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The entomological exhibition of a Science museum and its contributions to non-formal Education

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ABSTRACT. The Insecta Class is the most diverse group of animals on the planet. A big part of this composition is available in the collections of Natural History Museums, being essential for researches and diffusion actions involving a specialized and lay public. This paper aimed to verify the importance of an entomological exhibition of a Science museum for the acquisition of new knowledge and conception change regarding insects. To this end, 128 fourth-graders from elementary school were asked to draw an insect and write a brief description of it in relation to their knowledge about insects. Then, they visited an entomological exhibition, and a week later, using the "stimulated recollection method", they made a new drawing and description. The extracted data were organized in categories and statistically analyzed. Significant changes were observe regarding the children's knowledge and concepts on insects in most of the analyzed aspects, such as the decrease of drawings and descriptions of animals belonging to other taxonomic groups and an increase on correct descriptions of concepts.
Keywords: insects; Environmental Education; scientific divulgation; childish drawing.

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Introduction

There are about one million insect species, three times more than the rest of the animals, that is, about 90% of all described animals are insects, representing about 70% of all invertebrates and 80% of all arthropods (Toro, Chiappa, & Tobar, 2009; Farias, 2013).

The organization and maintenance of taxonomic collections (Martins, 1994), also known as scientific collections, is one way to know this biodiversity. Aristotle (384-322 BC) used this practice, by developing a classification system – Scala Naturae – based on the organisms collected by him and his students, thus describing at that time about 540 species, most of them from Greece (French, 1994).

Knowledge is gathered in databases originally based on these collections, which are often kept in institutions such as universities, zoos, research centers and museums, thus becoming the most important tool for classifying and describing species (Narendran, 2006). Linnaeus (1707-1778), creator of the 'binominal nomenclature', arranged for several of his students to travel to different parts of the world, besides Europe, to collect specimens to be used for such purposes (Nishida, 2009).

It is common for researchers to seek museums and use their collections. These collections can be used on the site and even lent to be studied at their workplaces, so they can circulate among different countries. Thus, a remarkable number of discoveries may be made, such as those carried out by the curator Philip S. Ward of the Bohart Museum, University of California - Davis, who was able to identify about 4000 species per year by studying ants of entomological collections (Suarez & Tsutsui, 2004).

According to their use, we can classify biological collections in different ways (Narendran, 2006). Besides scientific collections, there is another type of great importance: the didactic collection, in which the specimens are destined to the exhibition, demonstration, training or other educational activities (Ministério do Meio Ambiente [MMA], 2007).

In Parana, in the city of Maringá, the *Museu Dinâmico Interdisciplinar* at the *Universidade Estadual de Maringá* (MUDI-UEM) stands out. This museum houses an expressive entomological collection with approximately 8,000 items, the result of the work of the researcher PhD Yoko Terada. Considered as one of the largest Science museums in southern Brazil, MUDI emerged from an extension project *Centro*

Interdisciplinar de Ciências (CIC), carried out at the university since 1985, whose main goal is to integrate the university with the community at large.

Entomological collections have the potential to divulge the importance of insects to the ecosystems balance. The knowledge developed together with field and taxonomic studies, we can carry out actions to make Science popular based on the use of conserved specimens for didactic purposes. To do so, the assembly of exhibitions that propose important debates for Environmental Education (Falaschi, Capellari, & Oliveira, 2011) would be a primary tools.

Different researches showed that the public perception regarding insects is ambiguous, varying between positive and negative attitudes and feelings (Costa-Neto & Carvalho, 2000; Costa-Neto & Pacheco, 2004). This fact is explained by the hypothesis of entomoprojective ambivalence, according to which, the human beings tend to project feelings of noxiousness, dangerousness, irritability, disgust and disdain to animals associated with the culturally determined 'insect' category (Costa-Neto, 2006; Alencar et al., 2012). It is also interesting to note the symbolic use of the drawing of different insects in religions of different countries. They often figure prominently in the myths about creation, which probably derives from an innate recognition of these animals as ancient beings since the world beginning or soon after it. For example, the Cherokee, a native American ethnicity, believe that the earth was created from the moment a water beetle plunged and brought mud to the surface (Hogue, 2009).

This work aimed to verify the prior knowledge regarding insects of fourth year students of Elementary School and the importance of an entomological exhibition for conception change and the acquisition of new knowledge.

The referred exposition if part of MUDI, an university Science museum located in the city of Maringá in Paraná, Brazil. Nowadays, the *Exposição Entomológica Professora Yoko Terada* has as a proposal to bring to the public, in a playful and dynamic way, subjects about the importance of insects for Ecology, Health and Economy. The space consists of: 14 panels with general information, encompassing six themes: 'how to identify an insect', "metamorphosis', 'they and us', 'colors and shapes, 'importance to nature' and 'diseases transmission'; a game called 'try to find the camouflaged insects'; two panels with poems ('Polinization' by Ismar S. Mosqueta, and 'The waste picker' by Manoel de Barros); pictures, three panels with curiosities, tactile biscuit models (dengue-mosquitto – *Aedes aegypti* (Linnaeus, 1672), a lady bug and a fly's head), four insects in laid in resin (jequitiranabóia – *Fulgora laternaria* (Linnaeus, 1758), two beetles and a mamangava bee (*Bombus* sp)), a Madagascar cockroach terrarium (*Gromphadorhina portentosa* (Schaum, 1853)), microscopes for legs and wings observation, a screen with a video display, five insetaria, cladogram on the evolution of the Insecta Class and chandeliers with replication (Figure 1). As there is no fixed road map to the approach, each environment mediator works on themes in the order they see convenient and adapts them according to the different audiences.

Figure. 1. Overview of the entomological exhibition used in the research (a) and explanatory panels (b).

Due to the easiness of working with drawing and written texts, and also to the fact that the theme 'insects' was approached in children Education and in the first years of Elementary School, this was the chosen Educational level.

Material and methods

A total of 128 students participated in this study (male and female) of the fourth year of Elementary School from two public schools in Maringá, Paraná state, Brazil, from the first school, 63 students attended and the second one, 65. The schools were randomly selected using the museum visitation book.

In total, there were four meetings with the classes:

- 1st: A visit to the school coordination and classes to explain the objectives and procedures of the research and hand out the Term of Free and Informed Consent to the students. As the data collection involved only the students, there was no need for the teacher's signature;
- 2nd: application of the pre-test. In their respective classrooms, each child received a blank sheet of paper and the researcher requested them to write their names and make a drawing in one of the paper halves on their knowledge about the insects. They were also asked to write, in the other half, a brief explanatory text about the representation, aiming to reduce misunderstandings during the interpretation;
- 3rd: on a specific date for each school, the students took a guided tour at the MUDI and visited the insects exhibition. During this activity, which lasted about 30 minutes with each class, students initially took part in an approximately 20-minute talk with the mediator on the subjects present in the panels, where they had the opportunity to share lived experiences and clarify doubts. Later, they were free to explore, individually or with their colleagues, the interactive devices;
- 4th: application of the post-test. Seven days after the visitation, in each classroom, the researcher used with the students the 'stimulated recall method' (Falcão & Gilbert, 2005), showing the students printed general photographs of the groups at the moment of the visit and asking them to report their memories, which part called their attention and what they learned about a certain topic. After that, they were asked to elaborate a new drawing and a new description of their knowledge about insects.

For the drawing and texts analysis, categories of analysis were established. All the records were carefully analyzed and subdivided based in common general characteristics, easing the subdivision in restricted topics, which allowed the elaboration of the definition and boundaries of each category for the data inclusion or exclusion (Carlomagno & Rocha, 2016).

Six categories were settled for the drawing analysis, each one representing a different theme:

Category 1- Animal representation from other groups;

Category 2- Realistic colors. Drawing that presented insects with colors close to reality;

Category 3- Negative factor representation. Drawings that represent negative situations, such as an insect bite, diseases transmission and dirt associations;

Category 4- Anthropomorphization. Drawing tended to "lend" human characteristics to other animals;

Category 5- Mistaken morphological characterization;

Category 6- Animal insertion in the environment. Drawing that represents the insect in a context, in the environment that surrounds it and interacting with other life forms.

As for the written texts, the grammar was not analyzed, but the content. The word is essential for the drawing interpretation, seeing that the traced signs do not speak for themselves (Natividade, Coutinho, & Zanella, 2008). To identify and compare knowledge, desires and emotions presented in the texts, categories were also established, being possible to classify the text in more than one, since they already constitute distinct topics:

Topic 1: Other animals

Category 1- Description of an animal from another group.

Topic 2: Absence of explanation

Category 2- Animal's name only. When the student wrote only the name of the animal.

Topic 3: Description of biological/ecological concepts

Category 3- Wrong description of concepts;

Category 4- Partially correct description of concepts. Sentences where the students mix correct and

incorrect concepts;

Category 5- Correct description of concepts.

Topic 5: Experience report

Category 6- Description of a pleasant experience;

Category 7- Description of a negative experience.

Topic 5: Feeling demonstration

Category 8- Showing empathy;

Category 9- Showing disgust.

Statistical data analysis was also performed using the BioEstat5.0 software. For each category, the individual changes observed in the pre-test and post-test were identified, regardless of the school origin. The frequency of changes in each category had its own significance evaluated by the McNemar test, having as a significance level $p < 0.05$.

Results and discussion

The results of the drawing and written texts analysis are found respectively in Tables 1 and 2.

Table 1. Absolute and relative number of the drawing analysis made by the 4th-grade students from Elementary School in pre- and post-test according to categories defined in the study and their statistical analysis.

Categories	Number of drawings				McNemar*
	Pre-test		Post-test		
	n	%	n	%	
1 Animal representation from other groups	22	17.2	2	1.5	$p < 0.05$
2 Realistic Colors	25	19.5	71	55.5	$p < 0.05$
3 Negative factor	5	4	1	0.8	$p > 0.05$
4 Anthropomorfization	46	36	37	29	$p < 0.05$
5 Mistaken morphological characterization	37	29	48	37.5	$p > 0.05$
6 Animal insertion in the environment	45	35	34	26.5	$p > 0.05$

*Significant values: $p < 0.05$.

Table 2. Relative and absolute number for the analysis of texts written by 4th grade students of Elementary School in pre- and post-test according to the categories defined in this study and their statistical analysis.

Categorias	Number of texts				McNemar*
	Pre-test		Post-test		
	n	%	n	%	
1 Description of an animal from another group	19	14.8	2	1.5	$p < 0.05$
2 Animal's name only	4	3	4	3	$p > 0.05$
3 Wrong description of concepts	6	4.7	5	4	$p > 0.05$
4 Partially correct description of concepts	24	18.7	30	23.4	$p > 0.05$
5 Correct description of concepts	26	20.3	34	26.5	$p > 0.05$
6 Description of a pleasant experience	0	0	7	5.4	$p < 0.05$
7 Description of a negative experience	19	14.8	6	4.7	$p < 0.05$
8 Showing empathy	51	39.8	39	30.4	$p > 0.05$
9 Showing disgut	10	7.8	6	4.7	$p > 0.05$

*Significant values: $p < 0.05$.

The childish drawing is important because it develops itself from the relation of the child with the goal in question, being its mental structures what define the possibilities as the interpretation and representation of the goal (Pillar, 1996; Rodrigues, 2010). Through drawing, child express not only their knowledge, but also their way of interpreting things and even feelings about something, since they produce it from the memory of an image that serves as a mirror for mental representation. Therefore, exploring their illustrations may provide researchers with a better understanding of developing knowledge (Cherney, Seiwert, Dickey, & Flichtbeil, 2006).

The term 'insect' often refers to an ethnocategory that, culturally constructed, eventually encompasses animals from other taxonomic groups (Montenegro, Alencar, Silva, Lucena, & Brito, 2014; Lima, Chapani, & Silva Júnior, 2017), which explains the high number of the representation and description of animals from other groups in the pre-test. Initially, it is important to mention the significant change that occurred,

evidencing that the visit to the exhibition collaborated with the understanding of what an insect really is, since one of the topics addressed during the visit is how to identify one.

Analyzing the drawings, the exposition contribution becomes evident for the acquisition of knowledge, what can be easily observed, for example, in the utilization of colors. For Luquet (1969), when children paint a drawing, they can do it in two ways: realistic or purely decorative. The color is used in a realistic way when the individual considers it essential, when not, it is not more than any other character that is being designed. Therefore, it is noticeable that after the visit, children started representing more often animals with their real colors, possibly because they paid attention to the importance of the individual colors for the survival, a very approached topic during the visitation.

It is common to hear negative facts related to insects, such as the disease transmission and the agriculture plague. However, it is important that positive information to be also available to the population, so that they can understand the role these animals play in the balance of ecosystems and even for human life (Snaddon & Turner, 2007).

The anthropomophization was very present in the drawings. It is believed that this can be a reflex of the humanized impressions presented by the media that frequently represent other forms of nature with human characteristics (Luiz, 2012; Santos & Gomes, 2012). After the visitation, the participants paid more attention to the real morphology of the animals, reducing the quantity of anthropomorphized drawings.

As for the morphological representation, on the pre-test the students limited themselves to drawing common insects to be seen day-by-day, such as butterflies, bees and ants. Subsequently, they represented animals before unknown or never seen, such as the Madagascar hissing cockroach and buckwheat. It is possible to say that after the visit, they started exploring the image of the new, what can explain the increase in the amount of drawings anatomically incorrect. This tendency of representing these arthropods with flaws regarding the basic characteristics – body segmentation, number of legs, presence of antennas – also is highlighted in other works, such as Souza Junior, Costa-Neto, and Santos (2014).

The interaction perception is very important between insects and other natural elements, what demonstrates knowledge about ecology, subject where they frequently are used as model organisms (Gullan & Cranston, 2008). However, after the visit, most students chose to represent the animals separately, probably because most of samples are found exposed this way. This shows that when visiting the exposition, the relation between insects and their environment may have remained unnoticed by the children.

As for the mistaken concepts, wrong information and partially correct description some myths stood out, for example: "As far as I know the butterflies are colorful and she is also very poisonous if you kill her she releases a powder that can even kill instantly [...[." ('2' 4th A pre 2). Despite the visitation, on the post-test there was not any significant change regarding this category. In contrast, there was a significant increase in written texts with partially correct description and correct description, proving that the exhibition contributed with the knowledge acquisition: "I drew the kissing bug because it appears in the camp at night and bites and poops and the person scratches". ('1' 4th C post 2).

In recent years, specially in western cultures, the negative vision regarding insects has intensified (Costa-Neto & Pacheco, 2004). One explanation is the fact that with the time, man is increasingly distancing himself from the natural environment and losing the ability to distinguish an insect from another, and as a result, he generalizes negative attitudes (Hoyt & Schultz, 1999 apud Costa-Neto & Pacheco, 2004).

In this context, the results showed a significant reduction in reposts with negative experiences and a raise of pleasant experiences description, for example: "I drew these cockroaches because they is very nice to see and when I saw those cockroaches in the terrarium I thought they were in the fish tank. It was very good, I liked it a lot". ('1' 4thB post 23).

"I drew a butterfly because it is my favorite insect and because I think it is very beautiful". ('2' 4th C pre 11). "The buckwheat hides in the middle of the grass so you can see it that is why I liked it" ('1' 4th C post 1). Phrases such as these express, somehow, that the child likes or admires the animal. On the post-test, most children focused on writing information that called their attention, what explains the decrease in the number of comments that refer to empathy, and even, disgust.

Conclusion

When visiting an entomological exhibition, all 128 students had the opportunity of knowing a little more about the diverse world of entomofauna, relating new knowledge with their life experience, through

conversation, curiosity awake and doubt clarification. Thus, many had their negative concepts converted and acquired new information about the Insecta Class, what co-operates with the growing of environment respect and its interactions.

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