

Bee-Plant Relationship in Early Childhood: A Study through the Analysis of Children's Drawings

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Abstract: Bees play a key role for humans, since crops pollination relies heavily on them. However, bees' population is diminishing dramatically. Therefore, conservation actions are needed to protect them, including educational ones. Childhood Education is a crucial period to learn and strengthen values about nature and the environment. In fact, it is believed that early exposure to scientific explanations on natural phenomena and on different living species can lead children to value and respect more the environment. The aim of this paper is to study, through the analysis of drawings, whether young children establish the relationship between bees and plants, the basis of the pollination. 47 five and six-year-old-children took part in the study. Results showed that children begin to establish relationships between bees and plants in early childhood, which is a valuable starting point to work with them through educational programs on the role of bees in pollination and on the importance of bees' conservation.

Keywords: environmental education; childhood; pollination

1. Introduction

Bees play a key role for humans because crops pollination relies heavily on them and therefore, they are needed to feed global human population [1,2]. However, bees' population is diminishing dramatically worldwide, or in other words, their populations are in global decline [3]. This entails a huge risk both, for global food sovereignty and for ecosystems' health, on which our well-being depends. Therefore, conservation actions are needed to protect bees, including educational ones.

Childhood Education is a crucial period to learn about nature and the environment [4,5]. In the field of science education, it is believed that early exposure to scientific explanations on natural phenomena and on different living species can positively affect children understanding of the environment, as well as children success to understand subsequent scientific concepts. Besides, it can lead children to value and respect more the environment [6].

Many authors state that environmental behaviour increases as knowledge increases [7–10]. After all, it is difficult to love something we do not know, and if we do not love it, it is difficult that we take care of it. Therefore, knowing and being aware of the crucial role that bees and other insects play on food production thanks to the pollination of crops, could contribute to develop positive attitudes in favour of their conservation.

The transmission of this knowledge and values since early childhood will help consolidate them in an easier and faster way. This is why building positive attitudes towards nature from early childhood is one of the main objectives of environmental education.

Pollination is the transfer of pollen (e.g., by an animal or by wind) from a male part of a plant to a female part of a plant, enabling later fertilisation and the production of seeds [11]. Pollination is a fundamental process in terrestrial ecosystems because it is crucial for plant reproduction and food production. The vast majority of flowering plant species only produce seeds if animal pollination moves pollen from the anthers to the stigmas of their flowers. In this process, insects, such as bees, play a key role, because these pollinating agents are responsible of the 80% of the global pollination [2]. Bees go from one flower to another collecting nectar to feed themselves and to produce honey. In doing so, bees transport the pollen grains that stick on their feet from one flower to another, allowing pollen grains arrival to new flowers, where they fertilize their ovaries. This bees-plant symbiotic relationship is the basis of the pollination made by bees.

Thus, the objective of this paper is to study whether children of childhood education establish this relationship between bees and plants through the analysis of their drawings.

2. Materials and Methods

The sample studied is composed of 47 children (26 girls and 21 boys), aged between 5 and 6. All the children were in their last year of childhood education when the study was carried out. Data was collected in a public school of a city, with more than 200.000 inhabitants, in the Basque Country (northern Spain).

The procedure used to carry out the investigation was based on individual sessions with the subjects of the sample studied [12]. During the sessions, which generally did not take longer than ten minutes, two main tasks were presented to the children: (a) a semi-structured dialogue led by a set of open questions (Table 1), and (b) a pictorial task.

Table 1. Questions used in the semi-structured dialogue.

Questions
Have you ever seen a bee?
What do bees do?
Where do they live?
Do you like them? Why?
What do you do when you see a bee?
Are they alive? Why?
Where have you learned all the things you know about bees?

These sessions were carried out in the classroom during the regular development of the daily lessons. Prior to the initiation of the individual sessions, we presented a stuffed snowperson to the entire class to attract children's attention and to make them feel comfortable during the individual sessions [12]. After introducing the stuffed snowperson, we explained to the children that he needed help to find out things about bees and afterwards, the individual sessions were started.

Regarding the pictorial task, the children were asked to make a drawing about bees, and they were encouraged to draw all the things related to bees, while they were asked the questions shown in Table 1. For the pictorial task, children were provided by A4-sized papers, pencils, rubbers and coloured crayons. Not until the children stated that she or he was finished with the drawing, the individual session was considered over.

We obtained the authorization of the school board to interview children within this research. No personal information or voice/video recording was collected. The sessions with children were carried out during December 2016 and January 2017.

3. Results and Discussion

Children’s drawings are considered a very useful tool to explore very small children’s ideas. On the one hand, drawings made by a child are thought to be a mirror image of a child’s representational development [13]; and, on the other hand, drawing tasks prevent children from reproducing conventional answers and encourage them to externalize their thoughts, even in the case of children with communication difficulties [14].

Results of the analysis of children’s drawings are presented below. The different elements found in the drawings were classified in different categories according to their frequency and type of element. From the analyses of the drawings we can see that in over half of the drawings (68.09%) bees are the only drawing element. In the other 31.91% of the drawings, bees appear together with other elements, of which flowers are the most frequent (Figure 1, Table 2). Moreover, in 20% of the drawings where bees and flowers appear, children clearly draw bees feeding from flowers through a short of trunk (Figure 1). These results may indicate that young children establish a relationship between bees and flowers, which is an essential interaction in the pollination process.

Table 2. Elements found in the drawings.

Elements Found in the Drawings	%
Bee	100%
Flower	21.3%
Meteorological elements (sun, cloud)	10.6%
Animal and/or Human	10.6%
House	15.9%
Tree	8.5%
Hive	4.2%
Other	2.1%

The second element most frequent in the drawings were houses (Table 2). This is because children follow marked models in their drawings. When children are around 4-years-old, their drawing begins to incorporate concrete elements such as humans, houses, animals and others [15]. In the case of houses, the great majority follow the same pattern. According to Kellogg [16], houses in children drawings are a combination of diagrams of different shapes, rather than the result of observing houses in the street. This also occurs in our study (Figure 1). In fact, houses in children’s drawings are similar in studies made worthwhile. This is the reason why we state that children in our study follow the stablished patters, models or stereotypes in their drawings.

Finally, it is also important to highlight that children have knowledge on bees’ way of life, as their drawings also include hives (4.2% of the sample) (Figure 1). Moreover, 48% of the sampled children answered that bees lived in hives when asked where bees live in the semi-structured dialogue.

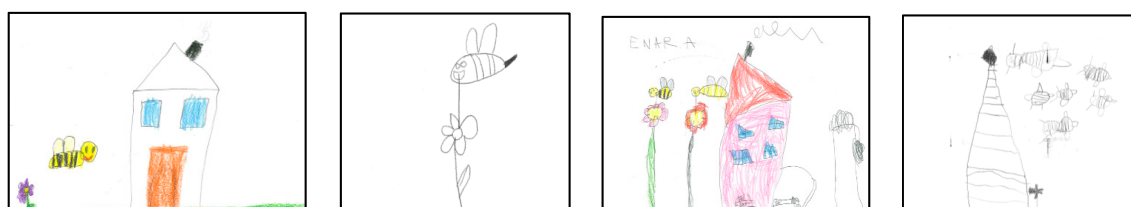


Figure 1. A sample of drawings with more than one element made by five and six-year-old children.

4. Conclusions

Our results show that children begin to establish relationships between bees and plants in early childhood, which is a valuable starting point to work with them through educational programs on the bees’ role in pollination and on the importance of bees’ conservation.

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Conflicts of Interest: The authors declare no conflict of interest.

References

1. Millennium Ecosystem Assessment (MA). *Ecosystems and Human Wellbeing: A Synthesis Report*; Island Press: Washington, DC, USA, 2005; p. 137. Available online: <https://www.millenniumassessment.org/documents/document.356.aspx.pdf> (accessed on 20 May 2018).
2. Organización de las Naciones Unidas para la Alimentación (FAO). Acción Mundial de la FAO Sobre Servicios de Polinización para una Agricultura Sostenible. 2018. Available online: <http://www.fao.org/pollination/background/es/> (accessed on 20 May 2018).
3. Kuan, A.C.; DeGrandi-Hoffman, G.; Curry, R.J.; Garber, K.V.; Kanarek, A.R.; Snyder, M.N.; Purucker, S.T. Sensitivity analyses for simulating pesticide impacts on honey bee colonies. *Ecol. Model.* **2018**, *376*, 15–27.
4. Zabala, M. *Didáctica de la Educación Infantil*; Narcea, S.A.: Madrid, Spain, 2006.
5. Cruz, J.L.; De Castro, A.; Ruiz-Montoya, L. Educar con Ética y Valores Ambientales para Conservar la Naturaleza. *Convergencia* **2009**, *16*, 353–382. Available online: http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1405-14352009000200014&lng=es&tlng=es (accessed on 20 May 2018).
6. Torres-Porras, J.; Alcántara, J.; Arrebola, J.C.; Rubio, S.J.; Mora, M. Trabajando el acercamiento a la naturaleza de los niños y niñas en el Grado de Educación Infantil. Crucial en la sociedad actual. *Rev. Eureka Enseñ. Divulg. Cienc.* **2017**, *14*, 258–270. Available online: <https://revistas.uca.es/index.php/eureka/article/view/3014> (accessed on 20 May 2018).
7. Kellert, S.R.; Westervelt, M.O. Children’s attitudes, knowledge and behaviors towards animals. *Child. Environ. Q.* **1984**, *1*, 8–11.
8. Kaiser, F.G.; Wolfing, S.; Fuhrer, U. Environmental attitude and ecological behaviour. *J. Environ. Psychol.* **1999**, *19*, 1–19.
9. Cohen, M.R. Environmental information versus environmental attitudes. *J. Environ. Educ.* **1973**, *5*, 5–8.
10. Thompson, T.L.; Mintzes, J.J. Cognitive structure and the affective domain: On knowing and feeling in biology. *Int. J. Sci. Educ.* **2002**, *24*, 645–660.
11. Arrows, E.M. *Animal Behavior Desk Reference. A Dictionary of Animal Behavior, Ecology, and Evolution*, 3rd ed.; CRC Press LCC: Boca Raton, FL, USA, 2011; 794p.
12. Villarroel, J.D. Young Children’s Drawings of Plant Life: A Study Concerning the Use of Colours and its Relationship with Age. *J. Biol. Educ.* **2016**, *50*, 41–53.
13. Cherney, I.D.; Claire, S.S.; Tara, M.D.; Flichtbeil, J.D. Children’s Drawings: A mirror to their minds. *Educ. Psychol.* **2006**, *26*, 127–142.
14. Holliday, E.L.; Harrison, L.J.; McLeod, S. Listening to children with communication impairment talking through their drawings. *J. Early Child. Res.* **2009**, *7*, 244–263.
15. Kellogg, R. *Analyzing Children’s Art*; Mayfield Pub Co.: Palo Alto, California, 1969.
16. Kellogg, R. *Análisis de la Expresión Plástica del Preescolar*; Cincel: Madrid, Spain, 1986.



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