on individual ecological footprint and sustainability due to emission of greenhouse gases and other air pollutants: *4th question - How do you usually transport yourself to the University? Choose one: Motorcycle; Car; Public transports; Walking.*

The fifth question relays on saving water and the answer will be interpreted in order to know if the student usually let the tap water running when brushing the teeth or shampooing in shower: *5th question - When you brush your teeth how many times do you open tap water? And in the shower?*

The sixth question search for the contributions on the prevention of standby mode consumption of electricity: *6th question - Where do you usually switch off the television? Choose one: Through remote control; Through TV button.*

The seventh question search also for pro-environmental behaviors on energy saving but, this time, on the adoption prevalence of energy efficient light bulbs: *7th question - At home, in the room you use most, what kind of light bulbs do you have? Choose one: Fluorescent bulbs; Incandescent bulbs.*

Finally, the octave question addresses electricity savings through lighting control: *8th question - Do you usually switch off unnecessary lighting? Choose one: Yes; No.*

This questionnaire was randomly applied in direct interviews to 205 students (134 females and 71 males, about 7% of total students) approached in previously defined places along the university campus.

B. Data analysis

The answers to each question were analysed through direct counting and their prevalence calculated in percentages in total samples and by gender. We also calculated the prevalence of pro-environmental behaviors in two groups of students: those who selected the *Environmental problems* as their main concern and those who selected other biggest concerns. Statistically significant differences ($p<0.05$) were calculated using Fisher Exact Test as defined by Agresti [8].

III. Results

Table I shows behaviors prevalence arranged by category: total; females; males; environmentally concerned; and other concerns. Forty percent of students appointed economic crisis as their biggest concern, followed by poverty (31%) and environmental problems (18%). Despite statistically significant differences ($p<0.05$) between gender in the prevalence of economic crisis concerns, higher in student males, and poverty concerns, higher in student females, environmental problems concern is similar between both sexes.

TABLE I
BEHAVIORS PREVALENCE
Global concerns, and shopping, mobility, water and energy behaviors prevalence among University of Madeira students, arranged by category: Total (n=205); Female (n=134); Male (n=71); Biggest concern with the environment (n= 40) and; Other concerns (n=165). Statistically significant differences ($p<0.05$) are marked in bold.

Answer	Total	Female	Male	Biggest concern	
Global concerns *1. What is your biggest concern right now?*					
Wars	9.4%	11%	6.8%	Environ-ment	Others
Refugees	1.7%	1.9%	1.4%		
Poverty	31%	**38%**	**15%**		
Environment	18%	18%	18%		
Economic	40%	**31%**	**59%**		
Shopping *2. Do you regard the origin of the products you buy?*					
Yes	34%	34%	34%	40%	34%
No	66%	66%	66%	60%	66%
3. What is the most important criterion in your purchasing decisions?					

Price	57%	61%	49%		
Quality	39%	36%	45%	87%	98%
Environment	3%	2.6%	3.6%	**10%**	**2%**
Other	1%	0.7%	2.4%	3%	0%
Mobility *4. How do you usually transport yourself to the University?*					
Motorcycle	3.4%	1.5%	7%		
Car	48%	45%	54%	42%	52%
Public transports	41%	**48%**	**28%**	58%	48%
Walking	7.6%	5.9%	11%		
Water *5. When you brush your teeth how many times do you open tap water?*					
One (open)	24%	22%	27%	15%	28%
Many (close)	76%	78%	73%	85%	72%
5.1. And in the shower?					
One (open)	51%	47%	59%	32%	53%
Many (close)	49%	53%	41%	**68%**	**47%**
Energy *6. Where do you usually switch off the television?*					
Remote control	61%	65%	54%	57%	63%
TV button	39%	**31%**	**46%**	43%	37%
7. At home, in the room you use most, what kind of light bulbs do you have?					
Fluorescent	52%	50%	56%	63%	50%
Incandescent	48%	50%	44%	37%	50%
8. Do you usually switch off unnecessary lighting?					
Yes	88%	89%	86%	**100%**	**85%**
No	12%	11%	14%	0%	15%

When shopping, the majority (66%) of the respondents don't base their choices in the product origin, being price (57%) and quality (39%) the most important criteria. The environmental criterion is the most important to only 3%. Although only 10% of the students highly concerned with environmental problems did actually assumes environmental criterion as the most important when shopping, it is a statistical significant higher prevalence than in the students most concerned with other problems (2%). Among students that base their choices in products origin (34%), only one respondent assume the environment as its principal criterion (data not shown). Some students on this group reveal that their products origin attention is driven by the concern about child exploitation and products quality.

More than half of total students drive (car: 48%; and motorbike: 3.4%) to the university, the rest goes by bus (41%) and on foot (7.6%). Female students (48%) have a use of public transportation (bus) statistically higher than male students (28%). Despite the students with higher concern on environmental problems show a more sustainable mobility (58%, by bus an on foot) than the others (48%), the difference is not statistically significant. These results show that the use of public transportation among the students of the University of Madeira is significantly higher than in the Portuguese general population (30%) [7].

Saving water when brushing the teeth is highly frequent (76%) among the University of Madeira students and significantly higher than in Portuguese population (58%) [7].

However, the most concerned with environmental problems doesn´t show a significant higher frequency (85%). Saving water on the shower (49%) is significantly higher in the students most concerned with the environmental problems (68%) than in the other concerns group (47%), but it is less frequent than when brushing the teeth. Considering together saving water when brushing the teeth and in the shower (Fig. 1), 43% of all students practice both behaviors and a third (32.4%) only does it when brushing the teeth. Saving water in both situations is significantly higher in the students most concerned with environmental problems (57.5) than in the others (39.2%) (Fig. 2). On total students, 7.4% saves water on shower but not when brushing the teeth, and 17.2% doesn't save water in neither of both situations (Fig. 1).

Switching off unnecessary lighting is a highly frequent behavior among students (88%), being significantly bigger among students concerned with environmental problems (100%) than in the others (85%). This behavior is also statistically most frequent than in the Portuguese population (75%) [7].

Switching off the television directly on the button of the apparatus, instead of doing it through the remote control, in order to avoid standby energy consumption, is not a highly frequent behavior among the students of the University of Madeira (39%), being statistically higher on student males (46%) than on student females (31%). Energy efficient bulbs were adopted by more than half of total students (52%), at least on the room most used.

The prevalence of pro-environmental behaviors in students most concerned with environmental problems was, in average, 12.6% higher than in others group. Those differences were statistically significant in "shopping with environmental criterion" (10% against 2%), "saving water on shower" (68% against 47%) and "switching off unnecessary lighting" (100% against 85%) (Fig. 3).

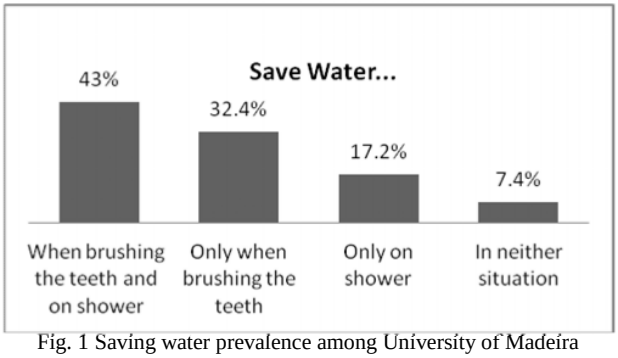

Fig. 1 Saving water prevalence among University of Madeira students

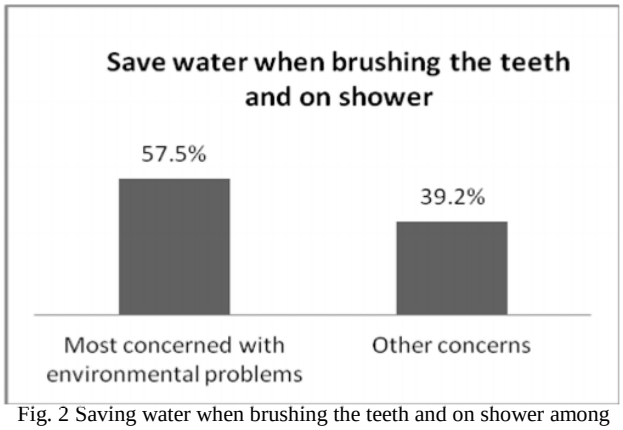

Fig. 2 Saving water when brushing the teeth and on shower among University of Madeira students, considering two categories: "most concerned with the environmental problems" and "with other concerns". Differences are statistically significant ($p<0.05$)

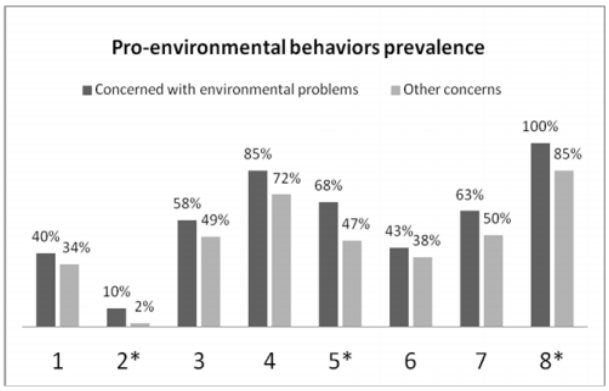

Fig. 3 Pro-environmental behaviors arranged in two categories: "most concerned with environmental problems" and "with other concerns". Statistically significance ($p<0.05$) between groups are marked*: **1**- Regard products origin when shopping; **2***- Consider environmental criteria when shopping; **3**- With a sustainable mobility; **4**- Save water when brushing the teeth; **5***- Save water on shower; **6**- Switch off TV on button; **7**- Uses efficient bulbs; **8***- Switch off unnecessary lighting

IV. Discussion

Although present study is not sufficient to define the relationship between pro-environmental behaviors in the University of Madeira students and specific projects or campaigns on education for sustainable development, it reveals the influence of two decades effort on schools and environmental non-governmental organizations. Generally speaking, results reveal that pro-environmental behaviors have been adopted by more than half of the University of Madeira students and, in particular cases, much more than that. However, this study shows great differences between pro-environmental behaviors, even among those a similar environmental contribution, unveiling the specificities of each behavior adoption. A higher pro-environmental behaviors prevalence in the students most concerned with the environmental problems shows that "awareness", despite not the only one important, has a great influence on the behaviors adoption.

The significant differences between "saving water when brushing the teeth" (76%) and "saving water on shower" (49%) is a paradigmatic example. Could these differences be interpreted as a higher motivation to save water when brushing the teeth than in the shower? Could be interpreted as a higher knowledge on how to save water when brushing the teeth than in the shower? Is it related with some loss of comfort, due to a decrease on the temperature, associated to closing the water on the shower? Or it is only the result of a lower level of internalization of the behavior of saving water on shower since most campaigns have been focused in the act of brushing the teeth? The differences among these two habits reveal the complexity of the changing behaviors process. Since it is not expected that who saves water when brush the teeth doesn't know how to do the same when on shower, the differences show the distance between the knowledge or attitude and the effective adoption of a behavior. On this specific situation, the "saving water on shower" lower prevalence could result from a highest distance between personal values and the specific action. This highest distance between knowledge/attitude and action reveals the existence of stronger barriers that difficult the behavior adoption. It would be important to investigate this specific situations in order to know what are these barriers, knowing that some of them could be related to a loss of comfort, namely due to the fact that many water heating systems doesn't guarantee water temperature maintenance when closing and opening the shower. To increase prevalence of "saving water on shower" behavior it will be necessary to reinforce individual motivation through environmental education programs that could overcome the existent barriers. Apart the influence of the existent barriers, considering that both behaviors adoption is significantly higher in students most concerned with environmental problems (57.5%) than in the others group (39.2%) (Fig. 2), it seems evident that the increase in environmental awareness is, for itself, very important on the adoption of these or other pro-environmental behaviors. In energy consumption, electricity or fuels, pro-environmental behaviors prevalence is not homogeneous, being most prevalent "switch off unnecessary lighting" (88%) and less prevalent "switch off television on button" (39%). However, all energy saving behaviors studied, namely "use public transportation or walking", "switch off unnecessary lighting", "use efficient bulbs" or "switch off television on button", show highest prevalence in students most concerned with environmental problems (Fig. 3). Although, taking into account energetic economic costs, we should take in consideration that a substantial motivation for these pro-environmental behaviors may be economic and not environmental, especially in the use of public transportation.

Once more, as was done for water saving behaviors, we need to address the question on why two pro-environmental behaviors with similar effects have such different prevalence. Why, despite a high prevalence of "switching off unnecessary lighting", the prevalence of "switching off television on button" is so low? We are talking about two different behaviors but both with the same goal of save electric energy. Keep a television in standby mode consumes more or less the same amount of electricity than an efficient bulb.

However, as the results show, despite few are capable of letting a bulb unnecessarily switched on when they go to sleep many, on the contrary, don't bother in let a television in standby mode all night long. In this situation, in opposition to what happens on the habits of saving water, it is not evident for all that switching off completely a television on the button will save energy as if switching off bulbs. Indeed, despite energy saving campaigns along past two decades have been focused on switching off bulbs, only recently some effort have been done to fight standby mode consumptions. Because of that, it is probable that the differences in the adoption of these two behaviors are strongly related to a standby mode energy consumption low knowledge and attitude.

More sustainable mobility, using public transportation or walking, is an important contribution to reduce the emission of greenhouse gases and prevent air pollution. Although it is a central issue in sustainability and in the mitigation of air pollution, sustainable mobility behaviors adoption is very difficult, loosing expression to the massive use of individual transport. Despite the use of public transport has been focused on the past decade environmental campaigns, the existent barriers to the adoption of a more sustainable mobility have been difficult to overcome. In the specific case of the mobility behaviors adopted by the University of Madeira students, we can see that almost half uses the bus (41%) or walk (7.7%).

This is a highest prevalence than in the Portuguese general population (30%) [7], probably because it is much less probable that the income of a student could afford an automobile. The differences on sustainable mobility habits among the students most concerned with environmental problems (58%) and others group (49%) are not statistically significant, which could reveal that other factors, in addition to the environment attitude and knowledge, constitute important barriers to the adoption of the behavior. Those barriers should include social and cultural factors that promote individual transportation in opposition to the bus, and others factors related to personal comfort and structural incapacities of public transport system. It is noteworthy the highest use of the bus by student females (48%) than student males (28%) which, again, should be related to social and cultural barriers that affect distinctively both genders. The reasons for these statistical differences should be studied in order to better adapt future environmental campaigns to promote the use of public transport.

Regarding shopping behaviors, present study reveals the need for a strong and effective environmental education campaign, focusing, particularly, in the adoption of environmental criteria and in the preference of local products.

V. Conclusion

This study identified the pro-environmental behaviors less prevalent among the University of Madeira students, which should be focused in future environmental education campaigns, especially standby mode energy consumption, environmental criteria adoption at shopping and public transportation use.

This work reveals also the need of specific approaches for each behavior that needs to be promoted since it is evident from our results that there is a lack of contagion effect between different behaviors, even between those that are strongly related.

Despite we can conclude that a higher concern with environmental problems lead to a most frequent pro-environmental behaviors adoption, it still's evident the existence of other importance factors that should be identified and taken into account in each specific case. The environmental campaigns, with the propose of transmit knowledge and induce action, need to be adapted to specific publics and identify and take into account the technological, social, cultural and others barriers that need to be overcome in order to facilitate pro-environmental behaviors adoption.

Increasingly, due to the growth of local and global environmental problems, such as climate change, air quality degradation and biodiversity loss, it is urgent to adapt environmental education programs to their ultimate goal, educate citizens to adopt environmentally friendly behaviors. In that way, besides the need to put in field new environmental education campaigns with focus in the less frequent but most consequent behaviors, it is indispensable to monitor its results in order to get the feedback needed to drive a continuous improvement of the methods used.

The University of Madeira, inserted in an insular and autonomic context, where the environment performance is crucial to social and economic development, should and could assume a prominent role in the promotion of sustainability, promoting the education, the research and providing services in environmental education and sustainability.

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