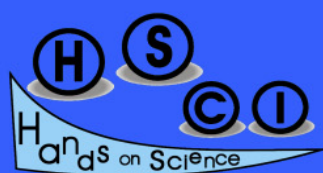


Hands-on Science

Brightening our Future

Edited by
Manuel Filipe P. C. Martins Costa
José Benito Vázquez Dorrió



The Hands-on Science Network

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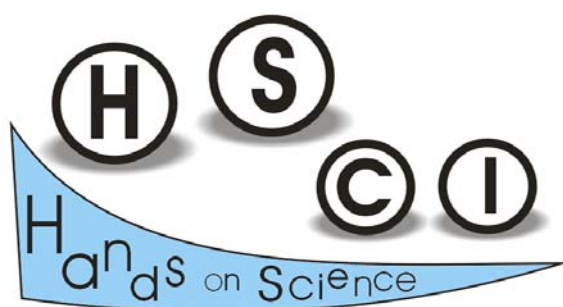


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Development of Children's Attitudes and Knowledge Towards Insects: the Pedagogical Role of School Visits to Exhibitions

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Abstract. School visits is a common non-formal science education strategy used regularly by teachers to call students attention and develop positive attitudes towards nature. The purpose of this study was to understand whether 6-14 year old school children gained positive knowledge and attitudes towards insects and science after visiting an exhibition of live insects from different parts of the world. Two questionnaires with nearly identical items were applied before and after the visit, to 182 elementary school students. The results showed that positive attitudes towards insects and animals increase after the school visit but the knowledge gained was below expectations. The importance of pedagogical planning is discussed.

Keywords. Attitudes; Biodiversity; Field trips; Insects; Non-formal Education; Science education.

1. Introduction

Recent research claims that we are facing the sixth mass species extinctions. A growing body of evidence suggests that present rates of species extinctions are higher than the pre-human rates [1], [2]. Positive attitudes towards biodiversity conservation are essential to prepare future generations to face the challenges of the current global biodiversity crisis. Citizens need to be aware of the importance of living things and become actively involved in preserving nature from the earliest age. As such, biodiversity has become a fundamental issue across Basic and Secondary Education school curricula. Insects due to their overwhelm diversity and abundance have a crucial role in natural ecosystems. Despite this, they rise little interest and attention to most people, in part because they are regarded as harmful to humans and their assets. Besides children are often taught to dislike insects and

to kill them whenever encounter them.

Most invertebrates are often seen by the general public with aversion, anxiety and ignorance [3]. Eagly and Chaiken [4] define human attitude as a "psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor". Thus, what people feel and believe about the environment determines their attitudes toward it [5]. Negative attitudes are difficult to change and represent a challenge to implement conservation programs, particularly in small, vulnerable biodiversity rich areas such as Madeira archipelago. In these oceanic islands the insects constitute about 78% of the known terrestrial biodiversity and nearly 23% of all taxa are endemic (~800 species). Conservation of these unique native island ecosystems is largely depending on the knowledge and positive attitudes of its inhabitants towards nature conservation. It is generally agree that the attitudes and behaviors in relation to nature must be understood and often influenced to avoid a greater harm to biodiversity. In fact, we need more knowledge about the development of the attitudes of children and adolescents in relation to nature. The pedagogical knowledge transmitted in the early years of education can have a very important role in changing attitudes of future citizens in relation to biodiversity. At schools, insects are used as examples to teach key concepts and process such as the circulatory and respiratory systems. However, after learning, students are still unfamiliar with insects, and have many misconceptions [6]. In science, field trips [7], visits to museums and zoos [8] and other types of learning activities (non-formal or informal) are regarded as useful to increase children's knowledge and motivation to learn [9].

Several authors described field trips as student experiences outside of the classroom at interactive locations designed for educational purposes [10], [11]. Through field trips students are taken to unique places that cannot be duplicated in the classroom. Each student can observe local and natural beings and create relevant personal meaning from their experience. Science school field trips include the visit to a variety of cultural institutions, such as natural history, and science museums, as well as zoos, and botanical gardens. In addition to stimulate new knowledge, these study visits can increase positive attitude towards science,

wake interests and provide many benefits for teachers and students [12]. The objective of this work is to understand whether students' knowledge and positive attitudes towards insects increase after visiting a study visit to an insect exhibition.

2. Methods

2.1. Exhibition purpose

The exhibition entitled *Living Insects from around the World* had as main purpose to show insect diversity to the general public and to grow the public interest towards insects. It was held at the University of Madeira (Funchal) between the 29th November 2007 and the 10th January 2008. Insect species were exhibited isolated in terrarium glass cages and the number of species displayed varied from 60 to 70 along the exhibition period. The exhibition included species from all over the world with representatives of various groups of insects like butterflies (Lepidoptera), praying mantis (Mantodea), stick insects (Phasmatodea), beetles (Coleoptera), locusts (Orthoptera), bugs (Hemiptera) and cockroaches (Blattodea). In addition were exhibited some specimens of non-insect arthropod groups like spiders (Araneae) and scorpions (Escorpiones).

2.2. Construction of Questionnaire

Two questionnaires with nearly identical items were applied: one was given to the student visitors before seeing the exhibition (Questionnaire A) and another was answered by the students after visiting the exhibition (Questionnaire B). The students were accompanied during the visit by their teachers and the exhibition was part of the student's lesson period.

Both questionnaires consisted of the same number of questions, a total of 20. The questionnaire A has three blocks of questions. The first block (7 questions) aimed to characterize the students; the second block dealt with students interest and attitudes about insects (3); the third block (4) assessed specific knowledge about insects; the fourth block (6) evaluated the students interest for the natural sciences: stars, planets and universe (1), origin and evolution of life in Earth (1); how insects live (1), animals from different parts of the world (1), how human body is made and works (1), how dinosaurs live and why they disappeared

(1). The second questionnaire (B) has also 4 blocks of questions, those of the first two and last blocks were the same as in questionnaire A. The third block asked the students what they insects liked most and what they have learned from the exhibition.

2.3. Participants

The study was conducted between November 2007 and January 2008. A total of 182 elementary school students (92 boys and 90 girls) aged 6 - 14 years old from first to the ninth grade attending two urban schools (Santa Teresinha and Salesian School of Arts and Crafts) and one rural elementary school (Prof. Francisco Barreto) participated in this study. The school of Santa Teresinha included 75 students of the fifth grade (age 9-11), the Salesian school included 78 students of the second grade (age 6-8) and the Prof. Francisco Barreto comprised 29 students, two of the seventh grade (age 12 and 14), 19 of the eighth grade (age 12-14) and 8 of ninth grade (age 14). No time limit was given for the completion of the two questionnaires.

2.4. Analysis

Comparison of student's mean interest and knowledge before and after visiting the exhibition was compared by Student's t tests at a confidence level of 95%.

3. Results

3.1. Before visiting the insect exhibition

Before the visit to the exhibition the knowledge of boys and girls of each school about insects was similar. Most students of the three schools responded correctly to the questions on whether insects can live in water (64.2% to 85.1%), larvae are insects (44.8% to 74.6%) and insects are important in nature (85.7% to 97.3%). However, the majority of students of the three schools did not know how many legs insects have. They considered that the number of legs varied depending on the type of insect (61.8% to 100%). Only 2.6% of the students from Santa Teresinha and Salesian school responded correctly to this question, while all students of Francisco Barreto gave a wrong answer.

There were also differences between rural and urban school students, being those of

Francisco Barreto less interested. Boys and girls of this school liked insects less (42.8% boys vs 7.6% girls), have less interest in having an insect as a pet (35.7% boys vs 6.6% girls) and when they encounter an insect were less those that said that would observe them (64.2% boys vs 50% girls) comparatively to students of the other two schools. In addition, Francisco Barreto students have less scientific interests (fourth block of questions) than students of the other two schools. Regardless of the school, boys and girls were more interested on how dinosaurs lived and why they have disappeared (83.1% boys vs 70.3% girls) than in the five other scientific topics.

3.2. After the visit to the insect exhibition

The student interest and attitudes regarding insects increased after the visit to the exhibition. As a whole more students stated that liked more insects after the exhibition (after 59.89 % vs 53.07% before) than before (Fig. 1).

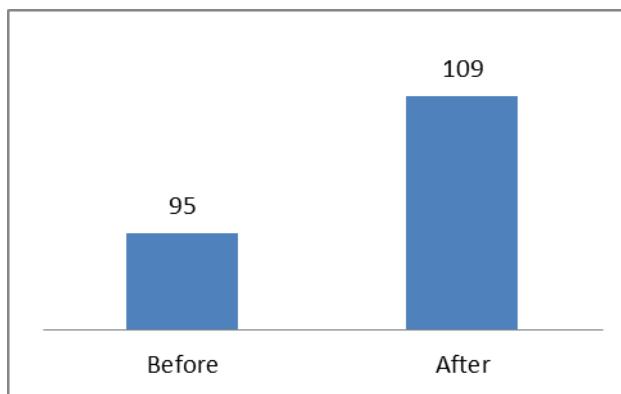


Figure 1. Number of students that said to like very much insects before and after visiting the exhibition

After the visit there were also a slightly increase in the percentage of students that said that would like to have an insect as a pet (41.4% before vs 41.9% after) (Fig. 2). The percentage of students that said after and before the exhibition that would not like an insect as a pet was similar.

There was a slight improvement in the reaction of students when they encounter an insect. The percentage of those that said that will observed them increase with the visit (69.2% before vs 72.3% after) while decrease the percentage of those that said that will kill them (7.2% before vs 6.6 % after), will ran away (8.2% before vs 8.9% after) and scare

them (14.5% before to 12.7% after) (Fig. 3).

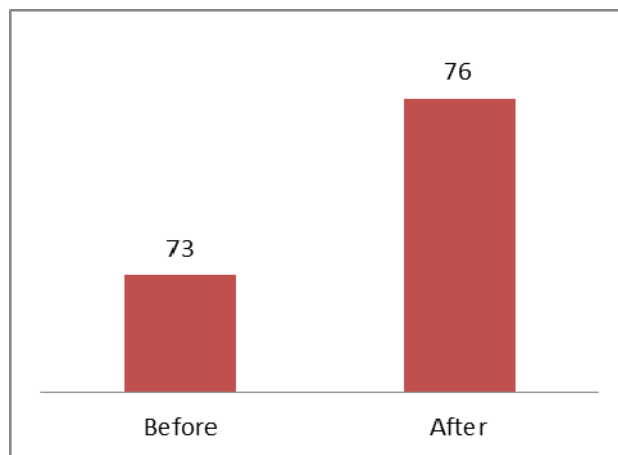


Figure 2. Number of students that said would like to have an insect as pet before and after visiting the exhibition

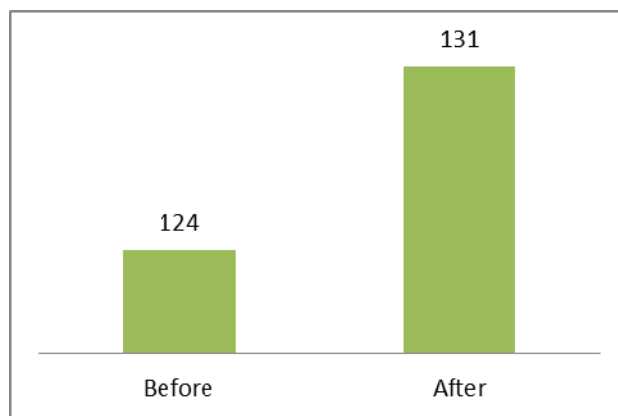


Figure 3. Number of students that said that if they encounter an insect will observe it before and after visiting the exhibition

Concerning knowledge, there was an increase in the level of the importance attributed to insects in nature with the visit (90.8% before vs 92% after) and also more students responded that larvae are insects (68.1% before vs 78.3% after). However, the visit did not allow the acquisition of more specific knowledge about insects. For example less students said that insects have six legs (2.2% before vs 1.6 % after) and less number of students said that there are insects that live in the water (73.2% before vs 60.3 % after) which suggest that the pedagogical content had not been worked before or during the visit with the teacher.

The visits to the exhibition awake also the interest of students for other areas of science. After the exhibition students were more attracted to stars, planets and universe (from

61.2% to 69.8%), the origin and evolution of life in Earth (from 56.3 to 64%); how insects live (from 58.8% to 71.1%), the animals from different parts of the world (from 63.5% to 68.5%), how human body is made and works (from 59.6% to 67.5%) and how dinosaurs live and why they disappear (from 76.5% to 81.9%). However, this increase was only significant for the origin and evolution of life in Earth ($t=2.705$, $df=16$, $p=0.008$) and how insects live ($t=-4.379$, $df=165$, $p=0.0$).

4. Discussion

Most people like small animals particular vertebrates such as birds, squirrels, dogs but dislike invertebrates, bats, rats and mice [13]. The results of this study suggest that most primary school children in Madeira have positive attitudes toward insects. They like insects and most students said that if they encounter an insect they would rather observe instead of kill it, scare it or run away. Contact with insects through the study visit influenced children's behavior towards insects, building positive attitudes towards animals. In this regard it has been suggested that teachers should encourage children to keep a diverse range of animals, particularly invertebrates, and that science activities should be more focused on rearing invertebrates and improving children's attitudes and knowledge [14]; [15].

Evertheless, the percentage of students that said that would like to have an insect as a pet after the visit to the exhibition increase only slightly. Likewise, as occur in other surveys [16], only few more students were those that would prefer to observe insects if they encounter them. It has been shown that when children interact with animals develop positive attitudes [17], [14]. It is unknown whether the students of this survey have such contacts with animals. More chances of contact animals/insects would be expected in children from rural residence areas as those Francisco Barreto School than children from the other two schools that live mainly in urban areas. Instead of this, children from rural areas not only were less interested on insects but also have less interest on other scientific areas. Because students from Francisco Barreto were older, their lack of interest may be related either to the area of residence and/or to age. Major differences in attitudes toward animals can occur among children according to age, sex,

ethnicity, and urban/rural residence [18], therefore the reasons for these differences cannot be ascertain.

The visit to the exhibition promoted not only an increase in positive behavior towards insects but also, an increase of interest for other areas of science as zoology, human biology and astronomy. The positive appreciation and increase interest on insects and science in general, did not correspond to an increase in the specific knowledge gained on insects, this was below expectations. Most children fail to enumerate the number of legs that insects have or that insects live in the water. In fact this knowledge decreased after the visit. This can in part be related to the fact that a few non-insects groups such as spiders and scorpions were exhibited together with insects in the exhibition. This, together with the title of the exhibition *Living Insects from around the World*, could explain in part why students fail to recognized the number of insect legs (6 insects vs 8 spiders/scorpions). It is generally believe that experiential learning activities and school field trips are effective strategies to create authentic learning opportunities for students regardless of the content area. However, experiential activities and field trips do not simply happen. Teachers need to understand that such activities require previous preparation of children and teachers, hands-on activities for children and follow-up actions to maximize the learning experience [10]. Teachers should prepare field trips in order to promote the interest and knowledge of their students. Children should also be allowed to interact with the organisms, observed them and discuss what they see [19] to acquire knowledge and avoid insect misconceptions [20]. Once teachers develop a successful field trip, they will enable students to grow interest in science, which may lead to better-quality learning and improved science literacy.

Science exhibitions increase visitors' knowledge and understanding of science but also can generate memorable learning experiences which can have a lasting impact on attitudes and behavior. Field trips offer a unique opportunity for students to create connections, which will help them to gain understanding and develop an enjoyment of learning. Farmer, Knapp, and Benton [21] suggested that one year after a well-designed field trip experience, many students

remembered what they had seen and heard, and displayed a newly developed prescience attitude. This long lasting effect was observed by the second author of this work, who took her 4 years old niece to the exhibition. At that at that time this little girl showed great interest and curiosity on the observation of the insects. Now that she is 12 years old still remembers many aspects of the visit and talks about it. Furthermore, she demonstrates high interest in science and nature in particular. Although science learning in the informal context may be often seem as haphazard and incoherent, it is believe to be long lasting because is internally rather than externally driven [22]. Thus, visits to exhibitions as well as other non-formal or informal learning activities can have a positive impact on children and adolescents' behavior in relation to nature and nature conservation.

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