



Using a questionnaire to investigate Brazilian primary school pupil's knowledge and attitudes towards “bad” mosquitoes and “beautiful” butterflies

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Abstract

Children have a basic knowledge of insects that they see during their everyday life out of school such as in their garden, round the house, walking around the block where they live or in the yard on school gardens or orchard. We sought to establish the level of knowledge amongst schools aged pupils. We have to understand the knowledge of mosquitoes and butterflies related to humans because mosquitoes are important vectors for Dengue fever in Brazil. A total of 361 children aged 3 to 16 years old enrolled in two southern Brazilian urban and rural public schools were invited to participate in this exploratory study. A 5 point Likert scale questionnaire was developed. The scale categories varied from strongly disagree to strongly agree as contents of the questions. The scale consisted of 22 biological statements: 11 for the mosquitoes and 11 for the butterfly. The questions were designed to explore what attitudes and knowledge about butterflies and mosquitoes.

Keywords: Attitude, Butterfly, Children, Dengue fever, Insects, Mosquitoes, Questionnaire, Southern Brazilian.

Resumo

As crianças da pré-escola e os alunos do ensino fundamental têm um conhecimento básico sobre os insetos visto no cotidiano, quer seja no jardim da casa, ao redor do quintal ou mesmo quando andam na quadra onde moram, ou na horta e pomar da escola que frequentam. Um total de 361 alunos de ambos os sexos de idades compreendidas entre 3 e 16 anos foram convidadas para participar deste estudo exploratório. Um questionário foi usado para coletar os dados na escala Likert variando em 5 pontos (discordo totalmente à concordo totalmente) consistindo de 22 proposições biológicas 11 para o mosquito e 11 para as borboletas. Estas proposições visaram descobrir quais as posturas dos alunos sobre atitudes e conhecimento em relação a borboletas e mosquitos, visto que estes últimos insetos são vetores da Dengue no Brasil.

Palavras chave: Atitude, Borboleta, Crianças, Dengue, Insetos, Mosquitos, Questionário, Sul do Brasil.

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1. Introduction

Children are acquiring some knowledge of endemic insects before they enter formal education [1]. These early learners develop their own ideas about the world around them by means of daily learning experiences and observations which depend on the socio cultural context which they are immersed in (Astolfi et al., 2001; Preczewski et al., 2009) [2, 3].

Researchers have established that children attending nursery, preschool and primary school are innately interested in living organisms, and this interest is influenced by curricular activities [4-7]. The name of animals and plants from the everyday are amongst the first words spoken by children [8, 9].

A fundamental concept which develops very early in children is a tendency to group living organisms according to certain structural characteristics. How to name, identify and classify living organisms forms a set of abilities which very young children develop as they start learning sciences in preschool. [10-16]

Children construct their own scientific ideas and attitudes informed by their observations but also by attitude towards living organisms. Formal school instructs these learners to develop their ideas towards the accepted understanding expected to be acquired in schools following rules of scientific method [17-19].

However, “dengue fever” is a disease now becoming prevalent in more than 100 countries and is still spreading. More than 40% of the world’s population is at risk of being infected with dengue. Cases of dengue have appeared in Texas, Florida, France, Croatia besides Brazil [20, 21].

The dengue’s vectors is *Aedes aegypti* (the female yellow fever mosquito) and as well as *Aedes albopictus* (the female tiger mosquito). These infect humans by puncturing the skin of the person and thus may transmit the virus particles causing the disease which manifests in the patient as higher degree of fever difficult to control with current medication. [22, 23]

These insects are prevalent in Central and South America (especially in Brazil) but even Australia and lower United States have them (Torres, 2005; Rangel, 2008) [22, 23]. The yellow fever mosquito

bites during the day and is able to spawn in water filled crevices. Its eggs can withstand drought conditions and spread after a dry period. It is now a common pest of dense urban areas, bringing disease with it (Barreto and Teixeira, 2008) [24]. It is expected that a better knowledge of the biology of mosquitoes starting in the early years of schooling may contribute to larger adherence to health preventive campaign started by the Brazilian Ministry of Health.

2. Theoretical background

Basic attitudes towards animals held by humans, particularly insects, may be related to fear, i.e., people are frightened or repulsed by insects or by the some degree of dominance or control insects have [25-27].

Additionally, structural characteristics and peculiar animals behavior, shape attitudes in humans in relation to organisms [28-31]. Children have a poor grasp of invertebrates [32]. These research are reported that the observations in visiting Natural History Museums are vastly under-represent insects as a component of rainforest biodiversity

Family members, when at backyard or gardens of their homes, judge the value of organisms by considering qualities, such as if they are beautiful have practical use, are rare or have peculiarities of behavior that attract people’s attention [33]. Such visual appeal of animals is produced primarily by visual stimuli which may influence families to do something intentionally to protect specimens of fauna and flora in the environment [34-36].

Children tend to avoid invertebrates in general because occasionally they can bite or sting, an experience they may have had at home (Danoff-Burg and Colker, 2002; Ludmand and Boyle, 2015) [37, 38]. Consequently children may have an attitude towards insects and spiders, but such seems to be mainly due to the fact that they are of small size, sticky to the kids and whose morphology and the way they react are strange to human beings and they kill these invertebrates [39-47]. Primary school teachers possess negative attitudes and beliefs



towards hissing cockroaches although using them in practical classes [47]. Surprisingly, children attending primary school in US, Portugal, France and Brazil show a positive attitude towards some insects such as ladybird beetles and other insects characteristics such the ones whose visual image and cultural personal experience in spite of stings [47-52]. Hence, nursery and primary school children have greater knowledge about harmful than helpful activity of insects for human beings although a positive perception of the role of bees, ants and butterflies [49, 52, 54].

Southern and northeastern young Brazilian children (4 to 6 years) already have a basic grasp on the concept of insects, whereas American children (USA) at equivalent ages show limited knowledge of insects, *i.e.*, do not understand the difference between spiders - *Arachnoidea* and insects - *Insecta* [6, 55]. Knowledge of insects is restricted to the external morphology found in primary textbooks and seldom from practical classes [56-59]. Understanding of adaptation of other animals is also not consistent among children [60]. A negative attitude towards spiders and bats was shown by data collected by a questionnaire in Slovakia which may be the result of cultural and historical reasons [61, 62].

Southeastern and northeastern Brazilian pupils (11 to 13) are not sure whether or not an insect is an alive creature, or whether an organism is an insect confusing insects with other arthropods [53, 54, 58, 63, 64]. They include in the Class Insect other arthropods and usually draw an insect without appendices or 2 pairs instead of 3 pairs, although with a pair of antennae.

Their knowledge of insects is restricted to the external morphology found in science textbooks and seldom from practical classes [56-59].

3. Research questions

1. What are pupils attitudes towards mosquitoes and butterflies?
2. What are pupils knowledge about mosquitoes and butterflies?
3. Where is the school located and if pupils have a pet?

4. Methods

The purpose of this exploratory study is to compare the existing attitudes and knowledge of a sample of Brazilian primary school pupils (grades 1st to 9th) about the mosquitoes and butterflies in their environment because at first insect is a nuisance biting people and some species are Dengue fever vector while the second insect is benign towards humans pollinates plants when collecting nectar. Due to the bright color of their wings, butterfly is used to decorate wall plates and trays [65, 66]. No previous study on attitude to these specific insects was done in Brazil. A questionnaire was collected from pupils in the cities of Paranaíba* (Paraná State) and Nova Londrina** (Paraná State) both in southern Brazil (Appendix 1).

Data collection was carried out by the first author in 2 public (philanthropic) schools during the class period and it took about 15 minutes to be filled by the pupils anonymously indicating gender, age, if living in urban or rural zone and if having a pet animal at home. A previous study was carried out in the Czech Republic and Slovakia and adapted for the present investigation [67, 68].

The first researcher of this study contacted the schools that agreed to allow their pupils to fill the questionnaire. The Head teachers of the schools concerned dealt with ethical issues of parent consent and procedure. The questionnaire was used as a research tool and its contents were discussed with the Head teachers. The schools were invited to select the pupils to be asked from the age groups (6 year olds/Grade 1st. up to 16 year olds/Grade 9th.), with as equal as possible distribution of male and female.

The questionnaire contained a 5 points Likert scale vary from (1) strongly disagree to (5) strongly agree (Appendix I) consisted of 22 items 11 for the mosquitoes and 11 for the butterflies. Items are intended on finding of attitudes (2 for mosquitoes: Question [Q.] 2 and 5) and (4 for butterflies: Q.1, Q. 3, Q.4, and Q. 11) and knowledge (9 for mosquitoes: Q. 1, Q. 3, Q.4, Q.6, Q.7, Q.8, Q. 9, Q.10, Q.11) and (7 for butterflies: Q.2, Q. 3, Q. 5, Q.6, Q.7, Q.9, Q.10). The questionnaire was translated and adapted from its original form into Portuguese [69]. Knowledge items are emphasized as to represent basic facts about the biology of these invertebrates,



as mosquitoes are important vectors for Dengue fever in Brazil. Pupils were reassured that the questionnaire was anonymous, that it was not a test but rather a research attempt to evaluate their knowledge and attitudes towards mosquitoes and butterflies.

The validity of the questionnaire was verified by three Professors in the field of entomology from University of Paraná, Curitiba-Brazil. The sample size consisted of (N = 361 pupils) both genders and the age of the pupils ranged from 6 to 16 (184 females and 177 males). Analysis of a total of 361 questionnaires was carried out by contents indicating percentage of the categories achieved, rating of the individual questions and the average (A) and standard deviation (SD). Information whether the school was located in a urban or rural area and if the pupil had a pet animal where also collected (Appendix 1). Due to proximity of age range, pupils either feminine or masculine were grouped in age blocks (6 to 8, 9 to 11 and 12 to 16 accordingly).

The completed surveys from the participants were combined into single data set. These data were examined to understand what they could tell us. Table 1 to Table 4 depicts the number of participants, age, gender and their ratings of each of the 22 questions (11 for mosquitoes and 11 for butterflies). The average score for each question is reported with its standard deviation. This test also reported the analysis of the percentage of this sample which strongly agree (category 5) and the adjacent Likert category (agree, category 4). It is included the percentage of those that strongly disagree (category 1) and disagree (category 2). Reported are the raw scores for each participant across the 22 questions. In this way, data have archival value and can be readily compared in other studies in which the scale is given in other regions in Brazil and South America. It is also reported the mean ages of pupils from both cities with reference to which pet they keep at home and

the mean number of pets related to rural or urban schools (Table 5).

5. Results

After collecting data we analyzed the answers comparing averages and standard deviation to each question in the questionnaire according to gender, ages, cities and if pupils where from a urban or rural area. The results are considered from mean scores for mosquitoes´ eleven questions at Paranavaí town were: females aged 6 to 8 (3.75), females 9 to 11 (3.28) and females aged 13 to 14 (3.25). The mean score for butterflies from the same females were aged 6 to 8 were (3.55), 9 to 11 (3.26) and 13 to 14 (3.21).

5.1. Tables (1-5)

- In Table (1), on the other hand, for males the mean score for mosquitoes were: aged 6 to 8 (3.36), males aged 9 to 11(3.17), and males aged 12 to 16 (3.18). The mean score for butterflies were: males aged 6 to 8 (3.40), aged 9 to 11 (3.26) and aged 12 to 16 (3.41).
- In Table (2), with reference to Nova Londrina town the mean score for mosquitoes, same questions were: females aged 6 to 8 (2.91), females aged 9 to 11(3.04). The mean score for butterflies were: females aged 6 to 8 (3.15), aged 9 to 11 (3.35).
- In Table (3), the mean score for males aged 6 to 8 was (2.90), males aged 9 to 11 (3.1) and males aged 12 and more (3.01). The mean score for butterflies were: males aged 6 to 8 (3.44), aged 9 to 11 (3.35), aged 12 and more (3.34).



Table 1. Ratings for mosquitoes (M1 to M11) and butterflies (B1 to B11) by female pupils aged 6 to 8 (A1), 9 to 11 (A2) and 13 to 14 (A3). (A = average, SD = standard deviation for each question, Likert category 4-5 in (%), where L4 = strongly agree, L5 = strongly disagree from Paranavaí (city 1).

Question	A,1	SD1	L4	L5	A,2	SD2	L4	L5	A,3	SD3	L4	L5
M1	4.5	1.0	82.5	7.5	3.9	0.9	76.60	10.60	3.7	0.8	62.50	6.25
M2	3.9	1.4	70.0	27.5	4.2	1.1	85.10	10.64	4.3	0.7	87.50	0.00
M3	3.2	1.3	30.0	20.0	3.1	1.1	34.00	19.15	2.9	1.3	31.25	25.00
M4	3.8	1.3	65.0	17.5	3.3	1.0	34.04	10.64	3.1	0.9	12.50	18.75
M5	1.9	1.4	15.0	77.5	1.8	1.0	10.64	85.11	2.0	1.1	6.25	75.00
M6	4.4	1.0	85.0	5.0	3.9	1.0	68.09	6.38	3.7	1.2	68.75	18.75
M7	2.6	1.5	27.5	47.5	2.2	1.2	12.77	59.57	2.8	0.9	6.25	31.25
M8	4.5	1.1	90.0	7.5	4.2	1.3	82.98	12.77	3.9	1.1	62.50	6.25
M9	2.2	1.6	22.5	60.0	2.7	1.0	14.89	46.81	3.2	1.2	31.25	25.0
M10	3.7	1.4	60.0	17.5	2.4	1.3	21.28	51.06	2.8	0.8	6.25	18.75
M11	4.6	1.1	92.5	7.5	4.4	1.0	89.36	6.38	3.4	1.0	50.00	18.75
B1	4.6	1.0	92.5	7.5	4.7	0.5	97.80	0.00	4.1	1.3	31.25	25.00
B2	2.0	1.4	15.0	75.0	2.0	1.2	12.70	65.9	3.2	1.0	81.70	18.70
B3	4.6	0.8	87.5	5.0	4.2	0.9	76.60	4.26	3.9	0.8	75.00	6.25
B4	4.8	0.5	95.0	0.0	4.6	0.9	91.50	4.26	4.4	0.7	87.50	0.00
B5	3.1	1.4	35.0	37.5	3.2	0.7	19.15	6.38	3.3	0.9	25.00	6.25
B6	1.9	1.3	15.0	82.5	2.1	1.1	10.64	70.21	3.5	1.3	50.00	25.00
B7	4.0	1.0	70.0	7.5	2.6	1.3	21.28	44.68	3.4	0.9	25.00	6.25
B8	4.6	0.9	92.5	5.0	4.2	0.9	78.72	2.13	3.8	1.2	68.75	12.50
B9	4.5	1.1	82.5	5.0	4.4	1.1	87.23	6.38	3.6	1.0	50.00	12.50
B10	3.9	1.3	60.0	15.0	2.6	1.3	23.40	40.43	3.2	1.0	31.25	18.75
B11	1.4	1.1	7.5	90.0	1.3	0.8	4.26	95.74	2.0	1.4	18.75	68.75



Table 2. Ratings for mosquitoes (M1 to M11) and butterflies (B1 to B11) by male pupils aged 6 to 8 (A1), 9 to 11 (A2) and 12 to 16 (A3). A = average, SD = standard deviation for each question, Likert category 4-5, “strongly agree” L4 in (%), category “strongly disagree” L5 in % from Paranavaí (city1).

Question	A,1	SD1	L4	L5	A,2	SD2	L4	L5	A,3	SD3	L4	L5
M1	3.9	1.4	70.0	16.67	3.5	1.3	52.9	29.4	3.5	1.2	60.0	29.0
M2	3.9	1.4	66.6	23.30	3.9	1.4	70.5	23.5	4.1	1.3	78,1	16.30
M3	3.2	1.5	43.3	26.60	3.1	0.9	35.2	29.4	3.3	1.2	42.2	23.60
M4	3.2	1.5	53.3	33.30	3.2	0.8	29.4	11.7	2.7	0.9	12.7	34.50
M5	2.0	1.5	20.0	73.30	2.0	1.4	17.6	64.7	1.9	1.3	12.7	81.80
M6	3.6	1.6	60.0	23.30	3.8	1.0	58.8	11.7	3.9	1.0	74.5	9.00
M7	2.5	1.5	26.6	50.00	1.8	0.8	0.0	76.4	2.1	1.0	5.4	63.60
M8	4.5	1.0	83.3	3.30	4.3	0.9	82.3	5.8	4.2	1.0	76.3	5.40
M9	2.3	1.4	26.6	53.30	2.3	1.0	11.7	58.9	2.4	1.1	10.9	49.00
M10	3.3	1.4	40.0	26.60	2.4	1.2	11.7	52.9	2.7	1.1	12.7	34.50
M11	4.1	1.6	75.6	20.00	4.6	1.0	94.1	5.8	4.2	1.3	81.8	12.70
B1	4.1	1.3	83.3	13.30	4.2	1.2	76.4	17.6	4.1	1.2	80.0	16.30
B2	2.1	1.3	16.6	73.30	2.2	1.3	17.6	64.7	2.6	1.0	12.7	36.30
B3	4.0	1.1	73.3	6.60	4.2	1.2	82.3	11.7	4.0	0.9	76.3	5.40
B4	4.2	1.0	73.3	6.60	4.7	0.7	88.3	0.0	4.4	0.9	83.6	3.60
B5	3.6	1.1	50.0	20.00	3.1	1.0	23.5	23.5	2.9	1.0	18.1	27.20
B6	1.9	1.3	13.3	73.30	1.9	1.0	11.7	82.3	2.7	1.3	30.9	52.70
B7	3.5	1.3	53.3	20.00	2.7	1.3	29.4	41.1	3.2	1.1	43.6	20.00
B8	4.3	0.9	76.6	3.30	4.1	1.2	76.4	11.7	3.9	1.0	70.9	9.00
B9	4.3	0.8	83.3	0.00	4.5	0.7	88.2	0.0	4.1	0.8	80.0	1.82
B10	3.7	1.1	56.6	13.30	2.2	1.4	17.6	70.5	2.9	1.1	25.4	27.20
B11	1.8	1.4	16.6	76.60	2.1	1.6	12.0	70.5	2.4	1.5	30.9	67.20



Table 3. Ratings for mosquitoes (M1 to M11) and butterflies (B1 to B11) by female pupils aged 6 to 8 (A1) and 9 to 11 (A2). A=average, SD=standard deviation for each question, Likert category 4-5 “strongly agree” L4 in %, category “strongly disagree” L5 in % from Nova Londrina (city 2).

Question	A,1	SD	L4	L5	A,2	SD	L4	L5
M1	3.4	1.2	71.4	21.4	3.3	1.5	50.7	28.3
M2	4.1	1.6	78.5	21.4	4.5	0.9	92.5	5.97
M3	2.6	1.4	28.5	50.0	2.7	1.5	37.5	44.7
M4	2.1	1.3	28.5	71.4	2.6	1.4	28.3	53.7
M5	1.3	0.5	0.0	100.0	1.3	0.9	4.4	95.5
M6	3.9	1.1	78.5	21.4	3.5	1.3	61.2	25.4
M7	1.9	0.9	0.0	71.4	2.4	1.3	25.4	58.2
M8	4.1	1.5	78.6	14.3	4.3	1.1	82.1	8.9
M9	1.6	0.9	0.0	71.4	2.3	1.2	16.4	59.7
M10	2.4	1.2	14.3	42.8	2.6	1.2	13.4	38.8
M11	4.7	0.5	100.0	0.0	4.0	1.4	74.6	20.9
B1	2.6	1.4	85.7	14.3	4.7	0.8	95.5	2.9
B2	4.5	0.7	35.7	50.0	2.5	1.4	28.8	47.7
B3	4.4	0.9	92.8	0.0	4.3	1.0	74.6	5.9
B4	3.0	1.0	92.8	7.1	4.5	0.8	91.4	4.4
B5	1.7	1.0	21.4	21.4	2.9	1.1	23.8	29.5
B6	2.9	1.6	7.14	78.5	2.5	1.3	23.4	52.2
B7	4.3	0.8	50.0	35.7	3.2	1.4	43.2	26.8
B8	4.1	0.9	78.6	0.0	4.3	1.0	85.1	8.9
B9	3.2	0.8	71.4	0.0	4.1	1.2	77.6	10.4
B10	3.2	1.5	35.7	7.1	3.1	1.0	23.9	16.4
B11	0.8	1.1	7.14	92.8	1.0	1.2	10.4	88.0



Table 4. Ratings for mosquitoes (M1 to M11) and butterflies (B1 to B11) by male pupils aged 6 to 8 (A1), 9 to 11 (A2) and 12 or more (3). A=average, SD= standard deviation for each question, Likert category 4-5 “strongly agree” L4 in %, category “strongly disagree” L5 in % from Nova Londrina (city2).

Question	A,1	SD	L4	L5	A,2	SD	L4	L5	A,3	SD	L4	L5
M1	2.5	1.4	33.3	50.0	3.1	1.5	46.8	35.9	3.0	1.8	50.0	50.0
M2	4.5	0.5	100.0	0.0	4.6	0.8	93.7	3.13	3.8	1.9	75.0	25.0
M3	2.3	1.5	16.7	66.7	3.0	1.3	45.3	37.5	3.3	1.5	50.0	50.0
M4	2.5	1.0	16.7	50.0	2.4	1.2	17.2	59.4	1.8	0.5	0.0	100.0
M5	1.5	0.5	0.0	100.0	1.5	1.0	7.8	89.1	2.0	0.8	0.0	75.0
M6	4.2	0.8	83.3	0.0	4.0	1.2	76.5	12.5	4.0	0.8	75.5	0.0
M7	2.5	1.0	16.7	50.0	2.1	1.4	18.7	65.6	2.5	1.7	25.0	75.0
M8	3.3	1.9	66.7	33.3	4.2	1.4	76.5	15.6	4.0	2.0	75.0	25.0
M9	2.0	0.6	0.0	83.3	2.6	1.5	28.1	57.8	3.0	1.8	50.0	50.0
M10	2.5	1.4	33.3	50.0	2.3	1.2	15.6	51.6	2.8	1.0	25.0	50.0
M11	4.2	1.6	83.3	16.7	3.1	1.1	87.5	10.9	3.0	1.8	50.0	50.0
B1	3.8	1.5	83.3	16.7	3.9	1.6	75.0	25.0	3.0	1.8	50.0	50.0
B2	2.8	1.2	33.3	33.3	2.2	1.4	21.9	64.1	2.3	1.3	25.0	75.0
B3	4.0	0.9	66.7	0.0	3.9	1.3	70.3	15.6	4.0	0.8	75.0	0.0
B4	4.3	0.5	100.0	0.0	4.3	1.2	82.8	9.4	4.3	0.5	100.0	0.0
B5	2.7	0.5	0.0	33.3	3.0	1.3	31.2	29.7	3.3	1.5	50.0	50.0
B6	2.2	1.2	16.7	66.7	2.5	1.4	25.0	51.6	2.8	1.7	25.0	50.0
B7	3.3	1.0	33.3	16.7	2.8	1.5	39.6	40.6	2.8	2.1	50.0	50.0
B8	4.5	0.5	100.0	0.0	4.3	1.2	86.0	9.38	4.0	0.8	75.0	0.0
B9	4.3	0.5	100.0	0.0	4.0	1.2	75.0	14.1	3.5	1.3	50.0	25.0
B10	4.0	0.9	66.7	0.0	2.9	2.0	29.7	32.8	3.5	1.3	50.0	25.0
B11	2.0	1.5	16.7	83.3	2.0	1.6	25.0	73.4	3.0	1.8	50.0	50.0

Table 5. Mean ages of pupils from Paranavaí rural (Pvai-R), urban (Pvai-U) and Nova Londrina rural (Nov-R), urban (Nov-U) schools related to average kind and number of pets.

City	Age	Hamster	Dog	Cat	Bird	Fish	Rabbit	Donkey	Hen	Nº. of Pets
Pvai-R	11.00	0.03	0.74	0.18	0.29	0.08	0.08	0.05	0.05	1.50
Pvai-U	9.58	0.03	0.72	0.10	0.14	0.06	0.01	0.01	0.03	1.10
Nov-R	10.00	0.00	0.83	0.25	0.21	0.00	0.08	0.00	0.04	1.42
Nov-U	9.52	0.01	0.77	0.22	0.20	0.03	0.04	0.00	0.03	1.30



5.2 Next results

A comparison was carried out comparing data obtained for kind of insects and sex and aged of the pupils to see if there was a preference for any organism: The following data were obtained: for females pupils aged 6 to 8 the score was (3.55), pupils aged 9 to 11 (3.26) and pupils aged 13 to 14 (3.21) all in Paranavaí city. On the other hand male pupils aged 6 to 8 the score was (3.40), for those 9 to 11 (3.26) and those aged 12 to 16 (3.41).

5.3 Nova Londrina, gender and kind of insect

As for Nova Londrina town the mean score for butterflies was for female pupils aged 6 to 8 (3.15) and pupils 9 to 11 (3.35). As for male pupils aged 6 to 8 it was (3.44), 9 to 11 (3.25) and aged 12 or more (3.34). Thus, taken as a whole group most of the mean score figures for either mosquitoes or butterflies are very close to each other except for males (2.91) and females (2.90) both aged 6 to 8 from Nova Londrina (Table 4).

5.4 Behavior of female and male mosquitoes

The most problematic items centered on biological knowledge related to mosquitoes behavior. For instance, question (1) stated that either male and female mosquitoes feed on human blood. It is well documented from research that only females need blood to maturation of ovaries and full development of eggs. However, pupils aged 6 to 8 and other range of ages both sexes either from Paranavaí (city 1) (Likert scale 4-5: 82.5%) or Nova Londrina (city 2) (Likert scale 4-5: 82.5%) believed that both mosquitoes sexes feed on human blood (Table (1) to Table (2)). Question 4 stated that female mosquitoes lay eggs during autumn, but it is documented that the Dengue fever transmission rarely occurs when temperatures drop below 16°C which is what happens in autumn in Southern Brazil. Pupils from Paranavaí (city 1) in the age range of 6 to 16 both sexes agree with the statement (Likert scale 12.73% to 65.0%) whereas pupils from Nova Londrina (city 2) in the same range of ages, both sexes disagree with the statement (Likert scale 50.0 to 100.0%) as shown in Tables (3) to (4). Question (7) stated that insects are viviparous i.e., the embryological development occurs inside the female mosquito). In fact among insects only aphids are either viviparous or

oviparous. Pupils from Paranavaí (city 1) in a range of ages from 6 to 16 both sexes disagree with the statement (Likert scale 31.25% to 76.47%) whereas the same trend was observed for Nova Londrina (city 2) (Likert scale 50.0 to 75.0) as show with more detail in Tables (1) to (4).

Question 10 stated that insects breathe by lungs as other vertebrates do. In fact insects breathe by a system of spiracles and tracheae what probably what older pupils would be familiar with the concept. Pupils in the age range of 6 to 16 (Paranavaí) had mixed opinions. Females aged 6 to 8 agreed (Likert scale 60.0) but those aged 9 to 11 and 13 to 14 disagree (Likert scale 18.75% to 51.06%) whereas boys aged 6 to 8 agreed (40.0%) but those older disagreed (Likert scale 34.55 to 52.94) as presented in Tables 1 to 4). However, pupils from Nova Londrina aged 6 to 12 or more, mainly disagreed (Likert scale 38.1% to 51.0%) as detailed in Tables 3 to 4).

5.5 Attitude, knowledge dimensions

Concerning attitude's dimension question (2) asked if pupils hate mosquitoes. Female pupils aged 6 to 14 from Paranavaí agreed with the proposition (Likert scale: 70% to 87.5%) as well as male pupils aged 6 to 16 (Likert scale 47.27 to 66.67%). The same trend was observed for Nova Londrina as female pupils aged 6 to 11 (78.57% to 92.54%) and male pupils aged 6 to 12 or more (Likert scale: 75.0% to 100.0%) as detailed in Tables 3 to 4.

5.6 Insect physiology

Question (1)0, still as a knowledge dimension question, asked if butterflies or breath by lungs which is a question suitable for advanced pupils. Paranavaí early years pupils aged 6 to 8 both sexes believed that these insects breathe by lungs (girls Likert scale 60.0%, boys 56.67%) and Nova Londrina same age range (girls Lickert scale 35.7%, boys 66.67%). Older pupils are uncertain and disagreed to the proposition, as for instance in Paranavai girls aged 9 to 11 (Likert scale 18.75% to 40.43%) and boys (Likert scale 27.27% to 70.59%), and Nova Londrina girls same age (Likert scale 16.42%, and boys 25.0 to 32.81%). Further details may be found in Table (1) to Table (4).



5.7 Pet ownership participants

Dogs were the most mentioned pet by Paranaíba pupils aged 11 living in rural areas (average: 0.74) and urban houses (average: 0.72) whereas a similar trend was found for Nova Londrina, rural areas (average: 0.83) and urban area (average: 0.77).

6. Discussion

Mosquitoes are considered unpopular by families and pupils as harmful insects whereas butterflies are considered to be popular by the population at large [44, 70]. The reaction of many people to insects is emotive and influenced by feelings of affection for insects benign to human, such as butterflies and bee, but by feelings of fear and disgust about insects perceived as harmful, such as mosquitoes as recorded in a sample population from pupils in southern Brazil (see Table (1) to Table (4)). These animals, which living usually in forests, commonly occur in human houses and gardens. A better knowledge of these insects may influence children's beliefs and attitudes towards them contributing to environmental education in schools and avoid destruction of biodiversity [26, 62, 71].

In examining the responses to knowledge dimension questions, the data show pupils from both towns are confused with biological information. They know that males or females feed on plants seeking for nectar or sap containing sugars. The data suggest they extend this notion being human blood a food source.

They are unsure of the optimum season for mosquitoes to lay eggs and lack knowledge of the lifecycle of insects. They use themselves as an example how should insects breathe. It is possible that the youngest pupils and maybe the old ones have heard about it from watching TV documentaries, sites in the Internet. Do they reason that organisms in general need oxygen but are not sure how this gas reaches tissues?

Pupils in this study were more familiar with the popular names of insects than scientific names which later will help in species identification and thus increases interest in nature care, understand biodiversity and makes a basis for sustainable

development [72]. Species insect identification is progressively being incorporated in the new educational schemes since the 1990s in all levels of education in Brazil and some countries of South America [73].

7. Conclusions

All pupils participating in this study reported had at least one pet in their home. A positive attitude towards pets was investigated in another culture by open-ended questions in the age range of 3 to 13 (Kidd and Kidd, 1985) [74]. In Paranaíba (city 1) rural schools the mean number of pets at home is larger than in town schools and the same trend was observed for Nova Londrina (city 2) rural school. The most common pets in the sample from Southern Brazil are dogs, cats, and the least common hamster and rabbits in the age range of 6 to 16 as found in a similar study in UK [75]. Results show that a better understanding of animals specially when taking care of pets at home, feeding the animals, observing that new ones are born helps develop children's grasp of biology. Our sample show a similar trend which is detailed in Table 5. An investigation in Slovakia where children of different ages provided drawings which contributed to their knowledge of internal organs, it stresses benefits of conceptual knowledge extended to invertebrates [76]. Another survey in the same European country carried out with primary school children (aged 10-15 years) showed that pupils had better knowledge but less favorable attitudes to unpopular animals compared to popular ones [77]. However, this exploratory study has limitations considering that Brazil is a large country with different biomass and just two cities in the Southern area were explored in this study, sample was not very large, further research is necessary countrywide.

Educational implications

- Emphasis in training courses for pre-service and in-service teachers as different ways how to raise butterflies and mosquitoes;



- Program visits to health institutions laboratories, for instance *Fundação FioCruz*, Rio de Janeiro where health campaigns against the mosquitoes are developed;
- Schools should program visits to Natural History Museums or Zoology Departments at their local University as a tool to assist learners obtain a strong grasp on insect biology and collections;
- Program field-trips showing the significance of insects living in ponds, lakes and rivers.

Schools:

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- II. Escola Municipal Cecília Meirelles, Rua Bahia, 151, Fone: (44) 3902-1011, 87703-370, Paranavaí, PR.
- III. Escola Estadual de Ensino Fundamental (Vale do Tigre), Rua Juscelino Kubitschek de Oliveira, 361, Fone: (44) 3432-1880, 87970-000, Nova Londrina, PR.

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Appendix I

This questionnaire is designed for research purposes and all information will be confidential. Please, read the questions carefully and then mark an answer according to your attitude to these invertebrates.

Gender: boy girl **Age..... The year of study:**

Residence: village town

Which pets do you keep at home?

Mosquitoes					
Question/attitude.	<i>strongly disagree</i>	<i>disagree</i>	<i>neutral</i>	<i>agree</i>	<i>strongly agree</i>
1. A male and female mosquito feed on human blood.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I hate mosquitoes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. The mosquitoes are important for a preservation of balance of nature.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Female mosquitoes lay eggs during autumn.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I like mosquitoes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Mosquitoes are a food for insectivorous birds.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Mosquitoes are viviparous, thus they do not lay eggs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Mosquitoes can carry diseases, like malaria, dengue fever.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Caterpillars are equal to mosquitoes' larvae	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Mosquitoes breathe by lungs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Female mosquitoes lay eggs into water.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Butterflies & moths					
Question/attitude	<i>strongly disagree</i>	<i>disagree</i>	<i>neutral</i>	<i>agree</i>	<i>strongly agree</i>
1. I like butterflies.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Butterflies can carry diseases.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. The butterflies are important for a preservation of balance of nature.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Butterflies are organisms with very attractive bright colours.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



5. Female butterflies & moths lay eggs during autumn.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Caterpillars of butterflies and moths are equal to mosquitoes' larvae.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Butterflies and moths originate from eggs being laid by other butterflies or moths.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Female butterflies and or moths lay eggs on the leaves of plants.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Butterflies are very interesting live organisms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Butterflies and moths breathe by lungs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. I hate butterflies.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Adapted from: M. Kubiátko & I. Vaculová (2012), Personal communication. [69]