

# PRIMARY SCHOOL CHILDREN AND PRE-SERVICE TEACHERS' KNOWLEDGE OF IBERIAN NATIVE AND AFRICAN SAVANNAH MAMMALS

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## Introduction

Humans have been related to other animals during their entire evolutionary process, using them as important promoters of their wellbeing. But this instrumental relationship is only one part of the human-animal connection, since it also develops curiosity about living beings and a propensity to generate empathy and even fear about them. According to the biophilia hypothesis proposed by Wilson (1984), through this contact over many thousands of years, humans developed an innate tendency to affiliate with other living beings and life processes. In fact, over time and in different cultures, people have established a strong connection with animals, and many cultural traditions imbue them with a symbolic value (Walsh, 2009). This seems to be the reason why the relationship established with animals has no parallel with the one which occurs with beings from other kingdoms, primarily through the possibility of interaction and reciprocity of their behaviour, especially with the more complex ones.

Of the animals, mammals seem to have a special place in human cultures, since they receive human attention more than any other taxonomic group, perhaps with the exception of birds (Kellert, 1996). This researcher explains that these animals generate a positive aesthetic response in people, and they can even contribute to an appreciation of the landscapes which they inhabit. Therefore, it seems that animals can function as inductors for the ecosystems where they belong.

## The Interest in Mammals

Knowledge of the characteristics and habitats of animals is essential for understanding zoological, ecological and environmental issues (Patrick & Tunnicliffe, 2011). Thus, the knowledge of and interest in different taxonomic groups of animals has been an important research issue, and the results of different studies have shown great knowledge and preference for mammals, which starts early in child development. For instance, Huxham, Welsh, Berry, and Templeton (2006) found that Scottish children, aged from 4 to 12, had greater knowledge about mammals than about birds or invertebrates. Also, a



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**Abstract.** *The present research compared the knowledge of primary school children and pre-service primary teachers about various native mammals of the Iberian Peninsula (IP-Portugal and Spain) and the African Savannah. For this purpose, a questionnaire was administered to 420 children and 215 pre-service teachers from these countries asking for the identification of animals through photos and whether they had native status on the IP. The pre-service teachers performed better than the children. The Savannah animals were better identified than those of the IP. The results were similar in both countries, even though the Spanish performed a little better. Children from both countries had more difficulty identifying the native status of the animals, with a high percentage of them thinking that Savannah animals lived in the wild on the IP. This error was less frequent among the pre-service teachers but, even so, with a percentage for certain animals that can be considered of concern. This issue is absent in the training courses in both countries, a conclusion based on an analysis of the syllabuses. The importance of improving knowledge of native fauna through formal and informal learning is discussed as a way to promote a conservationist attitude with direct repercussions on the recognition of the importance of local or regional biodiversity.*

**Keywords:** *pre-service teachers, primary school children, native fauna, savannah mammals.*

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study by Patrick et al. (2013), carried out in six countries (Brazil, England, Finland, Iceland, Portugal and the United States) found that students of different ages, 6, 10 and 15, given the task of naming as many animals as possible, were more aware of mammals as examples. These results were explained by the presence of mammals in the media, toys and books. And this presence reflects the fact that they are in general bigger than other animals and can easily harness human attention, a reason for their being used, along with birds, as flagship species in nature protection (Clucas, McHugh, & Caro, 2008).

A study by Batt (2009) also found that students from a University in England had a strong attraction to mammals, but this researcher highlights another explanation for this preference relating to the bio-behavioural traits we share with certain groups of animals; a similarity based not only on the physical features but on a broader perception that we share the same needs and interests. In fact, as Stephan and Finlay (1999) stated, among humans, empathy is essential to develop positive attitudes and behaviours towards others, helping to reduce discrimination. Since mammals are phylogenetically similar to humans, they provoke similar feelings, thus favouring more prosocial behaviours towards them. This evolutionary proximity is also responsible for the recognition that we both share similar emotions, establishing a strong connection with animals, a trend that is not free of forms of anthropomorphization (Jacobs, 2009).

#### *Knowledge about Animals and Age*

Another issue in animal-related research has focused on how knowledge about and interest in animals change with age. Huxham, et al. (2006) found in a study carried out in the UK that knowledge about different species increased with age and peaked at age 9, declining a little thereafter. The same trend was confirmed by Randler (2008) with German students but the peak of knowledge was at the age of 14. This researcher related the pattern to the waning of interest in biology during puberty. Even so, a subsequent study by this author found that the generational decline in interest in zoology during the last three decades was residual when compared with the one in botany (Randler, Osti, & Hummel, 2012). A similar trend was found in a study focused on birds with Slovakian students, aged 10-19, which concluded that the younger had more knowledge about these animals than the older (Prokop, Kubiátko, & Fančovičová, 2008). The result of a study by Prokop and Rodak (2009) with a Slovakian sample composed of primary school students, mean age 12.3, and university biology students, mean age 21.2, is also remarkable. The knowledge of both groups did not differ significantly when identifying 25 bird species, and two-thirds of the participants failed to identify common species. Even knowing that birds and not mammals were the focus of this and the previous study, their results suggest that knowledge about animals tends to stagnate after a certain age or even to decline. Thus, Patrick and Tunnicliffe (2011) argued that adults and children have a different understanding of animals but their actual knowledge about them shows only small differences. Even so, a study by Yli-Panula and Matikainen (2014) involving Finnish lower- and upper-secondary students and pre-service primary teachers concluded that the respondents of both groups knew the animals, especially mammals and birds, which lived in four distinct ecosystems: spruce-dominated coniferous forest, Finnish fen, savannah, and tropical rainforest. However, the number of animals mentioned increased with the age of the participants and level of schooling, with pre-service teachers performing better than the respondents from the other groups.

#### *Knowledge about Native versus Non-Native Animals*

Finally, another interesting subject of research is focused on knowledge about native or non-native species. This field, together with the other two highlighted above - preference for taxonomic groups and change of knowledge about animals with age -, are sometimes included in the same study. For instance, Huxham, et al. (2006) found that English children's knowledge of native species was very poor. A similar result was obtained by Paraskevopoulos, Padeliadu and Zafropoulos (1998) with Greek students from the 5<sup>th</sup> and 6<sup>th</sup> grades, and these researchers concluded that children had little interest in wild living beings, which cannot explain the poor knowledge about native species. Studies by Bizerril and Andrade (1999) and Bizerril (2004) focusing on the knowledge of students about the Brazilian Cerrado Biome (savannah-like vegetation), also found that the participants could not identify a number of animals native to Brazil. More recently a study by Almeida, García Fernández, and Strecht-Ribeiro (2018) with Portuguese and Spanish students concluded that children had a better knowledge of the Savannah animals than of the Iberian fauna. Similar results were obtained in studies involving pre-service teachers from different European countries (Lindemann-Matthies et al., 2011; Sánchez Emeterio & García Fernández, 2013).



However, other studies reported, at least partially, opposing results. It is the case of a study by Patrick and Tunnicliffe (2011) with a sample of English and American children: the first group named more exotic animals and the second more indigenous ones, which opens the possibility of different results according to the cultural context.

Randler (2010) found that knowledge about native species is correlated with age, level of schooling, frequency of nature walks, reading of thematic books or visiting game parks. But from these factors several authors highlight the decline of contact with nature across the world, especially among the younger urban generation (Kellert, 2005; Louv, 2010; Patrick & Tunnicliffe, 2011; Soga & Gaston, 2016). Louv (2010) stated that school does not reverse this tendency, since children know a lot about the rain forest and its threats but know nothing about their own forests. Frequently, they are not even familiar with the fields near school that offer so many forms of life that could be studied. Kellert (2005) has highlighted the tendency to be familiar with places where nature is managed, like zoos and aquariums. This contact seems to favour the knowledge of exotic species, since the majority of animals included in their collections are non-native (Consorte-McCrea, et al. 2017; Skibins & Powell, 2013).

### *Research Focus*

Since the results of different studies are not always coincident, further research is needed in the present field. This need is also due to the few studies focused on the kind of mammals that are better known in different ages, according to their biogeographical distribution. Therefore, the present research aimed to evaluate the knowledge of native mammals and savannah animals in two different age groups. Three objectives were defined with this purpose:

- 1) to compare primary school children's and pre-service teachers' knowledge about these two groups of mammals;
- 2) to establish the same comparison, now involving two subsamples of children and pre-service teachers, according to their country of origin, Portugal and Spain, the two countries that compose the Iberian Peninsula;
- 3) to discuss the implications of the results for science education and also for teacher training courses.

The assessment of the first objective tries to check which group of animals - Iberian Peninsula or African Savannah- is better known in terms of the identification of the names of different animals and of the recognition of their being native or not to the Iberian Peninsula. The second objective tries to check whether possible differences exist according to the country of origin of the participants, since each country, Portugal and Spain, has its own educational system with similarities and specificities. The third objective sets out to discuss the implications for science education and also for teacher training courses, due to the relevance of knowledge about native species and ecosystems.

## **Research Methodology**

### *General Background*

The research had a quantitative approach and aimed to check statistical differences between the knowledge of the groups considered: children and pre-service teachers of the two countries and between the same participants only considering their country of origin. The research scope is the follow-up to a previous one included in the same research project, which intends to check the knowledge of native fauna in students of different ages and in different countries (Almeida, et al., 2018).

### *Sample*

The participants in the present research involved primary school children from Portugal and Spain attending the 6<sup>th</sup> year of schooling, and pre-service primary teachers from two Higher Education Institutions from these two countries (Table 1). These countries share similar ecosystems and have several autochthonous mammals in common, an ideal situation for a comparative study with the present focus. The children's sample from the previous study was used but this time with completely different objectives as explained in the introduction.



**Table 1. Description of the sample of the present research involving children and pre-service teachers from Portugal and Spain.**

	Spanish sample		Portuguese sample	
	Children	Pre-service teachers	Children	Pre-service teachers
Boys/Men	106	46	105	102
Girls/Women	99	85	110	3
Mean age	11.3	22.4	11.7	23.9
SD Age	0.55	2.92	0.81	4.50

In both countries, the children were from primary schools where pre-service teachers do their teaching training practice. The children were randomly chosen from a group of schools: five state schools in the Lisbon area (Portugal) and six from the Ciudad Real area (Castilla-La Mancha, Spain) that cooperate with the higher education institutions attended by pre-service-teachers in the final year of their degree course. The schools are attended by children from different socioeconomic levels and none of the classes were involved in any project related to animals.

The existence of natural spaces in both regions had differences and similarities. Ciudad Real is a smaller city when compared to Lisbon, and therefore access to the countryside is easier. Even so, both regions have a number of nature or national parks and other green areas with native fauna, some of them included in the questionnaire that will be presented in the next section. The Lisbon region has more thematic parks where non-native animals can be observed. Nevertheless, the good transport connections of Ciudad Real, less than one hour from Madrid by train, makes it easy to visit zoos or other parks to observe more exotic fauna.

Pre-service teachers were predominantly female, a trend that can be found in Education courses in both countries. In the case of Portugal, students first attend a bachelor's degree course in Basic Education, a compulsory condition for admittance to the master's degree course in education. They are urban students (95%), living in the metropolitan area of Lisbon. In the Spanish case, they were in the last year of teacher training, and they have access to the studies mainly after finishing high school and, in a minority, when finishing a vocational training programme. Many of them were born and brought up in rural areas or have family in towns nearby.

#### *Instrument and Procedures*

A questionnaire was administered during the school years of 2016/2017 and 2017/2018 to both groups composed of primary school children and pre-service primary teachers from Portugal and Spain. The questionnaire included photos of 22 mammals, half of them from the Iberian Peninsula and the other half from the African Savannah. The choice of mammals was based on the studies already presented, which show that these animals are preferred by humans and may be better known by students of different ages. The final selection of animals is presented in Table 2, which includes their common, scientific names and mean mass in Kg.

**Table 2. List of animals presented in the questionnaire, and their mean mass.**

Iberian Animals			Savannah Animals		
Common name	Scientific name	Mean mass (kg)	Common name	Scientific name	Mean mass (kg)
Badger	<i>Meles meles</i>	13	Black rhinoceros	<i>Diceros bicornis</i>	1500
Bear	<i>Ursus arctos</i>	80-230	Cheetah	<i>Acinonyx jubatus</i>	21-72
Fox	<i>Vulpes vulpes</i>	10	Elephant	<i>Loxodonta Africana</i>	6000
Genet	<i>Genetta genetta</i>	2	Giraffe	<i>Giraffa reticulata</i>	800
Iberian lynx	<i>Lynx pardinus</i>	8-13	Gnu	<i>Connochaetes taurinus</i>	250
Mongoose	<i>Herpestes ichneumon</i>	3	Hippopotamus	<i>Hippopotamus amphibious</i>	1400-3500



Iberian Animals			Savannah Animals		
Common name	Scientific name	Mean mass (kg)	Common name	Scientific name	Mean mass (kg)
Otter	<i>Lutra lutra</i>	11	Hyena	<i>Crocuta crocuta</i>	44-64
Rabbit	<i>Oryctolagus cuniculus</i>	1.5	Leopard	<i>Panthera pardus</i>	31
Red deer	<i>Cervus elaphus</i>	80-200	Llion	<i>Panthera leo</i>	130-190
Wild boar	<i>Sus scrofa</i>	35-175	Thomson's gazelle	<i>Gazella thomsonii</i>	23
Wolf	<i>Canis lupus</i>	35	Zebra	<i>Equus quagga</i>	400

Note: The mass value was given in average Kg. A range of values is shown when the weight of the animals can vary greatly between their minimum and maximum, sometimes due to differences between males and females. Main sources: Purroy and Varela (2016) and Stehr and Burrell i Florida (1983).

The Iberian animals were selected from the list of mammals from Portugal and Spain made by Purroy and Varela (2016), and only the bear exists exclusively in the wild in Spain nowadays. The genet is not exactly native to the Peninsula, but its introduction occurred centuries ago. How it happened is still an object of debate, but it was probably during the Muslim invasion of this territory, since the genet used to be a Muslim pet (Alves, 2012). A similar situation can be described concerning the mongoose, introduced during the Roman occupation of Hispania (Detry et al., 2018).

The African Savannah animals were selected after analysing a variety of sites dedicated to this ecosystem (e.g. Secrets of the World, n. a.; Savanna Animal Printouts, n. a.). A number of these animals occupy a part of the collections of the zoos of the Iberian Peninsula: Lisbon (Portugal) and Madrid, Valencia and Barcelona (Spain).

High-quality photos of the animals were placed randomly on four A4 pages. All the animals were shown in their habitats, allowing a certain perspective of scale. However, the size scale of the animals was not respected, since the Iberian fauna include smaller animals when compared with those from the African Savannah. Iberian animals also have a lower body mass, with the exception of the bear, the red deer and the wild boar (Table 2). Even so, in both cases, the selection includes large animals normally easier to identify, which means that several common micro-mammals of the Iberian Peninsula were excluded. The photos were chosen from websites with images of free use.

The questionnaire was organized in two parts. The first aimed to collect a few personal data from the participants: age, gender, school or higher institution. The second part, included, for each animal, the two following questions: 1) What is the name of the animal in the picture? (Open Question); 2) Does this animal live in the wild on the Iberian Peninsula? (Closed question with the possibilities of *yes*, *no* and *don't know*). In primary school, children from both countries had to study different classes of animals, from vertebrates to invertebrates, their main features, and adaptations to the environment. Accordingly, the syllabuses of pre-service teachers training courses were analysed to check for the presence of the issue under discussion, especially in Science and Environmental Education curricular units.

#### *Validity and Reliability of the Questionnaire*

The instrument was used and validated in a previous research project (Almeida et al., 2018), but the validity was tested again in this research. The content validity of the questionnaire was analysed by four experts in Science Education after being informed of the main aims of the research. For content validity it is especially important to check whether the questions included are relevant to the purpose of the research (Cohen, Manion, & Morrison, 2006). In the present case, the list of animals included was considered representative of both regions, according to the parameters defined for the selection, but in this analysis.

The reliability of the questionnaire was checked on the basis of consistent results production (Field, 2009). The instrument was applied to 24 children and to 24 pre-service teachers not included in the final sample in order to identify any difficulties in the understanding of the questions and in the identification of the photos. After this process, two photos were not considered fit for the purpose and were substituted, due to the doubts raised by several students and pre-service teachers as to their sharpness and contrast in relation to the animal's habitat. Also based on the queries of the children, it was decided to show during the administration a few pictures of animals in the wild and in captivity. This strategy allows a better understanding of the meaning of "living in the wild".



The reliability of the closed questions of the test was also tested by calculating the Kuder-Richadson 20 test, the general version of the Cronbach's alpha due to the non-Likert scaled variables (Cortina, 1993; Feldt, 1969). The result, 0.931, shows an excellent reliability of the instrument. Thus, the questionnaire was approved as a valid and reliable instrument for the purpose for which it was designed.

#### *Research Ethics*

An authorization from the schools' head teachers was required and none of them considered that the content of the questionnaire, related to scientific knowledge, posed any ethical problems. The same opinion was shared by the children's teachers, who considered the issue of the questionnaire and the results relevant for their teaching practice. Therefore, both school directors and teachers considered that the questionnaire could function as a diagnostic activity related to the science syllabus. Even so, the children were informed about the *raison d'être* of the questionnaire, as related to a research project with no impact on their assessment. Accordingly, the questionnaire was anonymous, and the names of the schools involved were also not included in the dissemination of the results.

The research follows the principle of beneficence applied by O'Reilly, Ronzoni, and Dogra (2013) to all studies that can improve students' learning and have an impact on curricular changes which in turn could also have an impact on the educational system. The positive reasons for these impacts are explained at the end in the conclusion section, related to the importance of knowing and valuing the native fauna of a country or region.

In relation to the pre-service teachers' sample, all the participants were informed of the aims of the research. All the students were over 18 and participation was voluntary. Turnout was high and one of the main reasons could be related to the fact that the students are also involved in research studies at the end of their training.

#### *Data Analysis*

The frequency (absolute and relative) of correct answers related to the identification of the animals of the Iberian Peninsula and of the African Savannah was calculated, firstly for the children and the pre-service teachers and secondly for the children and the pre-service teachers of each country. The same comparison was made for the correct answers concerning the animals that live in the wild on the Iberian Peninsula. For this second calculation, consideration was only given to respondents who identified the animal correctly or left a blank space in the first question. The main reason for considering this latter situation was due to the fact that features of an animal might give clues as to its native status on the Iberian Peninsula. For example, a participant might not remember the name "giraffe" but consider correctly that these animals do not have the common characteristics of Iberian fauna.

Statistically significant differences between groups concerning the identification of each animal and its existence in the wild in the Iberian Peninsula were calculated using the chi-square test, since we are dealing with nominal variables. The Bonferroni correction was considered for the initial value of significance ( $p=.05$ ), since a number of tests were performed on a single data set. To do this, the critical  $p$  value was obtained by dividing the initial value by the number of tests, 22. With this adjustment the  $p$  value considered was  $p=.002$ .

Also, a global score of correct answers for each group of animals was calculated by giving two points for each animal correctly identified, one point when there was a blank answer but not a misidentification, and zero for a wrong answer. The total scoring for each group of animals was 22 points (2 x 11 animals), when a participant correctly identified them all, and a mean was obtained for each group of participants. The global score for the question concerning native status on the Iberian Peninsula obeyed the same rule. The means obtained by the groups of participants already mentioned for each question were compared applying a Mann-Whitney  $U$  test, after the use of the Kolmogorov-Smirnov test, which indicated a non-normal distribution of the data and the relevance of using non-parametric statistical tests.

### **Research Results**

The results obtained by the children and pre-service teachers of both countries regarding the identification of the Iberian Animals and the Savannah Animals are shown in Table 3.

In the case of the Iberian Animals, the differences between groups were statistically significant for the genet, the otter, the red deer, the wild boar (all with  $p<.001$ ), and the lynx ( $p=.001$ ), since a higher percentage of pre-service teachers successfully identified these animals. However, even considering this better performance of pre-service



teachers, very few students identified the badger, the genet and the mongoose. In relation to the Savannah animals, the performance of both groups was more similar and statistical differences could only be found in relation to the gnu and Thomson's gazelle (both with  $p < .001$ ).

Independently of these statistical differences the body mass of the animals was not a determining factor in a better identification of the animals of the two biogeographic reasons. This means that the larger animals were not always better identified, both by the children and the pre-service teachers.

Considering now the same question by country, Table 4 shows the results for the comparison between the Portuguese children and pre-service teachers in relation to animals of the Iberian Peninsula and of the African Savannah.

**Table 3. The absolute and relative frequency of correct identifications of the animals of the Iberian Peninsula and of the African Savannah in children (n=420) and primary pre-service teachers (n=236), from Portugal (P) and Spain (Sp).**

Iberian Animals	P+Sp Children	P+Sp Pre-serv.	<i>p</i>	Savannah Animals	P+Sp Children	P+Sp Pre-serv.	<i>p</i>
Badger	32 (7.6)	33 (14.0)	.009	Black rhinoceros	384 (91.4)	229 (97.0)	.005
Bear	415 (98.8)	235 (99.6)	.427	Cheetah	245 (58.3)	142 (60.2)	.646
Fox	398 (94.8)	228 (96.6)	.277	Elephant	417 (99.3)	236 (100)	.557
Genet	4 (1.0)	14 (5.9)	<.001	Giraffe	411 (97.9)	236 (100)	.024
Lynx	260 (61.9)	176 (74.6)	.001	Gnu	75 (17.9)	90 (38.1)	<.001
Mongoose	2 (0.5)	3 (1.3)	.356	Hippopotamus	406 (96.7)	233 (98.7)	.111
Otter	157 (37.4)	134 (56.8)	<.001	Hyena	287 (68.3)	183 (77.5)	.012
Rabbit	418 (99.5)	236 (100)	.539	Leopard	196 (46.7)	114 (48.3)	.687
Red deer	290 (69.0)	209 (88.6)	<.001	Lion	406 (96.7)	233 (98.7)	.111
Wild boar	339 (80.7)	219 (92.8)	<.001	Thomson's gazelle	139 (33.1)	115 (48.7)	<.001
Wolf	359 (85.5)	220 (93.2)	.003	Zebra	416 (99.0)	235 (99.6)	.659

Note: The level of significance was  $p = .002$  due to the Bonferroni correction.

The Portuguese pre-service teachers identified the animals from the Iberian Peninsula and from the African Savannah with a higher relative frequency when compared with the children of this country. However, in the case of the African Savannah the percentages obtained by the two groups for each animal were, in general, closer. Even so, and considering the Bonferroni correction, the differences were only statistically significant between the two groups for one of the Iberian animals, the red deer ( $p < .001$ ), and for one animal from the Savannah, the hyena ( $p = .001$ ). A very similar tendency was found between the Spanish groups and statistical differences were only found, respectively, for the genet ( $p = .001$ ), the otter, the red deer and the gnu ( $p < .001$ ). It is also important to highlight the very low percentage in the identification of the badger, genet and mongoose by children and by pre-service teachers of both countries, a result even more relevant since these three animals are not in danger of extinction and are quite common in the wild. In the case of the Africa Savannah animals, only the gnu has a very low percentage of identification, but only in the Portuguese sample.

Concerning the body mass of the animals, it is difficult to identify a clear trend in participants from each country. This means that factors other than size are more important in the identification of the different animals.



In relation to the recognition of the animals as native or non-native to the Iberian Peninsula, the results obtained by the children and the pre-service teachers of both countries are systematized in Table 5. It is important to remember that in this analysis only the participants who identified an animal correctly and also those who left the space blank were considered, since the visible morphological features could help in this assessment.

**Table 4. The absolute and relative frequencies of correct identifications of the animals of the Iberian Peninsula and of the African Savannah in the Portuguese sample - P (children - C, n=215, and pre-service teachers - PST, n=105) and in the Spanish sample - Sp (children - C, n=205, and pre-service teachers - PST, n=131).**

Iberian Animals	P (C)	P (PST)	<i>p</i>	Sp (C)	Sp (PST)	<i>p</i>	Savannah Animals	P (C)	P (PST)	<i>p</i>	Sp (C)	Sp (PST)	<i>p</i>
Badger	17 (7.9)	16 (15.2)	.043	15 (7.3)	17 (13.0)	.085	Black rhinoceros	193 (89.8)	103 (98.1)	.008	191 (93.2)	126 (96.2)	.244
Bear	213 (99.1)	105 (100)	1.000	202 (98.5)	130 (99.2)	1.000	Cheetah	144 (67.0)	68 (64.8)	.694	101 (49.3)	74 (56.5)	.196
Fox	199 (92.6)	101 (96.2)	.208	199 (97.1)	127 (96.9)	.947	Elephant	213 (99.1)	105 (100)	1.000	204 (95.5)	131 (100)	1.000
Genet	0 (0)	0 (0)	-	4 (2.0)	14 (10.7)	.001	Giraffe	212 (98.6)	105 (100)	.554	199 (97.1)	131 (100)	.085
Lynx	116 (54.0)	73 (69.5)	.008	144 (70.2)	103 (78.6)	.089	Gnu	18 (8.4)	14 (13.3)	.165	57 (27.8)	76 (58.0)	<.001
Mongoose	2 (0.9)	0 (0)	1.000	0 (0)	3 (2.3)	.058	Hippopotamus	208 (96.7)	104 (99.0)	.215	198 (96.6)	129 (98.5)	.296
Otter	71 (33.0)	49 (46.7)	.018	86 (42.0)	85 (64.9)	<.001	Hyena	132 (61.4)	84 (80.0)	.001	155 (75.6)	99 (75.6)	.994
Rabbit	215 (100)	105 (100)	-	203 (99.0)	131 (100)	.523	Leopard	115 (53.5)	55 (52.4)	.852	81 (39.5)	59 (45.0)	.316
Red deer	117 (54.4)	80 (76.2)	<.001	173 (84.4)	129 (98.5)	<.001	Lion	214 (99.5)	105 (100)	1.000	205 (100)	131 (100)	-
Wild boar	167 (77.7)	96 (91.4)	.003	172 (83.9)	123 (93.9)	.006	Thomson's gazelle	66 (30.7)	46 (43.8)	.021	73 (35.6)	69 (52.7)	.002
Wolf	185 (86.0)	100 (95.2)	.013	174 (84.9)	120 (91.6)	.069	Zebra	213 (99.1)	104 (99.0)	1.000	203 (99.0)	131 (100)	.523

Note: The level of significance was  $p=.002$  due to the Bonferroni correction.

**Table 5. Absolute and relative frequencies obtained by children and pre-service teachers of Portugal - P + Spain - Sp, who correctly identify the Iberian animals and the ones of the Savannah. Statistically significant differences between the two groups were calculated using a Chi-square test.**

Iberian Animals	<i>n</i>	P+Sp Children	<i>n</i>	P+Sp Pre-serv.	<i>p</i>	Savannah Animals	<i>n</i>	P+Sp Children	<i>n</i>	P+Sp Pre-serv.	<i>p</i>
Badger	150	32 (21.3)	98	26 (26.5)	.345	Black rhinoceros	413	218 (52.8)	235	206 (91.2)	<.001
Bear	417	202 (48.4)	235	89 (37.9)	.009	Cheetah	260	153 (58.8)	151	121 (80.1)	<.001
Fox	413	316 (76.5)	228	214 (93.9)	<.001	Elephant	418	247 (59.1)	236	215 (91.1)	<.001
Genet	317	39 (12.3)	161	24 (14.9)	.426	Giraffe	416	258 (62.0)	236	207 (87.7)	<.001
Lynx	380	220 (57.9)	214	161 (75.2)	<.001	Gnu	285	87 (30.5)	163	103 (63.2)	<.001



Iberian Animals	<i>n</i>	P+Sp Children	<i>n</i>	P+Sp Pre-serv.	<i>p</i>	Savannah Animals	<i>n</i>	P+Sp Children	<i>n</i>	P+Sp Pre-serv.	<i>p</i>
Mongoose	358	40 (11.2)	149	12 (8.1)	.292	Hippopotamus	414	205 (49.5)	234	205 (87.6)	<.001
Otter	343	126 (36.7)	206	83 (40.3)	.406	Hyena	401	186 (46.4)	226	150 (66.4)	<.001
Rabbit	420	387 (92.1)	236	230 (97.5)	.006	Leopard	268	144 (53.7)	136	103 (75.7)	<.001
Red deer	331	236 (71.3)	218	174 (79.8)	.025	Lion	419	251 (59.9)	236	210 (89.0)	<.001
Wild boar	379	246 (64.9)	224	205 (91.5)	<.001	Thomson's gazelle	347	117 (33.7)	199	98 (49.2)	<.001
Wolf	396	261 (65.9)	224	201 (89.7)	<.001	Zebra	420	210 (50.0)	236	198 (83.9)	<.001

Note: The level of significance was  $p=.002$  due to the Bonferroni correction; "*n*" corresponds to the number of participants who did not misidentify each animal in the first question.

An important result was that a number of animals of the Iberian Peninsula were not identified as native by both groups. This occurs not only with the animals that were wrongly identified, like the badger, the genet and the mongoose, but also with the otter and the bear. Even so, the statistically significant differences between the groups were for the fox, the lynx, the wild boar and the wolf (all with  $p<.001$ ), since the pre-service teachers had a much higher number of correct answers. In relation to the Savannah animals, the differences between the two groups were statistically significant for all the animals ( $p<.001$ ), with a greater percentage of children tending to consider these animals as native to the Iberian Peninsula. For instance, only the cheetah, the elephant, the giraffe and the lion were considered non-native by a majority of the children but, even so, with a percentage of around 60%. The percentage of pre-service teachers that wrongly considered Savannah animals as native is between 10% and 20%, but the value increases to more than 30% for the hyena and more than 50% for Thomson's gazelle.

The results comparing children's and pre-service teachers' answers by country are in Table 6 for the animals of the Iberian Peninsula and the African Savannah.

By country, the general tendencies in the recognition of the Iberian animals were also similar. The pre-service teachers tended to identify the native animals from this region better than the children, but the statistical differences occur only for four animals in the Portuguese sample, the fox, the wild boar, the wolf and the bear (in this later case with the children performing better) and for two animals in the Spanish sample, the lynx and the wolf (all with  $p<.001$ ). The Portuguese pre-service teachers had considerable difficulty in recognizing that the badger, the bear, the genet, the mongoose and the otter are native, and their Spanish counterparts had difficulty with the badger, the genet, and the mongoose.

As for the Savannah animals, the pre-service teachers from both countries were better than the children at identifying these animals as non-native to the Iberian Peninsula, with statistically significant differences for almost all the animals. In fact, among the Portuguese children, only the lion and the cheetah were identified as non-native by more than 60% of the participants, and among the Spanish children only the giraffe.

The means obtained by the children and pre-service teachers globally and by country concerning the identification of all the animals from each region were compared using a Mann Whitney *U* test and the results can be found in Table 7.

Overall, the pre-service teachers revealed a greater knowledge in the identification of the animals from both regions, and this tendency is the same considering the country of origin of the future teachers. Consequently, all the differences between the children and the pre-service teachers are statistically significant. Both groups also obtained a better mean in the case of the Savannah animals, and the children's means are closer for these animals to those obtained by the pre-service teachers. Nevertheless, in the identification of the animals, the Spanish groups performed better than the Portuguese. In the case of the correct identification of native and non-native animals of the Iberian Peninsula, the children revealed much greater difficulty than the pre-service teachers, a tendency also present in the participants of both countries. Even so, the pre-service teachers also had difficulty with this identification, which was more evident with the Iberian animals and within the Portuguese sample.



The syllabuses of the different curricular units in both countries did not include any reference to the study of native fauna or flora on the Iberian Peninsula, and in fact very few curricular units were related to Biology, Ecology or Environmental Sciences. This can be explained by the fact that primary teacher training courses have a multi-disciplinary approach due to the need to cover a variety of different areas of knowledge.

**Table 6. Absolute and relative frequencies of children and pre-service teachers from Portugal - P and Spain - Sp who correctly identified the Iberian animals and those of the Savannah. Statistically significant differences between the two groups from each country were calculated using a chi-square test.**

Iberian Animals	n	P Children	n	P Pre-serv.	p	n	Sp Children	n	Sp Pre-serv.	p
Badger	64	14 (21.9)	46	9 (19.6)	.769	86	18 (20.9)	52	17 (32.7)	.124
Bear	214	91 (42.5)	105	19 (18.1)	<.001	203	111 (54.7)	130	70 (53.8)	.882
Fox	209	151 (72.2)	101	96 (95.0)	<.001	204	165 (80.9)	127	118 (92.9)	.003
Genet	171	9 (5.3)	78	2 (2.6)	.336	146	30 (20.5)	83	22 (26.5)	.301
Lynx	190	98 (51.6)	99	67 (67.7)	.009	190	122 (64.2)	115	94 (81.7)	<.001
Mongoose	187	18 (9.6)	75	9 (12.0)	.568	171	22 (12.9)	74	3 (4.1)	.036
Otter	180	62 (34.4)	93	24 (25.8)	.145	163	64 (39.3)	113	59 (52.2)	.033
Rabbit	215	196 (91.2)	105	105 (100)	.002	205	191 (93.2)	131	125 (95.4)	.395
Red deer	145	75 (51.7)	87	49 (56.3)	.497	186	161 (86.6)	131	125 (95.4)	.009
Wild boar	193	102 (52.8)	97	92 (94.8)	<.001	186	144 (77.4)	127	113 (89.0)	.009
Wolf	203	129 (63.5)	101	91 (90.1)	<.001	193	132 (68.4)	123	110 (89.4)	<.001
Black rhinoceros	212	107 (50.5)	96	92 (95.8)	<.001	201	111 (55.2)	130	114 (88.5)	<.001
Cheetah	151	92 (66.9)	75	61 (81.3)	.002	109	61 (56.0)	76	60 (78.9)	.001
Elephant	214	126 (58.9)	105	100 (95.2)	<.001	204	121 (59.3)	131	115 (87.8)	<.001
Giraffe	215	122 (56.7)	105	95 (90.5)	<.001	201	136 (67.7)	131	112 (85.5)	<.001
Gnu	121	39 (32.2)	66	35 (53.0)	.005	164	48 (29.3)	97	68 (70.1)	<.001
Hippopotamus	213	98 (46.0)	104	96 (92.3)	<.001	201	107 (53.2)	130	109 (83.8)	<.001
Hyena	200	90 (45.0)	104	67 (64.4)	.001	201	96 (47.8)	122	83 (68.0)	<.001
Leopard	154	78 (50.6)	66	53 (80.3)	<.001	114	66 (57.9)	70	50 (71.4)	.065
Lion	214	130 (60.7)	105	100 (95.2)	<.001	205	121 (59.0)	131	110 (84.0)	<.001

Iberian Animals	n	P Children	n	P Pre-serv.	p	n	Sp Children	n	Sp Pre-serv.	p
Thomson's gazelle	188	66 (35.1)	102	48 (47.1)	.047	159	51 (32.1)	97	50 (51.5)	.002
Zebra	215	99 (46.0)	105	88 (83.8)	<.001	205	111 (54.1)	131	110 (84.0)	<.001

Note: The level of significance was  $p = 0.002$  due to the Bonferroni correction; "n" corresponds to the number of subjects who did not misidentify each animal in the first question.

**Table 7. Statistical comparison between the means obtained by all the children and all the pre-service teachers and also by these two groups considered according to their country of origin using the Mann Whitney U test.**

	Children	Pre-service	Man Whitney U	p	Portuguese Children	Portuguese Pre-Service	Man Whitney U	p	Spanish Children	Spanish Pre-Service	Man Whitney U	p
<b>Identification of the animals</b>												
Iberian Animals	17.366	18.233	33069.5	<.001	17.055	17.904	7559.5	<.001	17.692	18.496	8988.5	<.001
Savannah Animals	19.078	19.682	39418.5	<.001	19.027	19.504	9514.5	.020	19.131	19.824	10212.0	<.001
<b>Native or non- native</b>												
Iberian Animals	10.909	15.305	8880.0	<.001	10.227	14.761	1568.5	<.001	11.624	15.740	2906.5	<.001
Savannah Animals	14.607	16.690	35008.0	<.001	14.614	16.771	7839.0	<.001	14.600	16.620	9606.5	<.001

Even so, on the Portuguese course, pre-service teachers have a short curricular unit (only 13.5 contact hours) devoted to ecological knowledge related to Maths, and focused on the levels of organization in Ecology, biotic and abiotic factors and different types of ecological pyramids.

The Spanish teacher training syllabus includes a specific subject of 3 ECTS (Biology), in which the ecosystems are addressed, with particular mention of trophic chains, together with contents on anatomy and physiology of human nutrition, healthy habits and human evolution. Nevertheless, there is no specific mention of native or non-native fauna.

### Discussion

In the present research, the pre-service teachers were better able to identify the animals of both regions and scored much better in the case of the Iberian animals. Even considering that knowledge differences in the identification of animals between the two groups were not so marked in the case of the African Savannah animals, proving their popularity and greater prominence in different sources of information, the pre-service teachers continued to perform better and the differences between the two groups, including by country, were always statistically significant. The fact that they are older students increases the possibility of contact with more sources of information, which can improve their knowledge about the animal world, even knowing that their courses do not address native or exotic fauna. This result is contrary to the idea that the increase of knowledge of animals tends to stagnate after a certain age, as concluded by other studies described in the Introduction.

The Portuguese children and the Portuguese pre-service teachers also revealed more difficulties in the identification of the Iberian animals than the Spanish. Apparently, this could be explained by the fact that the Portuguese sample is from a more urban area with less contact with nature. But in fact, in the nature areas around Lisbon, the least identified animals, like the genet, the mongoose and the badger, exist in the wild. However, these animals are not easily seen due to their behaviour and period of activity, especially if children or pre-service teachers are not involved in outdoor activities which could, at least, provide them with indications of animal activity. Therefore, even knowing that a number of factors influence this lack of knowledge, it seems relevant to mention the idea of Pergams and Zaradic (2006), namely that this kind of result supports the possibility of a disconnection of the participants with their local environmental. And several studies have



shown how the connection with local fauna and flora can enhance children's knowledge and interest in nature (e.g.; Eshach, 2006; Gelman, 2009; Heezik, Dickinson, & Freeman, 2012; Lindemann-Mathies, 2005; Mateos Jiménez & García Fernández, 2016; Patrick & Tunnicliffe, 2011). To this end, there is a need to move from the usual visits to zoos and other thematic parks, where there is normally an absence of native fauna, to wilder places (Almeida et al., 2018).

Overall, the children's difficulties with the identification of Iberian animals can be also related to the lack of approach to native species at school. In fact there is no reference in the curriculum of either country to the importance of the native fauna (see, e.g. the essential learning for the 5th year of schooling in Portugal, Direção Geral de Educação, n.a.; The Royal Decree of minimum contents in Spain, Ministry of Education, Culture and Sport of Spain, 2014). Even so, the pre-service teachers also revealed difficulties with the identification of these animals despite their higher score. As they are soon to be qualified teachers, a principle advanced by Bizerril (2004) also seems important for the present discussion: the less a teacher knows about a subject, the less inclined they will be to approach that subject with their students.

There was no trend of an improved identification of animals of species with a high body mass in the global sample and in the samples of each country. This could be related to the fact that the species chosen were all large, even retaining the differences already stated between the Iberian and Savannah species, and to the influence of the above-mentioned aspects already discussed.

Globally, the lack of exposure to local or regional biodiversity, both in class and outside school can affect awareness of the threats faced by native species (Caride & Meira, 2004; Consorte-McCreaa, et al. 2017), a consequence to be expected both in children and future teachers. According to Kansky and Knight (2014), knowledge is not enough to develop a positive attitude to a certain species, but concern for local species is also unlikely when they are totally unknown (Dixon, Birchenough, Evans, & Quigley, 2005). A study by Ballouard, Brischoux and Bonnet (2011) with French students from urban and rural areas, aged 7-11, found that exotic species were better identified than local, and the children showed great interest in protecting the former.

The performance by both groups in identifying the animals as native or non-native to the Iberian Peninsula revealed even more difficulties, in particular among the children of the two countries, with a lower score for the Portuguese. In this respect, the number of participants who considered a variety of animals of the Savannah as native to the Iberian Peninsula was high. In fact, other studies involving children and even adolescents also obtained the same result with the participants considering that lions or elephants are part of the native fauna of countries like the United States or The Netherlands (Strommen, 1995; Verboon, Kraling, & Meier, 2004). But the present research showed that the inclusion of African Savannah animals in the native fauna of the Iberian Peninsula also occurred among pre-service teachers. It had a lower incidence, but the percentages may still be considered of concern.

Several explanations can be offered to explain this surprising result. Maybe children have greater difficulty in understanding the meaning of living in the wild, especially if their contact experiences with animals are confined to thematic parks where nature is managed. But probably many of them have difficulty in associating an animal with a certain biogeographic area. This can be related to the curricular syllabus of primary school in both countries, more focused as it is on the features of different taxonomic animals than on their ecosystemic insertion. And teachers may tend to narrowly meet the established goals even because the system periodically uses assessment tests. Pre-service teachers seem to show a lack of ecological knowledge, at least partially related with their academic training.

### Conclusions and Educational Implications

The results of the present study show scant knowledge about native mammals both in the children and the pre-service teachers of the two countries, with the participants having even greater difficulty in determining the native status of the animals than with their identification. This is explained by the higher presence of African animals in media, and by a lack of opportunities to see some Iberian native animals in the wild. The pre-service teachers performed better than children, what is contrary to the idea that the knowledge of animals tends to stagnate with the age, as pre-service teachers had more possibilities to get contact with different sources of information (also the environment) to improve their learning on this topic. Nevertheless, they also revealed gaps in their knowledge, specially related to native animals. Spanish children and pre-service teachers score



better than their Portuguese peers. Considering that native and exotic fauna does not appear in the syllabus for any group, we conclude that the presence of more urban areas in Lisbon might have limited the contact with the ecosystems, determining the results in this research. The body mass of the animals seems not to be determinant in the identification of the animal and the classification as native or not native.

Therefore, a more contextualized science education is needed, highlighting the local and regional natural heritage, and this can be achieved through more outdoor activities. Changes in teacher training courses in both countries can contribute to this improvement, following the trends just mentioned for children. Since these students will soon be fully qualified teachers, a change in their outlook will help to contextualize this curricular change and stimulate young children to preserve their native fauna.

Further research is needed in other education contexts (urban or rural), education levels (e.g. secondary education) and countries, to identify if the patterns found in the present research are exclusive of the context studied, or if they can also be found in other frameworks.

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