European Journal of Educational Research
Volume 7, Issue 3, 485 - 499.
ISSN: 2165-8714
http://www.eu-jer.com/

What do Brazilian School Children Know about Birds in Their Country?

Amauri B. Bartoszeck *
University of Paraná, PR BRAZIL

Waldinéia Vandrovieski
Escola Municipal Divino Espirito Santo, PR BRAZIL

Vanessa Tratch
Escola Municipal Divino Espirito Santo, PR BRAZIL

Franciane Czelusniak
Escola Estadual do Campo Professor Leonardo Salata, PR BRAZIL

Sue Dale Tunnicliffe
University College London, UK

Received: March 10, 2018 ▪ Revised: April 29, 2018 ▪ Accepted: May 8, 2018

Abstract: Children have a basic knowledge of birds that they observe during their everyday life either in their garden, other gardens, round the house, walking in the local area or in the yard on school gardens. A total of 515 children, aged 3 to 16 (249 girls and 266 boys) enrolled in southern Brazilian public preschools, primary school and secondary schools, were invited to participate in this exploratory study. A semi-structured interview was conducted with 206 pupils asking to name which birds they knew, where they had seen these birds, which ones live around home, which they had seen further away. Additionally, they were asked which birds they knew from a list and the source of this knowledge where they had learned about the birds. They were asked to draw on a sheet of paper a representation of what the word "bird" meant to them. Results show the importance of everyday observations rather than beyond formal education in the children knowledge. Children from the earliest years notice birds in their everyday lives, and build a bank of knowledge, gradually acquiring an understanding of adaptation to a variety of habitats. Children notice birds in their lives to differing extent and sources according to the culture in which they are immersed. Experiences of seeing or finding out about birds are encapsulated for many children in the form of narratives and contribute to their mental models of birds and their habitats on which they will drew in formal science later (Biology and Environmental Education). Educational implications are discussed.

Keywords: *Children, birds, mental model, drawings.*

To cite this article: Bartoszeck, A. B., Vandrovieski, W., Tratch, V., Czelusniak, F., & Tunnicliffe, S. D. (2018). What do Brazilian school children know about birds in their country?. *European Journal of Educational Research, 7*(3), 485-499. doi: 10.12973/eu-jer.7.3.485

Introduction

It is often said that young children and elementary school children are out of touch with wildlife (Louv, 2008). Bird observation only recently has been adopted in elementary school as a strategy to improve environmental and preservation education, as it stimulates pupils observations of organisms in the natural world and develops respect of the quality of the environments they live in and raises awareness about biodiversity (Vielliard, 2000). Thus, identification of morphological features, for instance beak shapes and bird popular names should be explored and known.

Surveys have indicated that there are 1,825 bird species which 234 are endemic to Brazil (Perlo, 2009). There are a series of Brazilian ornithological and observation studies of birds from Paraná State such as Scherer-Neto and Straube, (1994), Westcoot et al., (2002), Gimenes et al., (2007), Volpato et al., (2009), Straube, (2013). Some studies relate bird watching and ludic activities for the teaching of primary school science and environment education in Mato Grosso State, Brazil (Nogueira et al., 2015). Other studies are related to geographical distribution of birds from Saint Catarina State as for example Rosário, (1996; 2004) and from Rio Grande do Sul State (Meller, 2011) as well as from São Paulo State (Hofling and Camargo, 2002), Lavras, Minas Gerais State (Braga et al., 2010) respectively from southern and southeastern Brazil. Field guides provide information for the distributions of birds in South America respectively in Argentinian Patagonia and Antarctica e. g. Laguna Nimez and Bahia Redonda (Beccaceci, 2010; Fernández, 2010).

There are a large number of educational media besides textbooks available to teach children and adolescents about birds, as for instance, "eyewitness guides" (Burnie, 1990; Sipinski, 2009). However, usually the textbook is the only source of knowledge about birds in Brazil referred to in formal education. Rarely do the textbook deals with birds of

* **Corresponding author:**
Amauri B. Bartoszeck, Laboratory of Cellular Metabolism, Neuroscience and Emergent Science Education, University of Paraná, PR Brazil.
Email: abbartoszeck@gmail.com

children´s daily lives, regional distribution of bird species, bird song, bird watching, as means to improve formal science education. However, the textbook is still an important tool to support teachers when preparing and teaching classes in all levels of natural sciences teaching and learning (Frison et al., 2009).

Children are innately interested in living things, identifying, classifying, and seeking patterns especially on animals including birds (Evans, et al., 2006; Tomkins and Tunnicliffe, 2007; Reiss and Tunnicliffe, 1999, Bartoszeck and Tunnicliffe, 2017). However, children have partial knowledge from spontaneous observations and experiences in their local everyday environment and lessons at school, but not necessarily gained from formal education (Tunnicliffe and Reiss, 1999; Patrick et al., 2013). Although there are research studies on certain animals, or animals in general, plants and their classification, our knowledge of early years children´s knowledge of birds is limited (Whitin and Whitin, 1996; Buchholz, 2000; Gatt et al., 2007; Patrick and Tunnicliffe, 2011; Tunnicliffe, 2012).

In the pre-school years for pupils aged 3 to 5 natural science is poorly covered in Brazilian kindergarten curricula and papers in this area are scarce (Straube and Vieira-da-Rocha, 2006; Tozzo, 2011; Moura and Vasconcelos, 2011). However, in other culture, Slovakian pupils showed ability to identify birds which birds local Noah's ark types as penguin, ostrich, pigeons (Prokop et al., 2007). Brazilian school children have a limited knowledge of Brazilian birds and are left behind in environment education and a lack of knowledge on biodiversity. A survey indicated that by the age range of 5 to 6 year age, they spontaneously said they know the canary (canário-da-terra, *Sicalis flaveola*), parrot (*Brotogeris ciriri*), humming-bird (*Eupetomena macroura*, *Amazilia fimbriata*), wood-pecker (pica-pau-do campo, *Colaptes campestris*), pigeon (*Columba picazuro*), owl (coruja-buraqueira, *Athene cunicularia*), and southern lapwing (quero-quero, *Vanellus chilensis*) , whereas in the range age of 10 to 14 year age they mentioned the *Poroaria dominicana* (galo da campina), *Thraupis sayaca* (sanhaçu), *Sporophila albogularis* (golinha), *Cyanocompsa brissonii* (azulão) as the most referred to (Silva and Bartoszeck , 2011; Bartoszeck at al. 2011).

Children aged 10 to 14 years (primary school) drew coloured drawings depicting simple outlines of what they think is a bird and additionally birds feet and beak as well were mentioned. An anA

analysis of these drawings indicated that these children knew 51 names of local Northeastern Brazilian birds, but there is no information related to this issue in Southtern Brazil. (Bartoszeck et al., 2011; Silva and Bartoszeck, 2011). Analysis of the drawings to elicit the mental model children had of a bird following the perspective of Luquet´s "intellectual realism" through this drawing which is an expressed model (Luquet, 1927/1979).

Drawings are representations of children´s ideas, knowledge and impressions of a biological topic (Anning and Ring, 2004; Cox, 2005). In fact, they draw their mental models as they attempt to diagram what they "see" in their mind. Models are iconic i. e. their parts represent visual images (Glyn, 1997; Goswami, 2008).

It is through what we find children know about birds mental models expressed in the bird drawings we wanted to elicit from a sample collected in southern Brazil pre-school, primary school and secondary school pupils (Boulter and Buckley, 2001, Rapp, 2007). Through analyzing the content of the drawings we hoped to find out what children thought they knew about birds.

There is a scarcity of studies on pupils´ ideas about birds in environmental education in Brazil. Argel-de-Oliveira, (1996) and Oliveira and Soares, (2013) highlighted that bird watching can be carried out even without expensive equipment in school backyard, neighborhood streets, city lawns, home garden. It is not necessary organize expensive and risky field trips to rural areas as urban birds will provide basic information towards environmental education for school age pupils.

People from urban cities do know about birds. Straube and Vieira-da-Rocha, (2006) interviewed 630 adults in a main street downtown Curitiba, southern Brazil and this sample provided 72.6% mentions of mostly endemic popular names of bird exemplars. Farias and Alves, (2007) highlighted the importance to study local (Northeastern Brazil) birds by means of ethno-ornitology collecting data from participant observation.

Sousa & Freitas, (2000) collected 233 questionnaires from pupils (12 to 15 year olds in Portugal and found the most important features to identify bird were colour, beak shape, feathers and less important singing. These pupils identified 33 different urban exemplars and 44 wild birds by popular names.

Gaspar, (2008) investigated the awareness of birds of 60 preschoolers from different locations in Portugal. City children were less able to list bird characteristics, exemplars, and to imitate bird songs than other localities. Prokop and Rodák, (2009) investigated the response of 110 11 to 12 year olds in Slovakia and found bird song and growth were main features used in identification.

Learning about birds endemic to where pupils live is part of their learning about environmental/conservation education. However, pupils of all age range seen to have difficulties in classifying animals, including, birds (Prokop et al., 2007). Studies report pupils and students bird misconceptions at secondary and college levels respectively (Kubiatko et al., 2011; Cartak, 2009). More recently there is some research investigating what are the attitudes and myths expressed by adolescents related to birds in Slovakia and countries with different levels of economic development, for example Colombia in South America (Prokop et al., 2008; Hummel et al., 2015).

Rationale

Bird observation is an establish practice in Europe and US as a hobby, but it is mainly carried out by biologist and specialist ornithologist in Brazil (Costa, 2006). Only recently, has the activity has been adopted in elementary school as a strategy to improve environmental education for children as it was usually carried out as a ludic experience (Allenspach and Zuin, 2013; Grossi, 2017). It stimulates the capacity of pupils´ observation of organism in the natural world and the development of respect and preservation of the quality of the environment where they live in. Identification of morphological features related to feed habits and popular names were explored as well as colour selection, bird aspects and drawings (Vieira-da-Costa and Molin, 2008; Ahi, 2016). We know from research in other countries (as listed earlier) that children do notice local animals in their immediate environments. Hence we decided to elicit such potential knowledge amongst some Brazilian children. We formulated the following questions.

Research questions

This introductory study aims to explore the following questions:

- What do Brazilian school children gender and age know about the Brazilian birds?
- How a sample from southern Brazilian preschool and primary schools represent the external morphology of a bird by means of a drawing;
- Whether there is any difference by age and gender in understanding of how a representation of a bird is depicted according to a rubric scale of levels achieved;
- Which are the resources of bird knowledge prompted in interviews;

Methodology

The goal of this exploratory study is to ascertain what children across the age range of 3 to 16 years old think intuitively as the word "bird' is heard, where that source was acquired and what, if any, socio cultural influences affected their ideas. We asked Brazilian school children from this sample (N=515, 249 females and 266 males) to draw what they think are the external features of a bird whose ages and gender are shown in Table 1.

Table 1. Number of pupils by age and sex (F=girls, M=boys which performed drawings.

Age	Number and gender.
3	13 (F=8, M=5)
4	71 (F=34, M=37)
5	85 (F=41,M=44)
6	112 (F=55, M=67)
7	21 (F=10, M=11)
8	27 (F=17,M=10)
9	16 (F=8,M=8)
12	11 (F=5,M=6)
13	57 (F=29,M=28)
14	92 (F=42,M=50)
Total	515

Then we analysed the mental models of a bird (expressed model) they may have depicted in their drawings if so we were able to ascertain basic bird external characteristics by means of a rubric scale (Table 2).

Spontaneous drawings and individual interviews were collected from pupils attending a public school at a small village in the country-side named Mallet, Paraná. Pupils are from an urban environment and from a rural area coming from nearby farms. Most of the children are descendants from immigrant Polish and Ukrainian families whose forefathers came from Europe and settle down in this part of Paraná State, Brazil by the end of 1890. The preserve mother tongue, culture and religion. Data was also collected from public kindergartens located in the suburban area at the metropolitan city of Curitiba named Piraquara, from the villages of Palmeira, São João do Triunfo, Fóz do Iguaçu, State of Paraná, Southern Brazil. Analysis of the drawings intended to elicit the mental model they may have of bird on the perspective of Luquet´s, (1927/1979) "intellectual realism" through this drawn expressed model. Furthermore, the analysis would show if there were any difference by age, and understanding on the depiction represented in the drawing according to a scheme of bird characteristics, such as for instance beak shape and feathers and other features.

A semi-structured interview was conducted with 206 (Females=114, Males=92) pupils from mixed abilities, chosen by their teacher, to elicit with which birds these children were familiar with (question 1), where have they seen/found out this bird; many have seen on TV, books (question 2), with which birds that children notice of their everyday environment around home, near school, in the forest; where they have seen them (question 3). Additionally, which birds from a list (spoken) of 10 common Brazilian bird fauna they have seen (question 4) and from where they gleaned

their knowledge about birds through further data were obtained; tell more about where they have you seen the birds from question 4, maybe from TV, film, stories, books, real life (question 5) whose comments were tape-recorded and transcribed of the semi-structured interviews. The interview questions were prepared based in a previous pilot study (Bartoszeck et al., (2011).

A simple bird drawing rubric scheme for assessing the level of drawings was compiled based on researchers previous experiences after examining the drawings based on morphological attributes of birds and each drawing was scored by the raters (Table 2). Furthermore, the analysis of the drawings also took into consideration differences by age, on the level of understanding of the external features of a bird. Children were asked (during a session at school setting) to draw on a A4 sheet of paper what they think was a bird. They were told that it was not expected an artistic drawing. They were allowed 15 minutes to perform the drawing. Children were randomly selected by school teachers and only part of the sample handed their drawing to avoid disturbing the classes.

Ethical issues of parental consent were dealt with according to school protocols and procedures, and the questions being asked of the children were discussed with the head master and teachers. Exemplars of drawings and grades allocated are shown in Figures 1 to Figure 7.

Table 2. The rubric scale used to allocating a grade to bird drawings.

Level	Bird characteristics
0	Nothing recognizable
1	Scribble (resemblance of a bird)
2	3 parts body, legs, wings, beak
3	3 parts body, 2 legs on thorax, feathers, wings, tail, beak "insect catcher"
4	3 parts body, 2 legs on thorax, feathers, wings, tail, beak "seed breaker"
5	3 parts body, 2 legs on thorax, feathers, wings, tail, beak long (like humming birds)

The youngest children attending nursery school are used to draw pictures using crayons or colour pencils (Figure 1).

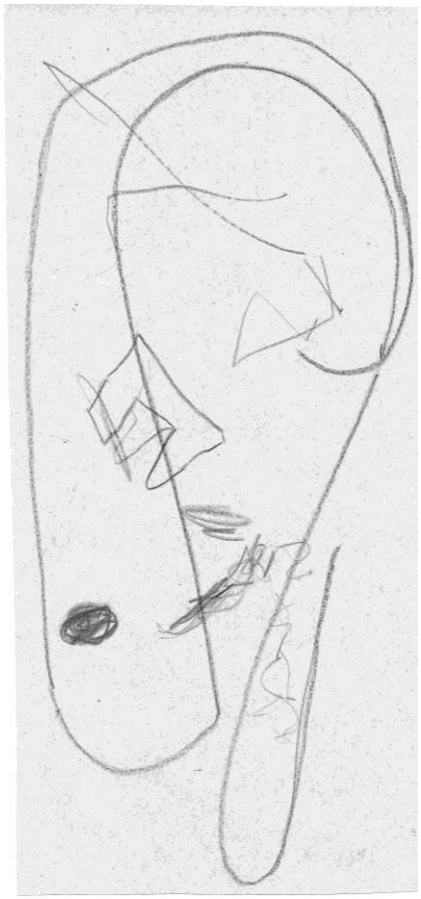

Figure 1. Drawing by a 3 year old girl depicting her concept of a bird, level zero (Fóz do Iguaçu town, Brazil).

Older children in kindergarten are used to draw pictures using black pencil (Figure 2, Figure 3 and Figure 4)

Figure 2. Drawing by a 5 year old girl depicting her idea of bird, level 1 (Piraquara, PR village, rural area, B razil).

Figure 3. Drawing by a 6 year old boy representing a bird, level 2 (Piraquara, PR village, rural area, Brazil

Figure 4. Drawing by a 7 years old boy, level 4 (Mallet, PR town, Brazil).

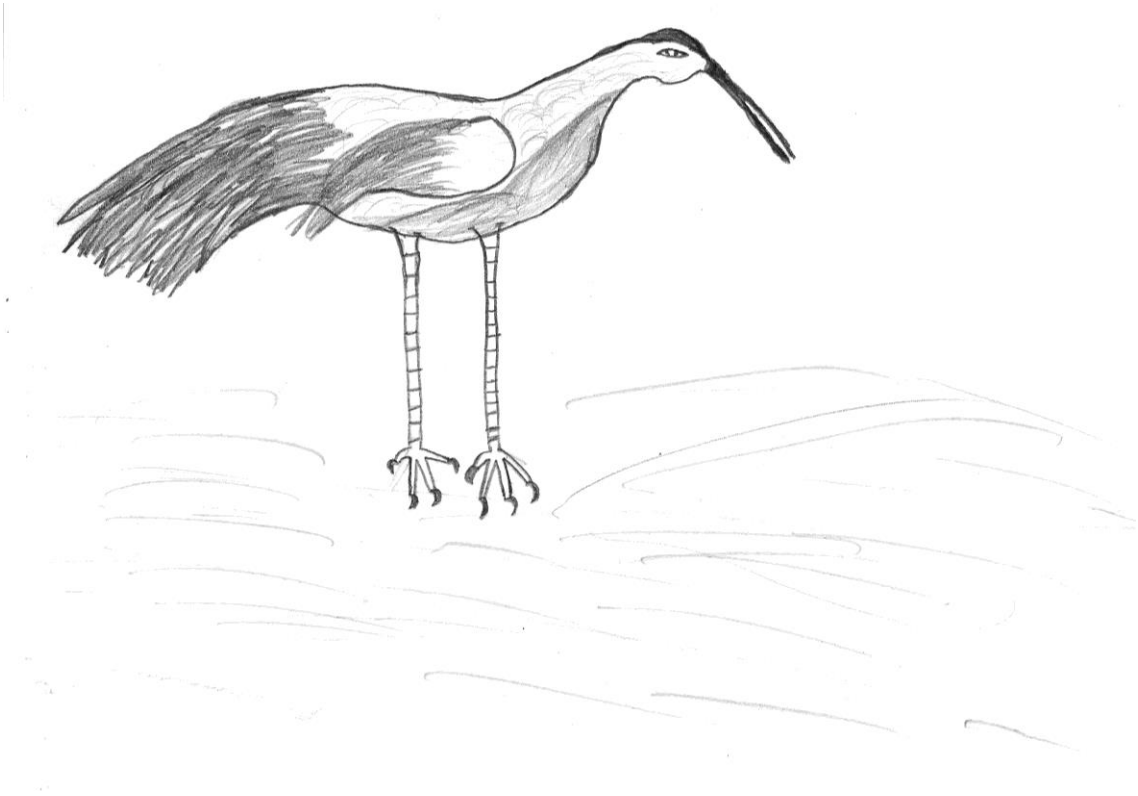

Figure 5. Drawing by a 13 year old boy, level 5 (Mallet, PR town, Brazil).

Figure 6. Drawing by a 17 year old girl, level 5 (Curitiba, PR town, Brazil).

Figure 7. Drawing by a 14 year old girl, level 3 (Palmeira, PR town, Brazil).

Interview findings

The first question in the interview asked pupils to name as many birds as they knew. It resulted in 30 bird names, it is presented first English name, second Portuguese name and scientific name: c1 canary/canário (*Sicalis flaveola*), c2 parrot/papagaio (*Amazonas aestiva*), c3 pigeon/pombo (*Columba livia*), c4 humming-bird/beija flor (*Eupetomena macroura*), c5 red ovenbird/João-de-barro (*Furnaris rufus*), c6 lapwing/ Quero-quero (*Belonopterus chilensis*), c7 cocktiel/piriquito (*Brotogeris tirica*), c8 toucan/tucano (*Ramphatos toco*), c9 crow/corvo (Corvus sp.), c10 treasurer/tesoureiro (*tyranmus savanna*), c11 wood-pecker/pica pau (*Melanerpes candidus*), c12 eagle/águia (Harpiahaliaetus *coronatus*), c13 bluebird/azulão (*Cyanocompasa rissonii*), c 14 blue magpie/gralha azul (*Cyanocorax caeruleus*), c15 hawk/gavião (*Buteogallus urubitinga*), c16 owl/coruja(*Perspicillata pulsatrix*) c17 trush/sabia (*Turdus rufiventris*), c18 chicken (*Gallus gallus domestica*), c19 arara/macaw (*Anodorhynchus hyacinthinus*) , c20 peacock/pavão (*Pavo cristatus*), c21 flamingo/flamingo (*Phoenicopterus ruber*), c22 swan/cisne (*Cygnus olor*) c23 kiskadee/bem-te-vi (*Pitangus sulphuratus*), c24 swallow/andorinha (*Dedichon dasypus*), c25 seagull/gaivota (*Larus minutus*), c26 heron/garça (*Ardea alba*), c27 southern house wren/coruira (*Troglodytes musculus*), c28 slaty-breasted wood-rail/saracura (*Aramides saracura*), c29 sayaca tanager/sanhaço (*Tangara sayaca*), c30 black bird/chupim (*Melothrus bonariensis*). The percentage distribution of the bird species according to pupils ages is shown in figures 8 to 11.

The second question asked where the pupil have seen or found out the bird mentioned in the first question. It resulted in 11 places coded as P1= at home, P2=backyard, P3=relative´s home, P4=on a tree, P5=on a street, P6=on TV, P7=flying, P8=in the park, P9=in a book, P10=in a magazine, P11=in the zoo.The third question asked which birds live around home, near school, in the forest, around, where the pupil have seen them. The fourth question asked if the pupil have seen any of the birds from a prompted list. The fifth question inquired from where pupils have seen the birds from the list, it could be from films, TV, stories, books, real life.

Drawings findings

The analysis of the collected drawings was carried out by the first and fourth authors and the levels achieved are depicted on Table 3.

Table 3. Analysis of pupils drawings according to levels achieved in percentage [%] (M=male, F=female NG=nothing recognizable)

Age	Sex	Level (L) 1	L2	L3	L4	L5	NG	N
3	M	-	-	-	-	-	100.00	5
	F	14.28	-	-	-	-	85.72	8
4	M	55.55	29.62	-	-	-	14.81	37
	F	75,00	8.33	-	-	4.16	12.50	34
5	M	40.74	59.25	-	-	-	-	44
	F	44.44	46.66	2.22	2.22	-	4.44	41
6	M	32.35	60.46	6.97	-	-	6.97	67
	F	46.66	30.00	13.33	3.33	-	6.66	55
7	M	50.00	28.57	14.28	7.14	-	-	11
	F	22.22	22.22	22.22	33.33	-	-	10
8	M	20,00	60.00	-	20.00	-	-	10
	F	40.00	40.00	-	10.00	-	10.00	17
9	M	15.38	30.76	46.15	-	-	7.69	8
	F	-	71.42	14.28	14.28	-	-	8
12	M	-	-	50.00	50.00	-	-	6
	F	-	20.00	20.00	60.00	-	-	5
13	M	-	50.00	28.57	21.42	-	-	28
	F	-	29.16	33.33	37.50	-	-	29
14	M	-	50.84	10.16	30.50	8.47	-	50
	F	-	56.60	3.77	32.07	7.54	-	42
Total	M/F	117	283	66	144	27	21	515

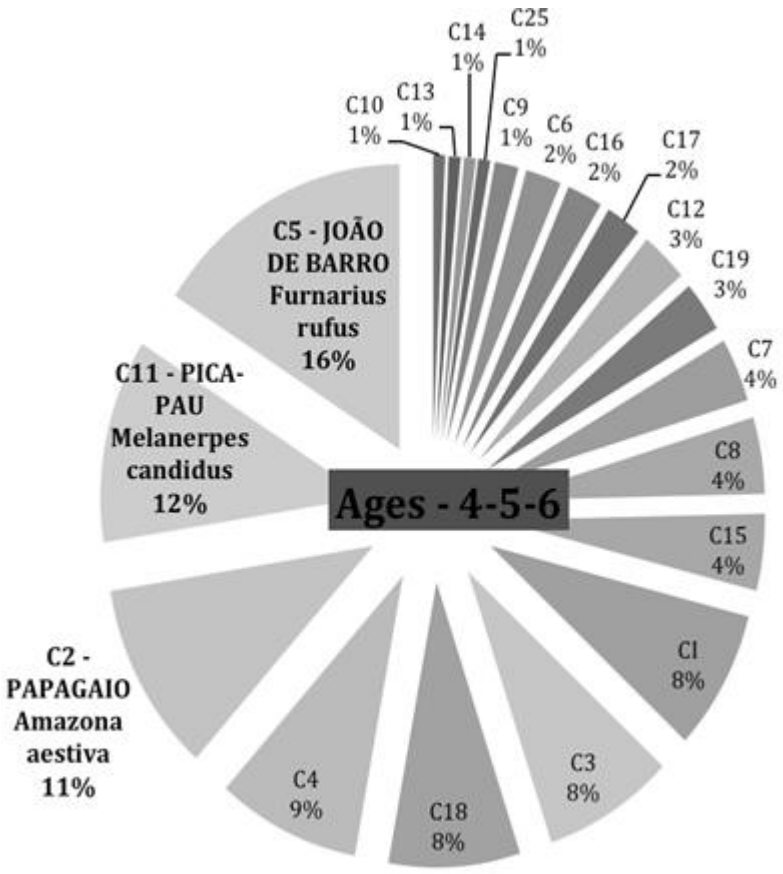

Figure 8. Percentage of the most observed bird species by pupils aged 4 to 6 .

Further interview results:

The largest percentages of species observations were for the red ovenbird/João de Barro (16%), woodpecker /pica-pau (12%) and parrot/papagaio (11%) as well as other bird species named by children 4 to 6 years old usually attending the kindergarten in Brazil (Figure 8).

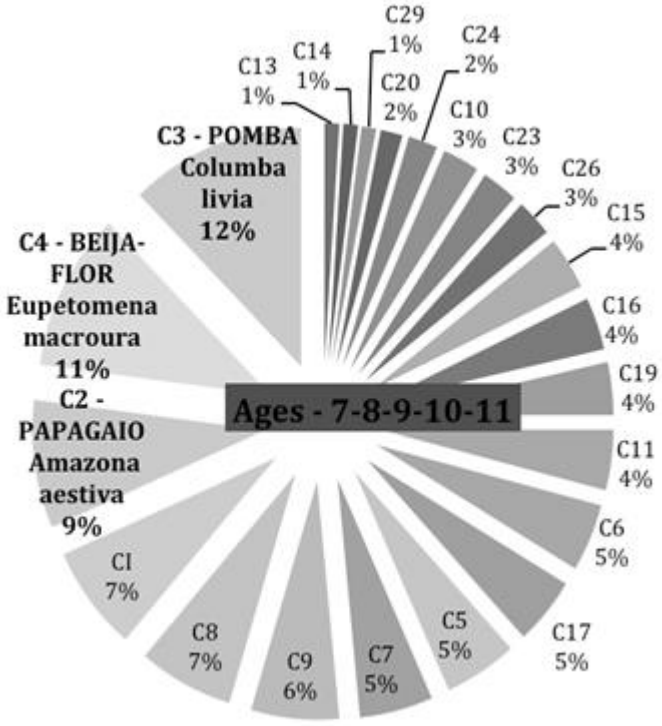

Figure 9. Percentage of the most observed bird species by pupils aged 7 to 11.

A similar pattern was noticed for the percentage of the most observed bird species by pupils enrolled in primary school (7 to 11 years old), pigeon/pomba (12%), humming bird/beija flor (11%), parrot/papagaio (9%) as well as other bird species (Figure 9).

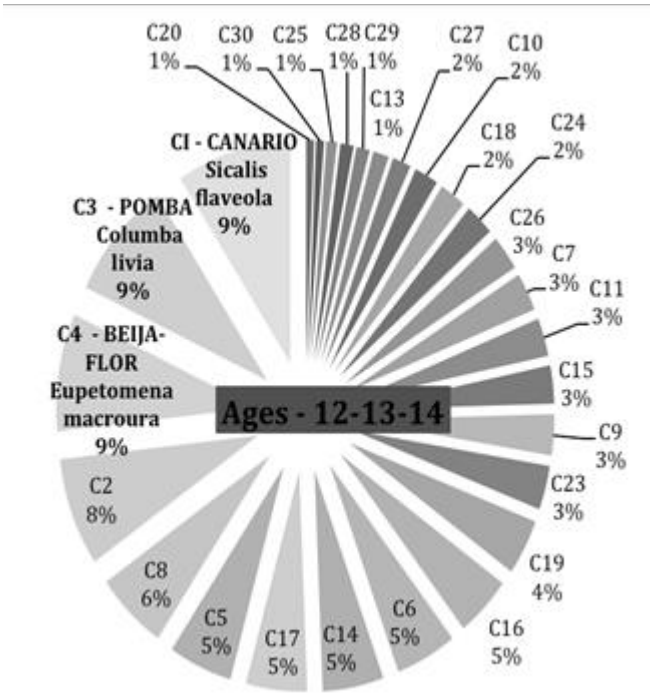

Figure 10. Percentage of the most observed bird species by pupils aged 12 to 14.

On the other hand, children aged 12 to 14 years old which are in the end of primary school selected as the most known species the canary/canário, pigeon (pomba) and humming bird all of them with (9%) as well as other bird species with lower percentages (Figure 10).

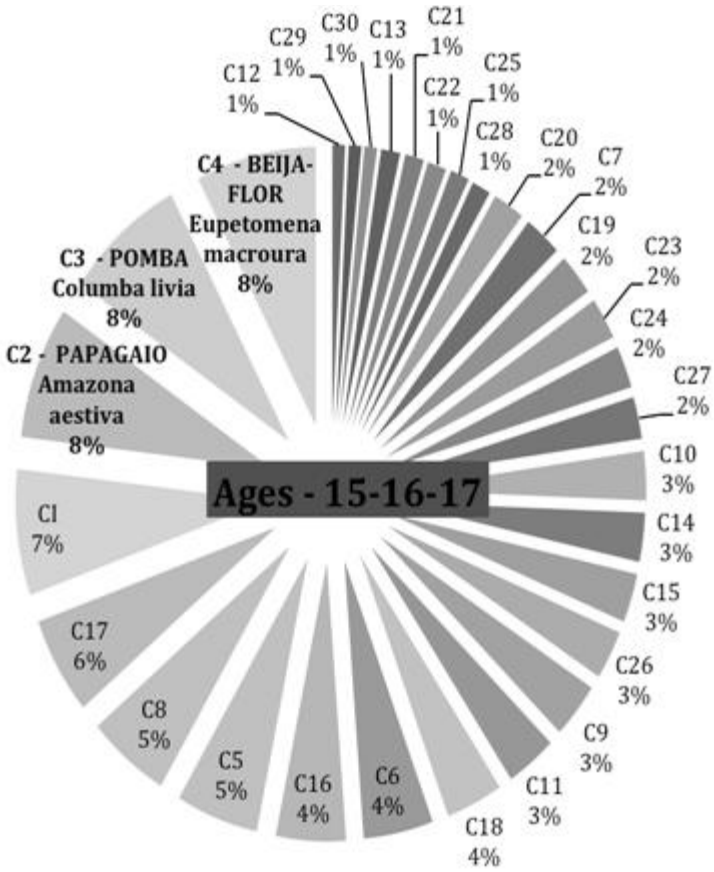

Figure 11. Percentage of the most observed bird species by pupils aged 15 to 16.

The last group of pupils comprised those attending secondary school and some the older ones (16 years old) are at the same time studying to pass examinations to enter university undergraduate courses. They selected the humming bird/beija flor, pigeon (pomba), parrot (pagaio) and the humming bird (beija flor) all of them with 8% of the observations amongst other species known (Figure 11).

The third question in the interview asked pupils in a range of ages, which birds they might know and seem which live around home, near school in short birds seem around.

The percentage of bird observations related to places (seem around) mentioned by pupils aged 4 to 6 were: on a tree(12%), in a book (11%), in a park (10%) on TV (8%), mentioned by pupils aged 7 to 11 were : on a tree, on TV both (11%), flying, in the park both (8%) and the least seem at relative´s home 3%. On the other hand, mentioned by pupils aged 12 to 14 were: on TV (12%), on a tree (11%0 in a park (10%) and the least seem in a magazine (3%) whereas pupils aged 15 to 16 mentioned at the relative´s home (17%), on a tree (11%), in the zoo (4%) and the least seem in a magazine (3%)

The fourth question in the interview asked pupils in a range of ages, if they had seen any of the kinds of birds named in a spoken list of 10 common birds. The interviewer ticked the ones pupils said they saw accordingly: S1=canary (canário), S2=parrot

(papagaio), S3=trush (sabia), S4=pigeon (pomba), S5=macaw (arara), S6=woodpecker (pica pau), S7=humming bird (beija flor), S8=swallow (andorinha), S9=owl (coruja), S10=seagull (gaivota), S11=toucan (tucano).

During the interview for question 4, pupils aged 4 to 9 said that the birds most seen were the parrot (84%), the pigeon (85.3%) and the woodpecker (80%) amongst other birds, but there was no mention for the toucan. The next age group (10 to 13 year-olds) mentioned the canary (85%), the parrot (92.6%), and the woodpecker (85.3%0 but also the toucan (68.2%) The last age group (14-17 year-olds) which roughly corresponds to the secondary school in Brazil, mentioned mostly the canary (96.4%), trush (99.4%) but also the toucan (78. 5%). These last two groups are more independent and can walk around by themselves and thus notice a larger quantity of birds than the younger pupils.

The fifth question in the interview asked pupils in a range of ages to tell more about the source where they had seem the birds in the fourth question. It could be some item from the –R1 to R5 source list below. R- resource alternatives. R1=TV, R2=film, R3=book, R4=stories, R5=real life. Pupils in the age range of 4 to 6 mentioned in the interview that common birds they saw in real life were humming-bird (40%), pigeon (40%), but those less common such as seagull and owl were from watching TV. On the other hand, pupils in the age range of 7-11 in a similar fashion to the younger ones, mentioned they had seen the parrot, the woodpecker, humming-bird and owl (23%) in real life but the thrush, macaw and swallow from watching TV. Pupils in the age range of 12 to 14 who are attending classes in the first part of secondary school in Brazil, besides mentioned they saw common birds from real life, such as the humming-bird (48%), canary (46%), woodpecker and the owl (both 42%) pointed out that the parrot and macaw were the least represented in school text-books

Pupils in the age range of 15-16 who are attending classes in the second part of secondary school said in the interview that the canary (25%), humming-bird (24%) and parrot were seen from real life. They also mentioned the owl, swallow, pigeon and trush were the less represented in school text-books.

Discussion and Conclusions

The present study aimed to explore in a preliminary way, pupils´ perceptions of what is a bird. Data were collected by means of a drawing and interviews from 515 pupils aged 3 to 16 year old from rural and urban schools random selected from Southern Brazil. Similar studies were carried out in Brazil, for instance, such as mentions of endemic popular bird names by adults (Straube and Vieira da Rocha, 2006). A questionnaire was previously applied to collect data as to find features to identify bird feather colours and beak shape in primary school level in Portugal and England (Sousa and Freitas, 2000; Evans et al., 2006).

Science as an organized body of knowledge is relatively new in Brazil. It started in the nineteenth century with scholarly studies of mathematics, physics and astronomy amongst other disciplines, and only more recently with Zoology and Biology (Azevedo, 1955). Natural History museums are rare and poorly distributed countrywide and anthropological museums in general exhibit issues related to historical developments as the country was inhabited by indians (Ardigó, 2011). Drawings taken as mental model of how pupils depict the characteristics of a bird were collected in the classroom and analysed by the authors following a rubric (Rapp, 2007).

It is well known that pupils construct their knowledge about birds from observing what happens in their environment, from their experience in interacting with information when attending school and textbooks. The aim is to integrate present information and previous knowledge in long term memory. However, from this sample younger pupils in the age range 3 to 11 year olds had fewer opportunities for observing birds in the open environment and this fact reflected on the way they noticed the bird morphological characteristics (i. e. feathers, tails, kind of beak). Even so, from the interview those aged 4 to 6 , the birds they remember more were the woodpecker, humming-bird and red ovenbird and a few others. On the other end, older pupils in primary school aged 7 to 11 remembered of having seen the pigeon, humming bird and the parrot and a few others as represented. Those pupils in the range age of 12 to 14 and 15 to 17 seemed to be more in touch with nature and were able to describe birds with further details as show on Table 3. They remembered having seen the canary, pigeon, humming bird and parrot, as well as pigeon and humming bird respectively (Figure 11).

During the interview pupils were prompted to tell in what places they had seem the birds. Although in the age range of 4 to 6 pupils do not know many birds they show interest specially on books depicting birds. They also mentioned they saw them at home, on a tree, on street when coming to school in the park and in the zoo when they visit on Sundays and holidays. Those in the primary school (aged 7 to 11) besides indicating at home, on a tree they also paid more attention and saw birds in the school backyard and TV programmes. Those pupils in the secondary school aged 15 to 16 are start preparing to sit for examinations to enter undergraduate colleague courses. Thus, they mentioned they saw birds at home, on the street when visiting relatives at farms or gardens, but less on TV and books.

The third question in the interview was stated as such" tell me which birds live around home, near school, in the forest; where have they seen them?. The objective of the question is to have birds pupils actually might know and really saw in the places stated.

Therefore, pupils aged 4 to 6 mentioned the largest percentage for pigeon, humming bird, lapwing and canary. Those pupils attending the first part of the primary school aged 7 to 11 mentioned the largest percentage for lapwing, humming bird, parrot, owl, toucan, macaw. Those pupils attending the second part of the primary school mentioned the largest percentage for canary, owl, pigeon, lapwing. And finally those pupils attending secondary school referred to the most birds seen as canary, pigeon, thrush and hen. Probably the last one usually found in farms and popular city vegetables fairs.

The last two question in the interview consisted of the name of 10 most common popular bird names (except seagull), where the researcher asked if the pupil had seen every one of those spoken from the list or not. Next the pupil was asked "tell me more about where had you seen the birds from this spoken list. It could be from TV, books, real life.

Younger pupils usually attend classes in the school premises and have no open field classes where they could observe less common birds as seagull and owl. Curiously a similar trend was noticed for pupils in the age range of 7 to 11 who said they saw the canary, thursh, macaw and swallow, from watching TV instead from real life as they have more mobility the explore the environment. The last two groups (secondary school) had more opportunities to go out and saw a larger number of birds in real life. However, they referred that many birds are poorly represented on school textbooks.

Drawings are representations or pieces of information how pupils construct science knowledge in the context of social interaction and local culture. During the analysis of the drawings collected it was intended to elicit the mental model pupils from this sample might had of a bird on the perspective of Luquet´s (1927/1979) "intellectual realism" through this drawn expressed model. Most of the drawings from the pupils in the age range of 3 to 7 achieved in the analysis, levels 1 to 2 (i. e. resemblance of a bird, basic body parts, legs, wings, beak) and a few level 3. Particularly, children attending nursery school drew pictures classified as nothing recognizable according to the rubric criteria, but explained that is the way they saw birds (Table 3). An example is illustrated on Figure 1. However, pupils in the age range 8 to 12 did a little better with some drawings reaching levels 3 and 4 (i. e. besides body parts including wings, tail, they also distinguished beak shapes such insect catcher and seed breaker). On the other way, there was a trend for those pupils aged 13 to 16 whose drawings were classified mostly levels 3 and 4. Specially those aged 14 to 16 achieved level 5 (i. e. body parts plus shape of the beak long). In short, older pupils which probably had more cognitive experiences were more confident and made further observations with meaning -birds characteristics- as on Table 3. Some representative drawings are shown from Figure 1. to Figure 7.

The findings suggest that there are similarities as well as differences in children's ideas on the concept of bird according to their age–range and cognitive development. However, this exploratory study has limitations. The number of pupils in the age-range of 3 to 4 is limited. Just a few country areas were sampled. Further studies should have to cover other areas of Brazil and explore the diversity of birds known by children.

Drawings can help children make their scientific ideas visible to teachers, who may provide remedial work to correct faulty knowledge about biological concepts and scientific thinking.

Educational implications

- Improve instructional strategies on Brazilian birds at schools plus field trips;
- More emphasis should be in pre-service and in-service teacher training courses;
- Start "bird watching clubs" to identify backyard birds in safe surrounding for younger pupils;
- Program visits to Natural History Museums where pupils could watch preserved birds accompanied by family members;
- Program visits to the Zoological Garden, where pupils could see birds alive and with indications of kind of species;
- Encourage local people, particularly families, to be involved in an aspect of citzien science of comunity bird observations.

Acknowledgements

The authors acknowledge the Head Master and teachers from Escola Municipal Divino Espírito Santo (Mallet, PR), Escola Estadual Nicolau Copérnico (Mallet, PR), Colégio Estadual Dario Veloso, (Mallet, PR) Centro de Educação João Paulo II, (Piraquara, PR), Escola Municipal Palmeira, (Palmeira, PR) Escola Municipal Sebastião Antunes Ferreira, (São João do Triunfo, PR), Pré-Escola Coelho Sapeca, (Fóz do Iguaçu, PR) all villages in Paraná State, Southern Brazil for allowing collecting of data in their premises.

References

Ahi, B. (2016). Flying, feathery and beaked objects: children´s mental models about birds. *International Electronic Journal of Environmental Education, 6*(1), 1-6.

Allenspach, N., & Zuin, P. B. (2013). Aves como subsídio para a educaçãoo ambiental: o perfil das iniciativas brasileiras. *Atualidades Ornitológicas, 176*, 50-57 [Birds study as a contribution to environmental education].

Angoro, F. K., Waxman, S. R., & Medin, D. L. (2008). Naming practices and the acquisition of key biological concepts. Evidence from English and Indonesian. *Psychological Science, 19*(4), 314-319.

Anning, A. , & Ring, K. (2004). *Making sense of children´s drawings*. Maidenhead: Open University Press.

Ardigó, F. [Ed.] (2011). Histórias de uma ciência regional. São Paulo: EditoraContexto [Science regional history].

Argel-de-Oliveira, M. M. (1996). Subsídios para a atuação de biólogos em Educação Ambiental. O uso de aves urbanas em educação ambiental. *Mundo da Saúde, 20*(8): 263-270. [Biologist actions towards environment education. Using urban birds in environment education]

Azevedo, F. De [Ed.] (1955). As ciências no Brasil. São Paulo: Edições Melhoramentos, volume, I:7-412, II:10-399 [Science in Brazil].

Bartoszeck, A. B., Silva, I. G., & Tunnicliffe, S. D. (2011). Brazilian children´s concept of bird: an exploratory study. Poster presented at the 9th Conference of the European Science Education Research Association (ESERA), Lyon, France, September 5th-9th.

Bartoszeck, A. B., & Tunnicliffe, S. D. (2017). What do children think is inside a crab? Journal of Emergent Education, 13:20-28.

Beccaceci, M. (2010). Patagonia & Antarctica field guide. Acassuso: South World.

Boulter, C. J., & Buckley, B. C. (2001). Constructing and using typologies of models in science education: the case of models of decay in an ecology course. Proceedings 3rd. ERIDOB:143-156.

Braga, T. V., Zanzini, A. C. S., Cerbocini, R. A. S., Miguel, M., Moura, A. S. (2010). Avifauna em praças da cidade de Lavras (MG): riqueza, similaridade e influência de variáveis do ambiente urbano. Revista Brasileira de Ornitologia, 18(1):26-33 [urban birds from Lavras town].

Burnie, D. (1990). Aves:aventura visual. São Paulo: Editora Globo [eyewitness guides-birds].

Cartak, O. (2009). Science students´ misconceptions about birds. *Scientific Research and Essay, 4*(12), 1518-1522.

Costa, R. G. A. (2006). Inserção da ornitologia na educação como estratégia de conservação das aves. *Atualidades Ornitológicas, 131*, 8-9. [Introducing ornithology in education as an strategy for preserving birds].

Costa, R. G. A. (2007). Observação de aves como ferramenta didática para educação ambiental. Revista Didática Sistêmica, 6:33-44, [observation of birds as a teaching tool in science classes]

Cox, M. (2005). The pictorial world of the child. Cambridge: Cambridge University Press.

Evans, S., Dixon, S., & Heslop, J. (2006). Pupils´ knowledge of birds: how goo is it and where does it come from? *School Science Review, 88*(322), 93-98.

Farias, G. B., & Alves, A. G. C. (2007). É importante pesquisar o nome local das aves? *Revista Brasileira de Ornitologia, 15*(3), 403-408 [Is it important to study local bird names?].

Fernández, D. P. (2010). El Calafate Birds-Laguna Nimez and Bahia Redonda. El Calafate: BirdLife IBA.

Frison, M. D., Vianna, J., Chaves, J. M., Bernardi, F. N. (2009). Livro didático como instrumento de apoio para construção de ensino de ciências naturais. 7th Encontro Nacional de Pesquisa em Educação em Ciências (ENPEC), 10p. [Textbook for teaching natural sciences].

Gaspar, R. (2008). Improving awareness and knowledge of preschoolers ideas about birds and their songs. 7th Conference of European Researchers in Didactics of Biology (ERIDOB), 3p., The Netherlands.

Gatt, S., Tunnicliffe, S. D., Borg, K., & Lautier, K. (2007). Young Maltese children´s ideas about plants. *Journal of Biological Education, 41*(3), 117-121.

Gimenes, M. R., Lopes, E. V., Loures-Ribeiro, A., Mendonça, L. B., & Anjos, L. dos (2007). Aves da planície alagável do alto Rio Paraná. Maringá: Editora da Universidade Estadual de Maringá [Birds from Rio Paraná plains].

Goswami, U. (2008). *Cognitive Development: The Learning Brain*. Hove: Psychology Press.

Grossi, M. G. R. (2017). O lúdico na aprendizagem: relato de experiências. *Revista Ibero-Americana de Estudos em Educação, 12*(3), 1689-1709 [The ludic in the learning of students: reported experiences].

Hofling, E. (2002). Aves no campus da Cidade Universitária Armando de Salles Oliveira. São Paulo: Editora da Universidade de São Paulo [Birds in the USP campus].

Hummel, E. Ozel, M., Medina-Jerez, W., Fancovicova, J., Usak, M., Prokop, P., & Randler, C. (2015). Interest in birds and its relationship with attitudes and myths; a cross-cultural study in countries with different levels of economic development. *Educational Sciences: Theory & Practice, 15*(1):1-12.

Kubiatko, M., Usak, M., Pecusova, E. (2011). Elementary school pupils´ knowledge and misconceptions about birds. Eurasian Journal of Educational Research, 43:163-182.

Louv, R. (2008). *Last Child in The Woods: Saving Our Children from Nature-Deficit Disorder.* Chapel Hill, NC: Algonguin Books.

Luquet, G.-H. (1927/1979). Le dessin enfantin. Neuchatel-Paris: Éditions Delachaux & Niestlè. [O desenho infantil. Porto, Pt: Livraria Civilização Ed].

Meller, D. A. (2011). Aves da capital das missões. Santo Ângelo: Editora da URI [Birds from Santo Ângelo, Brazil].

Moura, de E. M. S. L., & Vasconcelos, P. A. C. (2011). Educação infantil e seu cotidiano. Revista Diálogo Educacional. 11(32):57-67. [Preschool education and its daily life].

Nogueira, M. L. Piranda, E. M., Silva, M. B., Ilha, I. M. N., Paludetto, N. A., & Benites,V. A. (2015). Observação de aves e atividades lúdicas no ensino de ciências e educação ambiental. Revista Brasileira de Educação Ambiental, 10(2):187-203.[Birds observation and ludic activities in teaching sciences and environmental education].

Oliveira, D. K., Soares, B. M. (2013). Aves como ferramenta sensibilizadora e formadora em experiências educativas. Vivências, 9(16): 89-99.[Birds as a tool in the development of educational experiences].

Patrick, P., Tunnicliffe, S. D. (2011). What plants and animals do early childhood and primary students´ name? Where do they see them? *Journal of Science and Educational Technology, 20*(5), 630-642.

Patrick, P., Mathews, C., Tunnicliffe, S. D. (2013). Using a field trip inventory to determine if listening to elementary school student´s conversations, while on a zoo field trip, enhances preservice teachers´ abilities to plan zoo field trips. *International Journal of Science Education, 35*(15), 2645-2669.

Perlo, B. V. (2009). *A Field Guide to The Birds of Brazil.* Oxford, UK: Oxford Univ. Press.

Prokop, P., Kubiatko, M., & Fancovicová, J. (2007). Why do cocks crow? Children´s concepts about birds. Research in Science Education, 37:393-405.

Prokop, P., & Rodák, R. (2009). Ability of Slovakian pupils to identify birds. Eurasia Journal of Mathematics, Science & Technology Education, 5(2):127-133.

Rapp, D. N. (2007). Mental models: theoretical issues for visualization in science education. In: J. K. Gilbert [Ed.], Visualization in Science Education (pp. 43-60). Dordrecht: Springer.

Rosário, L. A. do (1996). As aves em Santa Catarina: distribuição geográfica e meio ambiente [Birds from Santa Catarina: geographical distribution and environment].

Rosário, L. A. do (2004). Um outro olhar da via expressa Sul [A new point of view over South high road].

Scherer-Neto, P., & Straube, F. C. (1995). Aves do Paraná: história, lista anotada e bibliografia. Curitiba: Ed. dos autores. [Birds from Paraná State: history and bibliography].

Silva, I. G. M., & Bartoszeck, A. B. (2011). Desenhos: representações de aves no ensino fundamental-anos finais, um estudo introdutório. 5th EREBIO-Sul, 4th ICASE, Londrina, BR, September 18th-21th, 10p.[Representing birds by drawings in primary school].

Sipinski, E. A. B. (2009). Cartilha: um jeito de cuidar da biodiversidade de Curitiba. Curitiba: Prefeitura Municipal de Curitiba e Sociedade de Pesquisa em vida selvagem e educação ambiental(SPVS), 26-32. [A booklet: a way to deal with Curitiba´s biodiversity].

Sousa, A. S., & Freitas, M. J. (2000). Bird watching as a strategy of environmental education. Proceedings of International Symposium BioEd-2000. Biology International, 39:1-9.

Straube, F. C., Deconto, L. R., & Vallejos, M. A. V. (2013). Guia do observador de aves. Curitiba: Fundação Grupo Boticário de Proteção à Natureza/Hori Consultoria Ambiental [Bird Field Guide].

Straube, F. C., Vieira-da-Rocha, M.C. (2006). O conhecimento da avifauna pela população de Curitiba (Paraná-Brasil) com subsídios para propostas locais de educação ambiental. Atualidades Ornitológicas, 133:18-21.[Knowledge of birds from people livingin Curitiba, contributions for proposals in environment education].

Tomkins, S., & Tunnicliffe, S. D. (2007). Nature tables: stimulating children´s interest in natural objects. *Journal of Biological Education, 41*(4): 150-155.

Tozzo, A. M. S. (2011). [Org] Educação Infantil. Nossa Escola-Edição especial. Secretaria Municipal de Educação de Chapecó, RS, 32p. [Preschool Education curriculum and objectives in Southern Brazil].

Tunnicliffe, S. D. (2010). First engagement with environment. People & Science, March, p. 25.

Tunnicliffe, S. D. (2012). Visualisation of animals by children: how do they see birds? *C. E. P. S. Journal, 1*(4):63-79.

Tunnicliffe, S. D., Reiss, M. J. (1999). Building a model of the environment: how children see animals? *Journal of Biological Education, 33*(3), 142-148.

Vielliard, J. M. E. (2000). Bird community as an indicator of biodiversity: results from quantitative surveys in Brazil. *Anais da Academia Brasileira de Ciências, 72* (3), 323-330.

Vieira-da-Rocha, M. C., Molin, T. (2008). Aceitação da observação de aves como ferramenta didática no ensino formal. *Atualidades Ornitológicas, 146*, 33-37 [Birds observation as a didactic tool in schools].

Volpato, G. H., Anjos, L. dos, Mendonça, L. B., Lopes, E. V., Berndt, R. A.(2009). Aves da Fazenda Monte Alegre: um estudo da biodiversidade. Londrina: Editora da Universidade Estadual de Londrina [Birds from Monte Alegre Farm: a biodiversity study].

Westcott, P. W., Mariño, H. F., Anjos, L. dos (2002). Observando aves em Londrina-norte do Paraná, Brazil [Observing birds in Londrina, Paraná, BR].