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Urban and Rural Children's Knowledge on Biodiversity in Bizkaia: Tree Identification Skills and Animal and Plant Listing

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***Abstract*—**Biodiversity provides humans with a great range of ecosystemic services; it is therefore an indispensable resource and a legacy to coming generations. However, in the last decades, the increasing exploitation of the Planet has caused a great loss of biodiversity and its acquaintance has decreased remarkably; especially in urbanized areas, due to the decreasing attachment of humans to nature. Yet, the Primary Education curriculum primes the identification of flora and fauna to guarantee the knowledge of children on their surroundings, so that they care for the environment as well as for themselves. In order to produce effective didactic material that meets the needs of both teachers and pupils, it is fundamental to diagnose the current situation. In the present work, the knowledge on biodiversity of 3rd cycle Primary Education students in Biscay (n=98) and its relation to the size of the town/city of their school is discussed. Two tests have been used with such aim: one for tree identification and the other one so that the students enumerated the species of trees and animals they knew. Results reveal that knowledge of students on tree identification is scarce regardless the size of the city/town and of their school. On the other hand, animal species are better known than tree species.

***Keywords*—**Biodiversity, population, tree identification, animal identification.

I. Introduction

BIODIVERSITY is an indispensable resource and a heritage for the upcoming generations [1], for it offers a great range of ecosystemic services such as food, tissues, pollination, cultural and aesthetic [2]. However, in the last decades, the increasing exploitation of the Planet has caused degradation of habitats, increasing abundance of foreign species and, consequently, a biodiversity loss [2]. In fact, while throughout the history of the Earth the disappearance of the species has happened by natural factors, due to humans' excessive exploitation of natural resources, the destruction of the species and ecosystems is currently occurring at a pace that has never previously been observed [1].

In such a framework, it is necessary to make a call of attention on the biodiversity crisis to humanity [3], so that the knowledge on biodiversity is recovered and, probably then, awareness of the need to care for biodiversity, and therefore, human behaviour might also change [4]. Finally, it is indispensable to educate responsible persons who can confront the crisis of the Planet [4]. Yet, this is not a new issue. In fact, the International Convention on Biological Diversity, agreed at the United Nations conference held in Rio de Janeiro in 1992 [5], on the need for education as a tool to slow down biodiversity loss. From then on, many actions have been taken [6]. For example, 2011-2020 has been acknowledged as "The Decade of Biodiversity". The final objective is to promote sustainable development, which will be acquired when the conservation and effective use of the environment meets the current needs without compromising the ability of future generations to meet their own needs [7]. Therefore, the binomial between biodiversity knowledge and conservation of nature is indispensable for sustainable development. In fact, knowledge is the most important factor for promoting a reasonable use of natural resources.

Nowadays, people have less relation with plants and animals and, consequently, in the last decades, children's knowledge and capacity to identify species of plants and animals regardless their origin has dramatically decreased [8],[9]. Unfortunately, the same trend has been reported amongst current teachers and those of the future [9]. Several studies state that human's ignorance on Biology is increasing, especially regarding plants. This phenomenon is acknowledged as "Plant Blindness" [10], [11]. The perception on the importance that species have on both biodiversity and sustainability has also decreased remarkably [12].

The skill to identify species increases as children grow up , until they are 8-9 years old, and it decreases afterwards [13], since the identification of organisms and their name does not seem to be important to them any longer [14]. Yet, a minimum knowledge on species to understand ecology processes is necessary [15].

Some authors report that Primary School students learn of species at home or through direct observation and scarcely at school [16]. This is directly related to education outside the classroom, since it is through the latter form of education that students can acquire experiences, interests and emotions [17]. In that sense, the work performed during field trips or in the mountains is excellent for the identification of species through direct observation. Besides, the knowledge of species, an interest in nature and the experiences lived in nature are the

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Open Science Index, Humanities and Social Sciences Vol:12, No:3, 2018 publications.waset.org/10008756/pdf

factors considered most important for understanding environmental issues and a sustainable life style [18]. On the other hand, some authors report that children from rural areas are more positive towards the environment and have greater skills in species identification [19]. However, other authors appoint no differences regarding either knowledge [20] or awareness [1], [21].

Knowledge on Biodiversity is crucial at the current curriculum in Primary Education [22]. Students at the 3rd cycle of Primary Education must contemplate the plurality and richness of the Basque and Spanish landscapes and show interest for the knowledge of their local environments. Also, beyond the contents, the Basque Government states the need to acquire capacities for the scientific, science and health cultures, so as to understand the consequences of human activities on the environment and on human health.

The goal of this work is double: First, the knowledge on Basque trees of 3rd cycle Primary Education students at two educational institutions of Biscay is to be analysed and compared amongst them and to that of their teachers. The second objective of this work is to detect the animals and trees most listed by alumni and teachers.

II. Materials and Methods

A. Biscay

Biscay is a province at the west of the Basque Country at the North West coast of the Iberian Peninsula. It occupies 2,217 km^2 and it is quite mountainous, although in general, soft slopes predominate. The oceanic climate of Biscay is Atlantic, mild (14.5ºC per year on average). Clouds are abundant throughout the whole year and it rains 1.400 mm per year on average.

As for lithology, rocks in Biscay are mainly sedimentary, both detrital (conglomerates, sandstones, etc.) and carbonated (limestones, marls, etc.).

The potential vegetation of Biscay would consequently consist of deciduous trees. At heights beyond 600 m, the European beech (*Fagus sylvatica*) would prevail and below that, oaks (*Quercus petraea* and *Quercus robur*) would appear. In the valleys and mixed forests, along with the oak, ash trees (*Fraxinus excelsior*), maples (*Acer campestre*), hollies (*Ilex aquifolium*), birches (*Betula celtiberica*), and chestnut trees (*Castanea sativa*), among others, would grow. Alders (*Alnus glutinosa*) would prevail at high phreatic level zones. However, human activities have changed the landscape. Nowadays, the area of Biscay is occupied by cities and infrastructures (7%), scrublands (8%), pastures and crops (%23), and trees (%58) [23]. In spite of the fact that more than the half of the area of Biscay is covered with trees, these are mainly pines (*Pinus radiata*), and eucalyptus (*Eucalyptus sp.),* which respectively occupy 70000 ha and 10191 ha; quite large areas compared to the smaller 5207 ha and 4237 ha areas occupied by indigenous trees: oaks and beeches, respectively.

B. Schools

Ninety-eight 3rd cycle Primary Education students joined this study, with 45 studying in a school located in Gernika, but most of these students lived in smaller villages nearby. The other 53 pupils studied in Bilbao. In addition, 18 teachers at the school in Bilbao (40 years old, in average) also filled in the questionnaires. None of them had specific knowledge on biodiversity.

The population of Gernika is 16,763 inhabitants [24]. It is located in the very centre of Urdaibai Biosphere reserve. For such reason and also because the students in Gernika lived in smaller villages outside of the area itself, the students of the school located at Gernika were considered to be quite attached to nature, both to coastal and forest environments.

Bilbao is the capital of the province of Biscay with a population 345,122 inhabitants [24]. Until the 1980s, Bilbao was an industrial city, with an economy based on steel and shipbuilding. However, Bilbao became a city of services, and nowadays the 67% of the economic activity corresponds to the services sector and the 24% to the industrial sector [25].

C. Tests

Two kinds of questionnaires were elaborated. The first consisted of the pictures of nine of the most abundant trees in Biscay: *Quercus pyrenaica* (Pyrenean oak), *Quercus robur* (Pedunculate oak), *Quercus rotundifolia* (Holm oak), *Eucalyptus globulus*, *Alnus glutinosa* (alder), *Pinus radiata* (Monterrey pine), *Fraxinus excelsior* (Common ash), *Fagus sylvatica* (beech) and *Betula celtiberica* (birch). Those surveyed were asked to identify the trees with their regular names in 20 minutes.

As part of the second survey, students and teachers were asked to list the name of any ten trees and animals they knew.

D. Statistics

Statistical differences between average data were assessed by ANOVA procedure at SPSS system version 24.

III. Results and Discussion

A. Identification of the Trees of Biscay

As it is observed in Table I, the average number of trees that were correctly identified is only as much as two out of nine. Also, no significant differences were attained among the number of right, wrong or blank answers obtained from pupils and teachers; however, the pupils at Gernika could significantly identify more trees (2.33) than those of Bilbao (0.73). There can be two reasons for this result. On the one hand, children and adults not in contact with the environment have a poor knowledge and are apathetic to environmental problems [26]. Therefore, children who live in rural areas hold a better knowledge of the environment, and of animals and plants [27]. In fact, industrialization and urbanization dramatically reduce interaction with nature and the interest in the fate of living beings; a situation that according to some researchers, can negatively affect the conservation of nature [28]. Additionally, technology causes a loss of the ecological and biological consciences [29].

As mentioned, no other significant differences were

detected among the groups compared: all of them failed or did not attempt to identify the same number of trees regardless of where they lived in or their occupations. Such is a remarkable result for it contradicts the specification of the Curricular Decree 236/2015 of the Basque Government on the need for Primary Education students (and their teachers) to know organisms and their habitats [22].

The tree most frequently identified by pupils from both locations was the pine, with a frequency of 39% and 82%, in Gernika and Bilbao respectively. In Gernika, children were also able to identify the eucalyptus 38% of the time, while in Bilbao children could identify it with a frequency of 18%.

As with the students, the tree mostly identified by the teachers was the pine (86%).

TABLE I
COMPARISONS OF NUMBER OF RIGHT, WRONG AND BLANK ANSWERS BETWEEN SCHOOLS, STUDENTS AND TEACHERS

	Right Average		Wrong Average		Blank Average	
Gernika	2.33	*	0.77	ns	5.9	ns
Bilbao	0.73		0.98		7.3	
Students	1.48	ns	0.88	ns	6.64	ns
Teachers	1.63		1.63		5.75	

* is significant at the 0.05 probability level, and ns is not significant at the 0.05 probability level.

Such results agree with the reality of the landscape of the province of Biscay. In fact, more than half of the area of Biscay below 600 m is covered with pine plantations, coloring most of the slopes with their characteristic green color [29]. On the other hand, the area occupied by eucalyptus trees is increasing, especially near the seashore [30]. Children, as well as people in general, are usually concerned about what they know, about species (plants or animals) present in their everyday [31]. It should also be mentioned that the oak is a symbolic tree for the Basque people. In fact, certain chosen oaks have been kept and revered since the 15th century in Gernika. It is thus evident from the results that in Biscay, Primary Education students need effective resources to learn about trees, as a positive attitude is not enough to learn concepts (and names) [8].

B Tree Lists

The students of the school in Gernika enumerated as many as 29 tree species; 42% of those listed all the 10 tree species they were asked for. The tree species they mentioned the most were as follows: oak (91% of the students), apple (84%), pine (80%), pear (60%) and cherry (51%). The oak, the apple and the cherry trees can be considered indigenous, while the oak is the only one that does not produce fresh fruit.

The students of Bilbao named 20 different tree species, while only 6% of those students enumerated 10 trees. The tree species they mentioned the most were the apple (70%), pine (60%), orange (43%) and lemon (39%).

Overall, teachers enumerated 33 different species; while 67% of the teachers named all the 10 species of trees they were asked for. The hazelnut (95%), birch (81%), palm (76%) and apple (66%) were the trees most frequently mentioned.

Fruit trees were often mentioned at both schools. However, according to the findings of Patrick and Tunnicliffe [31], the mentioning of fruit trees does not necessarily mean knowledge of that tree; it is more likely that the trees are named after their fruit, since it can be eaten or seen.

C.Animal Lists

Altogether, 98 questionnaires were collected. In those, students had listed the name of any 10 animals as a maximum. In Gernika, students enumerated as many as 68 species and 69 in Bilbao. In total, 95 animal species were named, almost the half of which, 42, were mentioned in both schools participating in this study. At both schools, pets were also mentioned but they were discarded for the sake of the study.

Better results were attained at the school in the rural area as compared to the one in the city: In Gernika, 42.3% of students surveyed mentioned all 10 species, while only the 6% of the students did so in Bilbao. Among the top 10 most mentioned species in Gernika, (wild boar, wolf, tiger, lion, fox, bear, deer, wildcat, eagle and crocodile) seven were native to the region; while for the top 10 most mentioned species (lion, tiger, snake, monkey, shark, elephant, wolf, bat, bear and zebra) in Bilbao, only four are native. When considering all the collected data, again, more native animals were mentioned by respondents from the smaller town: 40% vs. 24% (the result attained in Bilbao). Again, these results contradict the specification of the current curriculum which specifies that children should know mainly the species and ecosystems of the Basque Country [22].

Children are linked to animal images in their everyday life, either at home or via the media [32]. Many of those images are based on pets or animals that provide humans with milk, meat, eggs and honey [33]. Beyond that, in developed countries, children both in big cities and small towns, relate to exotic animals also via wildlife parks and zoos [31].

As it can be observed in Fig. 1, mammals, followed by birds, were the most frequently mentioned species at both schools. Other authors [13], [33], have also reported that pupils have a better knowledge of mammals than of birds or arthropods. In this sense, [34] claims that awareness of the biodiversity of the planet is scarce and that mammals and birds are too emphasized by media and conservationists. In fact, most of the animals in the Planet are insects [35]. In fact, the number of insect species is reckoned to be in the range of 2.5 to 10 million, and in spite of their small individual size, they are the most abundant and conform the largest biomass of animals [36].

Regarding biomes, pupils at both schools most mentioned animals from the savannah, the tropical rainforests and warm rainforests (Fig. 2). Such results lead to the conclusion that most of the animals that appear in the everyday lives of Basque children aged, 11-12 years, at school, in films, books, or cartoons. etc., are not indigenous.

Open Science Index, Humanities and Social Sciences Vol:12, No:3, 2018 publications.waset.org/10008756/pdf

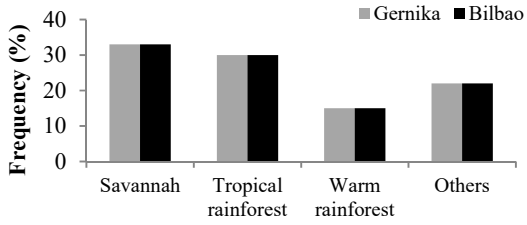


Fig. 1 Frequency with which animals were mentioned according to their taxonomy at the schools in Gernika and Bilbao

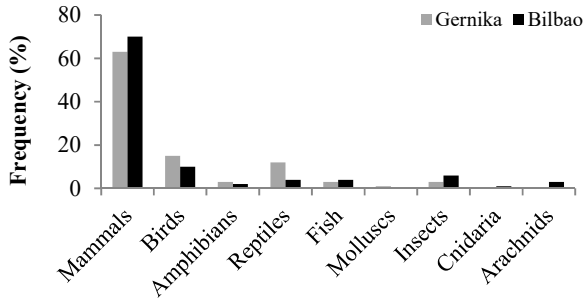


Fig. 2 Frequency with which animals were mentioned according to their biome at the schools in Gernika and Bilbao

D. Plant Blindness

It is remarkable that both in the smaller town and in the city, it was easier for the students to name animals rather than trees. As in many other countries [10], [31], the phenomenon of plant blindness or ignorance about plants, is also acknowledged among the students who participated in this research.

Modern societies are not aware of the value of plants and nature [37], even though humans are totally dependent on plants since they provide food, pharmaceutical products, clothes.... Yet, such needs also result in the demand for specific plants, and consequently, the loss of forests and jungles [38]; currently, 25% of all plant species are on the verge of disappearing.

Wandersee and Schussler [10] analyzed why animals are better acknowledged than plants. One possible reason is the fact that plants are sessile and have no attacking mechanisms. Another acquainted possible reason is that teachers usually invest more time in explaining the animal kingdom than the vegetal [39]. Consequently, plants in the classroom are negligently regarded [40]. According to other researchers, the lack of interest on plants is due to the fact that humans are animals and thus have an intrinsic interest in animals [41].

In the last 50 years the world population in urban zones has dramatically increased from 30% to 54%. In the coming decades, this migration from rural areas to cities is expected to continue and even accelerate in the 21st century [42]. Likewise, in the industrialized countries, less than 10% of time is spent in contact with nature [43] and the time children spend in the open air is limited [29], [44].

IV. Conclusions

According to the results, three actions should follow regarding the plant blindness perceived among the Basque students and teachers surveyed in this work. First, teachers should acquire specific knowledge on biodiversity and ecosystem ecology so that they could teach future students. Second, research on biodiversity and its comprehension, should be strengthened. Finally, effective and comprehensive educational materials on the issue should be designed and tested.

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