Are plants living beings? Biases in the interpretation of landscape features by pre-service teachers

Jerónimo Torres-Porras & Jorge Alcántara-Manzanares

Department of Social and Science Education, Faculty of Education Sciences, Universidad de Córdoba, Córdoba, Spain.

CONTACT Jerónimo Torres-Porras jeronimo.torres@uco.es

Abstract

Interpreting the landscape that surrounds us is somewhat personal. However, it is necessary to explore the interpretation made by future teachers so that we can reflect on their observations. This study collected data from five academic years of undergraduates in Early Childhood Education (N = 421), who were asked to fill out a questionnaire with different items while observing the landscape features when walking through a park. This article demonstrates for the very first time that the trend shown in childhood of not considering plants as living beings remains in the landscape perception of the university students. The students must be confronted with their own biases in interpreting the landscape, so that they are aware and do not transfer these biases to their future students.

Keywords: living beings, plants, Early Childhood Education, teaching sciences, outdoor education

Introduction

The awareness that human beings have of their surroundings is a source of ideas from which a notion of landscape will be created a posteriori (Zoido 2012). However, the concept of landscape arose during the humanist renaissance and the geographic conception cannot be freed from its historic past as a visual concept (Cosgrove 1985).

According to Antrop (2013, 14): 'Scientific research on landscape started with the systematic descriptions during the naturalist explorations of Alexander Von Humboldt (1769-1859) and Charles Darwin (1809-1882)'. Indeed, the first scientific definition of landscape is attributed to Alexander Von Humboldt as: '*the total character of a region*' (Bastian 2001). Later, in the twentieth century, scientific perception-based approaches to landscape started to abound. A firm advocate of this line was Spanish biologist Fernando González Bernáldez, who defined landscape as the multisensory perception of a system of ecological relationships (González Bernáldez 1981). At present, the most well established and internationally agreed definition of landscape is: '"landscape" means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors' (Council of Europe 2000).

Thus, employing the definition above, landscape is a perceived territory. This perception consists of the intellectualisation of the landscape captured via the senses, eminently by means of sight, and via the memories and feelings that it evokes. In order for this perception to lead to understanding, one must know of and learn to apply the foundations of landscape observation and interpretation and, concretely, to identify its constituent parts and to interpret them (Liceras Ruiz 2003). These items may be grouped as biophysical (geology, morphology, lands, vegetation…), cultural (land uses, patterns of human settlement…) or perceptual (preferences, memories…) (Tudor 2014).

But, what does the definition of landscape as people's perception of the landscape refer to? To answer this question, it is essential to narrow down the term 'people' and centre on a

specific group of people for this study. For the scope of this work, the people will be students in the Early Childhood Education Bachelor Degree, whose training will be decisive in their future careers working in childhood education. It will also be important for incorporating a new teaching paradigm or model into landscape studies (Bonet Pla, Pena Vila and Ribas Vilàs 2004).

Landscape has entered powerfully in the world of education since the end of the 20th century (Gómez Ortiz 2001). Landscape is a cross-cutting concept that can be handled jointly from different areas of knowledge, which will influence the students' acquisition of competences (Delgado Huertos 2015). However, procedures for working with landscape should continue to flourish by means of its interpretation and adaptation to different educational stages. Thus, at an early age, landscape should be approached universally, starting to teach it through the children's closest surroundings (Bajo Bajo 2001; Martínez and García 2013). The analysis of landscape can even be done at different geographic scales, as landscape can mean everything from a mountain to a city park (Swanwick 2002), where the latter space is a suitable area for urban child students to approach nature (Ernst and Tornabene 2012; Torres-Porras et al. 2017). According to the study conducted by Yılmaza, Olgana and Yılmaztekinc (2016) on contact with nature, child education teachers prefer parks and other landscaped areas for educational purposes, while they personally lean towards wilder nature spots.

One way of working with landscape in childhood education is via guided observation. Looking at a photograph or a real landscape, teachers must ask them in turns to look for and identify things. The teachers guide the activity, establishing whose turn it is, and then reviews the different items in the landscape (Mérida Serrano, Torres-Porras and Alcántara Manzanares 2017). However, this activity is more suitable to do during a stroll, as the best way to perceive and experience the landscape is to walk through it (Kessler 2000; Rybråten, Skår and Nordh 2017). The activity is based on analysing the landscape as a context for learning (Brandt 2013), where it is therefore highly suitable for children, due to their dependence on the learning context typical of this educational stage (Marín Martínez 2005).

Understanding how future teachers of childhood education perceive the landscape is essential so that their initial degree lets them practice their profession with assurance, in their guidance role to promote learning about the environment to child students, without biases or

conceptual errors. An example of these misconceptions is the one described in the animistic model in which students consider animals more alive than plants because of animal ability of changing their location through motion (Yorek, Sahin and Aydin 2009). There are several studies underlying that children have a low level of knowledge about plants life and they find difficulties to attributing life status to plants (Villarroel 2013). On the contrary, children with best knowledge about living things show important aspects of plants cycle in their drawings (Villarroel and Infante 2014). The problem in perceiving plants as an organism not only appears on children, it has been describe in teenagers too (Yorek, Sahin and Aydin 2009). This mistake in plants comprehension is a symptom of plant blindness. Plant blindness is defined as the inability to see or notice the plants in the environment (Wandersee & Schussler 2001). But are plant blindness and other landscape perception biases maintained in adults? Plant blindness could not only be maintained in adults, in fact it may be influencing plants conservation which receives much less funding than animals conservation projects (Balding & Williams 2016). And finally.., Are teacher students free of these type of biases?

The objective of this study is to determine the patterns for identifying things, multisensory perceptions, preferences and abstract conceptualisations in the landscape among pre-service teachers of the Early Childhood Education Bachelor Degree and, based on the results, outline the issues that would have to be included for the students to have a better-rounded and complete education. Specially their perception when they are observing living beings in a park with a great diversity of plants.

Materials and methods

This study has been conducted with students in year three of the Early Childhood Education Bachelor Degree in the Faculty of Education Sciences at the University of Córdoba (Spain) during the 2013/14, 2014/15, 2015/16, 2016/17 and 2017/18 academic years, where seven different class groups (with an average of 60 students) took part for a total of 421 students, of which 96% were female students.

An outing was taken to a park close to the faculty in the framework of a more global subject-matter approach to nature worked on in the course. It has been done in the subject "Natural

sciences in early childhood education" in which different contents are discussed to work on science and nature in children's education. Students participated during scheduled course learning. The site, named Cruz Conde Park, covers 14 hectares and has a large abundance and diversity of trees and grassy areas, a running track and an area with exercise equipment. The outing was done with average sized groups of some 20 students for 4.5 hours, during which they did different activities (see Authors et al. 2017 for in depth descriptions of activities). The activity of this study consisted of students filling out an individual questionnaire, on which they had to write down different items during a walk through the park without the presence of the lecturer, so that they had the freedom to explore the parts of the park that interested them and observe the different elements they could locate in such an environment, one that would be suitable for them to take their pupils to in the future (Table 1). Before the activity, special care was taken not to influence the students and it was after the activity when the park was visited with the professors observing plants, animals, fungi, lichens ... Each questionnaire was given to them indicating that they had to fill it out individually, without sharing the information, since it was important later to see the possible variability between them. They had to write only one thing, the first thing they identified about each issue. Each question was independent and therefore they could repeat answers, the task was to write down in each question the first thing observed. The questionnaire is originally aimed at high school students (Autonomous Government of Andalusia 2006)and was modified by the authors of this article) to include items that could be found in the urban landscape and worked with in childhood education.

 [Table 1 near here]

Then they met at the starting point and shared each of the items on the questionnaire and discussed and commented on their responses and the implications for childhood education. The students were informed that the data would be treated anonymously later.

Data taking consisted of logging the response of each of the items to observe on the questionnaire, as well as noting down the academic year of the student and their gender. Data

analysis first consisted of categorising a posteriori the responses for some items. Then a frequency analysis was conducted for the categories identified. Lastly, we analysed if there were significant differences in response patterns. To conduct the statistical analyses (t-test; Pearson Chi-square) and graphs, the program STATISTICA 8.0 was used (Statsoft Inc., Tulsa, Oklahoma, USA) and Microsoft Excel.

Results

The first item participants had to write down was a living being and, as they were in a park where the majority of the biomass is formed of plants, probability led us to expect that the majority would indicate a plant. However, 73% of responses were animals and only 27% of plants (one sample t-test between percents $(419) = 10.617$; $p < 0.001$). If we break these down by academic years, the same percentages are maintained without differences (Pearson Chi-square = 5.33; df = 4; p = 0.25; Figure 1). Namely, most people tend to think of a living being as an animal and look for one in their surroundings until they find it. During the subsequent sharing, they were asked for their responses one by one and were made to see this bias in their interpretation of the landscape.

The answers with the highest percentages were bird, tree and person (Table 2). The most used taxonomic level has been species (31%), with person, dog and common blackbird, followed by class (20%), phylum (18%), and in minor percentages family (10%), genus (10%) and kingdom (7%).

[Figure 1 near here]

The second item asked them to look for inert matter, with the aim of contrasting living beings and inert matter. In general, everybody wrote down different landscape elements formed of inert matter (Table 2)..

With regard to the items for natural and artificial elements, we should highlight that in this case, the natural feature did centre on living beings, concretely on the plant kingdom, with 82% of responses, a percentage that remained stable over the years (Pearson Chi-square = 17.63; df = 4; p = 0.0014; Figure 2), where tree was the most common (Table 2). . This time they did look around them searching for a natural element and did detect the predominant presence of vegetation (82%), even though when asked to look for a living being only 27% made reference to plants, meaning there are significant differences in these response percentages (Two samples t-test between percents (839) = 16.016; p < 0.001). Among the responses that did not refer to a plant, which we have classified as others (Figure 2), earth was the most frequent (8%), followed by rock (1.6%). For artificial elements, they wrote down the items most abundant in this category in the park (Table 2).

[Figure 2 near here]

The purpose of the fifth item (something that would not be there that night) was to make them think not only of the present, but also of the near future. The most frequent response was the sun, to which we should add who mentioned sunlight and shadow, totalling 70%.

Item number 6 asked them to observe and write down an animal, where the most common responses were dog, bird and pigeon. It is important to point out that human beings were only included in 0.5% of responses, when the activity was done in groups, which shows a bias with regard to real observation.

Out of total responses, 80% were vertebrate animals, and the rest invertebrates. Among the most prominent groups were birds at 50%, mammals with 29%, arthropods with 20% and annelids with 1%. If we differentiate between wild and domestic animals, 59% of the animals logged were wild, with the remaining 41% domestic animals.

[Figure 3 near here]

Item seven (something that might be there but cannot be seen) incites both the imagination and reasoning, as it requires looking beyond what is perceived directly with the vision. There was a total of 52 different responses, where the three most frequent were air , roots and insects. If we classify these responses in three categories: those that refer to living beings, to elements in the physical environment and other issues, the percentages are 57%, 37% and 7%, respectively.

The eighth item focused on elements that are there, but should not be, with responses centred on out of place rubbish (Table 2). This reveals that this continues to be an essential topic to work on during outings to natural settings.

Items 9, 10 and 11 asked for items that are red, yellow and green. The most frequent red items in their responses were flowers and exercise equipment; for yellow: leaves, flowers and exercise equipment; and green: the grass, leaves and streetlamps.

The following three items did not centre on sight, so we could employ the multisensory education of natural sciences, thus asking for something they could smell, something rough and something that makes sounds. With regard to the first, the most common responses were flowers. For the second we have the bark of some trees. Lastly, for sounds birds prevailed, where all other responses were less than 10%.

To finish, we asked them to write down something they liked and something they did not like. What they liked most were flowers, from among 105 different responses, where all others had percentages lower than 10%. If we break these responses into groups, the highest percentage of responses groups plants (flowers, trees, grass…) with 41%; different feelings (calm, peace) with 13%; sundry aspects of the park (nature, spaciousness, fresh air) 11%; animals (primarily birdsong) 10% and different visual aspects (landscape, colours) 10%. We should point out in this case we suggested using different senses, where vision was predominant, but also smell (smell of nature, plants, grass, pure air) and hearing (birdsong, silence).

With regard to things they did not like, the main one among the 90 responses logged was rubbish on the ground, with 42%, including trash (34%), dog excrement (6%) and cigarette butts (2%), where the rest were below 5%. If we group the responses, the main one—as mentioned—was rubbish on the ground, although this was followed by animals (insects, mosquitoes, bugs, dogs not on leashes), with 16%.

Discussion

The analysis of the results logged during the guided observation activity of the surrounding landscape by pre-service teachers let us detect a series of biases in their interpretation of some of the features of this landscape.

We have shown how when the undergraduates in the Early Childhood Education were asked to look for a living being in a natural environment with an abundance of plants, the probability was that the highest percentage of responses would be in this group, but the large majority of responses centred on animals. Different research projects show that boys and girls tend to recognise animals as living beings, but not plants (Stavy and Wax 1989; Garrido 2007; Martínez-Losada, García-Barros and Garrido 2014), although other ages such as adolescents do correctly classify plants (Babai, Sekal and Stavy 2010), despite having longer reaction times compared to classifying animals, or list living beings in which animals predominate (Yorek, Sahin and Aydin 2009).

Here, we have shown that the trend to not identify plants as living beings persists among university students. This supports the idea of plant blindness (Wandersee and Schussler 1999, 2001), or inability to see plants as part of the environment and therefore not conceiving their importance for life on Earth. It is not that they do not know that plants are living beings, but that they do not have it internalized and their search image of a living being corresponds to an animal, which prevents them from interpreting the reality that surrounds them. Therefore, search images interfere with sensation-based perception (Tønnessen 2018).

These results show that it is essential to confront them with this faulty reasoning so that as future teachers they do not transmit this trend. University professors have to take into account

this perception of their students and work with them to reduce their blindness to plants, making them see the importance of these living beings, confronting them with their own ideas and making them know the meaning of the term "plant blindness". Activities should be encouraged to observe and be in contact with plants, as well as to design activities to work the plants that could be used in their future profession, as teachers. Studies of local biodiversity focused on flora (Lindemann-Matthies 2002, 2005), outdoor educational programmes (Fančovičová and Prokop 2011) and school gardens (Benkowitz and Kohler 2010) have positive results.

These responses contrast with what happened when they were asked for a natural element in the environment they were observing. In this case, responses did centre on plants, although animals were predominant when they were asked to look for a living being. Something similar happens when asked about what they liked most about the park: there is a high percentage of responses about plants.

When they were asked about something that would not be there that night, the most frequent response was the sun, or referring to the sun as sunlight. We pointed out to them that this topic could be introduced in child education, starting from the students' preconceptions, as they tend to have a great variety of previous ideas on day and night (see Vega Navarro 2007). They should also be aware that some of their responses included animals that would be there at night, but hidden or sleeping, meaning they could talk about diurnal and nocturnal animals, which have different activity cycles, but can be present in the same habitat.

With regard to observation of an animal, the results show the absence of the human species in this classification, whose absence continued in the later debate. Only in a few cases, when asked to name the realms of living beings, did students state that our species is a separate group and that we do not belong to the animal kingdom or were uncertain how to classify humans. Numerous studies show that boys and girls do not think of humans as animals (Tema 1989; Chen and Ku 1998; Garrido 2007; Alanazi 2018), although with age they do classify humans in the animal group (Barman et al. 2000) and the majority of university students, as well as primary education teachers, also classify humans as animal (Bell 1981; Bierema and Schwartz 2015). Here, we show that when looking for an animal, its search image does not include humans , although we should point out that in daily language, we do tend to

differentiate humans and animals (Waldau 2013), which influences this consideration, as they were not asked directly to classify humans, just to write down an animal, but when asked about living beings they did include humans.

Students' preconceptions should be detected with regard to the classification of the animal kingdom, stating the importance of the bias in this response of how they have interiorised that an animal is any species except ours. Thus, they should work on this topic with the youngest ages, including themselves and their future students in classifications and examples given of animals. Thus, one could ask that child education students would interiorise that we are one more animal among all those present on the planet, governed by the same biological rules, and not a superior species or a separate group. That is, shifting collective thought from an anthropocentric vision to a more biocentric one (Aramburu 2000), although this continues to be a controversial topic (Hunter, Redford and Lindenmayer 2014). Perhaps if future generations take on these issues from childhood, they will feel closer and more identified with the rest of the species and this could influence their personal decisions on environmental matters.

Another important issue in childhood education is working with elements that cannot be seen, but which are there and have their functions, which the university undergraduates should be made to reflect upon. Their most prominent responses included air and roots, so child education students' preconceived ideas should be captured, with activities designed to work on hidden concepts like those mentioned. however, there are many more items, the stars, underground cables conducting electricity to the streetlamps or the pipes that carry water to the fountains, all of them present but unseen.

A critical stance is also important for the elements that should not be there, mainly trash thrown on the ground, when there are rubbish bins in which to deposit waste. Although the percentages may make one think that the park must have had a lot of trash on the ground, this was not the case, although there was some strewn about the park. This is another issue that requires continued work at university so that when they are teachers, they work with it at schools, as reality has shown that society keeps throwing rubbish on the ground, and they detected that this should not be done, which involves spending time with the aim of achieving a more civic-minded society.

The items on colours let them reason about the why of these colours in flowers, or in leaves and grass. These questions could include: Why are most plants green? Why are some flowers yellow or red? This makes them question things they are accustomed to observing but not questioning and reasoning about them.

Multisensory teachings in the sciences are also important (Soler 1999), to use other senses besides sight and oblige students to employ and focus on them. In outdoor education, it is necessary to use all the senses to connect and interpret the landscape (Auer 2008), in fact, one of the things that they liked most about the park were feelings of calm and that being in contact with nature can reduce stress (Corraliza, Collado and Bethelmy 2012). To encourage multisensory, some items made reference to something they could smell, something rough and something that made sounds. After this activity, other exercises were conducted focusing on sounds, closing their eyes and listening to the sounds in the park. Students were invited to touch tree trunks to detect the different textures, as the actuality is that in some cases, the items they named as rough or smelly had been selected by sight, and they had not approached them to experience them with the other senses. .

We can close by stressing that with respect to the difficulty of conceiving plants as living beings that is detected in the earliest educational stages, this remains in the landscape perception of the university students, and something similar occurs with classifying the human species as another mammal.

Therefore, we could conclude that the education and training of future teachers of early child education should be encouraged to acquire the competences and skills they need to analyse and understand all dimensions of the landscape, to prevent biases that they could inadvertently pass on to their future students.

Acknowledgments

collaboration, as well as the help provided by Carmen Briones Fernández in building the database.

Disclosure statement

No potential conflict of interest was reported by the authors.

References

Auer, M. R. 2008. "Sensory perception, rationalism and outdoor environmental education." *International Research in Geographical and Environmental Education* 17(1): 6-12.

Alanazi, F. H. 2018. "Saudi children's taxonomic knowledge of animal species." *Journal of Baltic Science Education 17*(3): 395-413.

Antrop, M. 2013. "A Brief History of Landscape Research." In *The Routledge Companion to Landscape Studies*, edited by Peter Howard, Ian Thompson and Emma Waterton, 12–22. London: Routledge.

Aramburu, F. 2000. *Medio ambiente y educación*. Madrid: Summary.

Babai, R., R., Sekal, and R. Stavy. 2010. "Persistence of the intuitive conception of living things in adolescence." *Journal of Science Education and Technology* 19(1): 20-26.

Balding, M., & Williams, K. J. 2016. "Plant blindness and the implications for plant conservation." *Conservation Biology* 30(6): 1192-1199.

Bajo Bajo, M. J. 2001. "El paisaje en el currículum de Educación Primaria, dentro del Área del Conocimiento del Medio Natural, Social y Cultural." *Aula* 13: 51-61.

Barman, C. R., N. S., Barman, M. L., Cox, K. B., Newhouse, and M. J., Goldston. 2000. "Students' ideas about animals: Results from a national study." *Science and Children* 38(1): 42–46.

Bastian, O. 2001. "Landscape Ecology – towards a unified discipline?" *Landscape Ecology* 16: 757-766.

Bell, B. F. 1981. "When is an animal, not an animal?" *Journal of Biological Education* 15(3): 213–218.

Benkowitz, D., and K. Kohler. 2010. Perception of Biodiversity—The Impact of School Gardening. In *Urban biodiversity and design* edited by N. Müller, P. Werner, and J. G. Kelcey, 425-440. Oxford: Willey-Blackwell.

Bierema, A. M. K., and R. S., Schwartz. 2015. "Undergraduate Biology Students' Interpretations of the Term 'Animal.'" *Anthrozoös* 28(3): 371-383.

Bonet Pla, M. T., R., Pena Vila, and J., Ribas Vilàs. 2004. "El paisaje como recurso educativo en el marco de la educación para la participación." *Didáctica geográfica, 2ª Época* 6: 33-48.

Brandt, C. 2013. "Landscapes as contexts for learning." In *International handbook of research on environmental education* edited by R. Stevenson, M. Brody, J. Dillon, and A. Wals, 275- 283. New York: Routledge.

Chen, S., and C., Ku. 1998. "Aboriginal children's alternative conceptions of animals and animal classification." *Proceedings of the National Science Council*, *Republic of China, Part D*: *Mathematics, Science and Technology Education* 8 (2): 55-67.

Corraliza J. A., S., Collado, and L. Bethelmy. 2012. "Nature as a Moderator of Stress in Urban Children." *Procedia - Social and Behavioral Sciences* 38: 253-263.

Cosgrove, D. 1985. "Prospect, perspective and the evolution of the landscape idea." *Transactions of the Institute of British Geographers* 10(1): 45-62.

Council of Europe. 2000. *European Landscape Convention*. Florence, Italy.

Delgado Huertos, E. 2015. "El paisaje en la formación de maestros, un recurso educativo de alto interés para la educación primaria." *TABANQUE Revista Pedagógica* 28: 117-138.

Ernst, J., and L., Tornabene. 2012. "Preservice early childhood educators' perceptions of

outdoor settings as learning environments." *Environmental Education Research* 18(5): 643-664.

Fančovičová, J., and P. Prokop. 2011. "Plants have a chance: outdoor educational programmes alter students' knowledge and attitudes towards plants." *Environmental Education Research* 17(4): 537-551.

Garrido, M. 2007. "La evolución de las ideas de los niños sobre los seres vivos." PhD Diss., Universidade da Coruña.

Gómez Ortiz, A. 1993. "Reflexiones acerca del contenido 'paisaje' en los 'currícula' de la Enseñanza Obligatoria." *Revista Interuniversitaria de Formación del Profesorado* 16: 231-240.

Gómez Ortiz, A. 2001. "El paisaje como tema transversal en el diseño curricular base (D.C.B.) de la educación obligatoria. La montaña como objeto de estudio." *Biblio 3W. Revista Bibliográfica de Geografía y Ciencias Sociales 267.*

González Bernáldez, F. 1981. *Ecología y paisaje*. Madrid, Blume.

Hunter Jr, M. L., K. H., Redford, and D. B., Lindenmayer. 2014. "The complementary niches of anthropocentric and biocentric conservationists." *Conservation biology* 28(3): 641-645.

Junta de Andalucía. 2006. Árboles bosques de vida. Fichero de actividades, Seville.

Kessler, M. 2000. *El paisaje y su sombre*. Viareggio, Italy: IdeaBooks.

Liceras Ruiz, A. 2003. *Observar e interpretar el paisaje. Estrategias didácticas*, Granada, Grupo Editorial Universitario.

Marín Martínez, N. 2005. *La enseñanza de las ciencias en educación infantile*, Granada: Grupo editorial universitario.

Martínez-Losada, C., S., García-Barros, and M., Garrido. 2014. "How children characterise living beings and the activities in which they engage." *Journal of Biological Education* 48(4): 201-210.

Martínez, R., and R., García. 2013. "La enseñanza del paisaje en la Educación Infantil en España." Paper presented at the *III encontro CITCEM, Paisagem- (I) Materialidade*, Centro de Investigaçao Transdisciplinar, Facultade de Letras, Universidade de Porto, Porto, Portugal, November 21-24.

Mérida Serrano, R., J., Torres-Porras, and J., Alcántara Manzanares. 2017. *Didáctica de las Ciencias Experimentales en Educación Infantil*. Madrid: Síntesis.

Ortega Cantero, N. 2006. "Entre la explicación y la comprensión: el concepto de paisaje en la geografía moderna." In *Paisaje y Pensamiento,* edited by Marchán Fiz, S., Maderuelo, J., 107-129. Madrid: Abada Editores.

Rybråten, S., M., Skår, and H., Nordh. 2017. "The phenomenon of walking: diverse and dynamic." *Landscape Research* 1-13. DOI: 10.1080/01426397.2017.1400527.

Soler, M. A. 1999. *Didáctica multisensorial de las ciencias: Un nuevo método para alumnos ciegos, deficientes visuales, y también sin problemas de visión* (Vol. 40). Barcelona: Paidós.

Stavy, R., and N., Wax. 1989. "Children's conceptions of plants as living things." *Human development* 32(2): 88-94.

Swanwick, C. 2002. *Landscape character assessment – Guidance for England and Scotland.* Cheltenham: Countryside Agency Publications.

Tema, B. O. 1989. "Rural and urban African pupils' alternative conceptions of 'animal.'" *Journal of Biological Education* 23 (3): 199-207.

Tønnessen, M. 2018. "The search image as link between sensation, perception and action." *Biosystems* 164: 138-146.

Tudor, C. 2014. *An Approach to Landscape Character Assessment.* London: Natural England.

Vega Navarro, A. 2007. "Ideas, conocimientos y teorías de niños y adultos sobre las relaciones Sol-Tierra-Luna. Estado actual de las investigaciones." *Revista de Educación* 342: 475-500.

Villarroel, J. D. 2013. "Environmental judgment in early childhood and its relationship with the understanding of the concept of living beings." *SpringerPlus* 2(1): 87.

Villarroel, J.D. and Infante, G., 2014. "Early understanding of the concept of living things: An examination of young children's drawings of plant life." *Journal of Biological Education* 48 (3): 119-126.

Waldau, P. 2013. *Animal Studies: An Introduction*. Cary, NC: Oxford University Press.

Wandersee, J. H., and E. E. Schussler. 1999. "Preventing plant blindness." *The American Biology Teacher* 61: 84–86.

Wandersee, J. H., and E. E. Schussler. 2001. "Toward a theory of plant blindness." *Plant Science Bulletin* 47: 2–9.

Yılmaza, S., R., Olgana, and E, Ö., Yılmaztekinc. 2016. "Nature Connectedness and Landscape Preferences of Turkish Preservice Preschool Teachers." *International Journal of Environmental and Science Education* 11(15): 8120-8142.

Yorek, N., M., Sahin, and H. Aydin. 2009. "Are animals 'more alive'than plants? Animistic-anthropocentric construction of life concept." *Eurasia Journal of Mathematics, Science & Technology Education* 5(4): 369-378.

Zoido, F. 2012. "El paisaje un concepto útil para relacionar estética, ética y política." *Scripta Nova: Revista Electrónica de Geografía y Ciencias Sociales* 16.

Table 1. Items on the landscape observation questionnaire filled out by students

1. Living being
2. Something inert
3. Natural item
4. Artificial item
5. Something that won't be here tonight
6. An animal
7. Something that might be here but can't be seen
8. Something here that shouldn't be
9. A red item
10. A yellow item
11. A green item
12. Something that smells
13. Something rough
14. Something that makes sounds
15. Something that you like
16. Something that you do not like

Table 2. Most frequent answers of students

Items	Common answers	Percentaje
1. Living being	Bird	18%
	Tree	16%
	Person	11%
2. Something inert	Rock	45%
	Bench	15%
	Streetlamp	12%
3. Natural item	Tree	35%
	Grass	12%
	Leaf	11%
4. Artificial item	Streetlamp	33%
	Benches	31%
	Rubbish bins	12%
5. Something that won't be here tonight	Sun, sunlight, shadow	70%
	People	24%
	Animals	3%
6. An animal	Dog	28%
	Bird	26%
	Pigeon	12%
7. Something that might be here but can't be seen	Air	27%
	Roots	13%
	Insects	9%
8. Something here that shouldn't be	Trash	76%
	Cigarette butts	8%
	Dog excrement	5%
9. A red item	Flowers	64%
	Exercise equipment	11%
	T shirt	5%
10. A yellow item	Leaf	43%
	Flowers	21%
	Exercise equipment	17%
11. A green item	Grass	41%
	Leaf	21%
	Streetlamp	17%
12. Something that smells	Flowers	41%
	Grass	17%
	Wet soil	10%
13. Something rough	Bark trees	73%
	Path	10%
	Leaf	7%
14. Something that makes sounds	Bird	72%
	Leaf	5%
	Walk	4%
	Flowers	19%

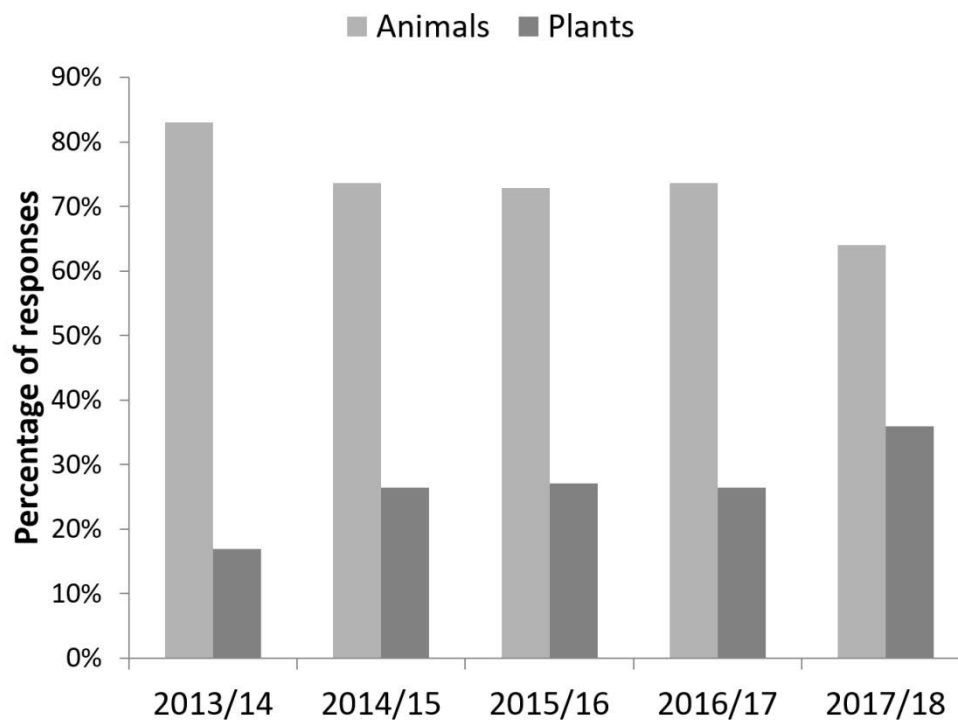| 15. Something that you like	Calm	8%
	Landscape	6%
16. Something that you do not like	Rubbish	34%
	Dog excrement	6%
	Shortage of water sources	5%

Figure captions

Figure 1. Results of observation in park of a living being (by percentage of academic year)
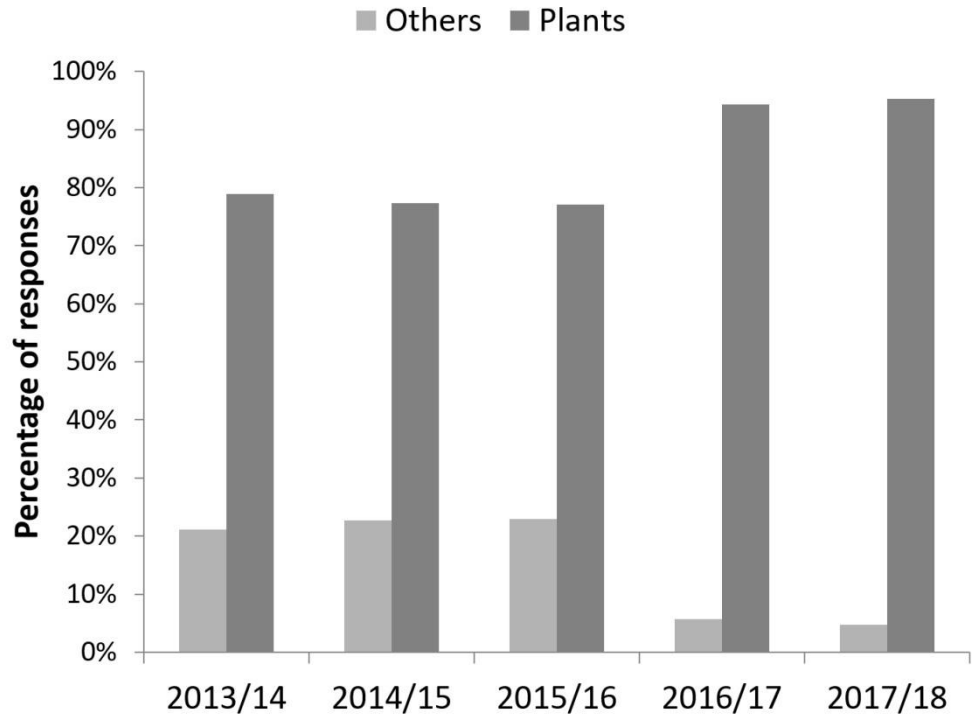
Figure 2. Results of observation in park of a natural element (percentage by academic year)

Figure 3. Results of observation in park of an animal

Figure 1. Results of observation in park of a living being (by percentage of academic year)

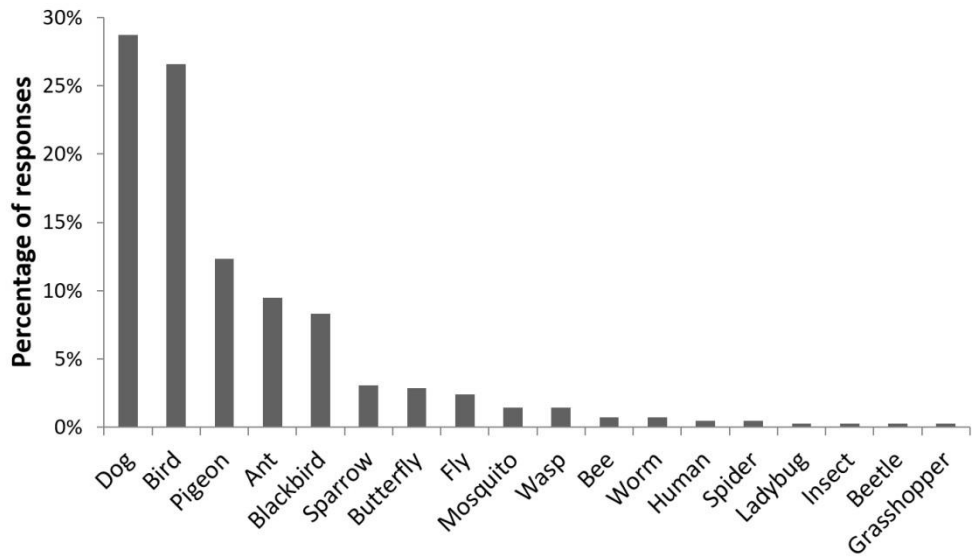Figure 2. Results of observation in park of a natural element (percentage by academic year)

Figure 3. Results of observation in park of an animal