

## Environmental education supports conservation action by increasing the immediate and long-term environmental knowledge of children in West Africa

Markéta Grúňová, Karolína Brandlová, Jan Svitálek & Pavla Hejcmanová

**To cite this article:** Markéta Grúňová, Karolína Brandlová, Jan Svitálek & Pavla Hejcmanová (2017): Environmental education supports conservation action by increasing the immediate and long-term environmental knowledge of children in West Africa, Applied Environmental Education & Communication, DOI: [10.1080/1533015X.2016.1273153](https://doi.org/10.1080/1533015X.2016.1273153)

**To link to this article:** <http://dx.doi.org/10.1080/1533015X.2016.1273153>



Published online: 25 Jan 2017.



Submit your article to this journal [↗](#)



View related articles [↗](#)



View Crossmark data [↗](#)

## Environmental education supports conservation action by increasing the immediate and long-term environmental knowledge of children in West Africa

Markéta Grůňová, Karolína Brandlová, Jan Svitálek, and Pavla Hejčmanová

Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, Prague, Czech Republic

### ABSTRACT

Local communities play a key role in the sustainability of any conservation program. We evaluated the impact of an environmental education program for school children in the surroundings of the Delta du Saloum Biosphere reserve (Senegal) dedicated to the conservation of African charismatic fauna with the critically endangered Western Derby eland as a conservation flagship. Questionnaires evaluating knowledge and attitudes were filled in by children before and after the program in 2008 and 2009. We found a significant increase in knowledge that carries the potential to support conservation activities of protected area management. This knowledge alone is, however, not enough to change behavior and attitudes, proving the need to approach the problem in context of a complex, targeted awareness campaign.

### Introduction

Western Derby eland (*Taurotragus derbianus derbianus*) conservation program has been conducted in Senegal since 2000. Until 2008 there was no systematic work with local communities that could complement conservation efforts. Therefore, the two-day educational programs for children were begun in 2008 and their impact evaluated in order to improve future programs. Questionnaires evaluating knowledge and attitudes were completed by elementary school students before and after the program in 2008 and 2009, and the role of the chosen variables on results was evaluated.

The conservation of large mammals, in general, requires countering with specific variables for Environmental education (EE) process. Such programs as the Andean bear conservation project (Andrade, 2004), the Chipembele Wildlife Education Trust in Zambia (Chipembele, 2013), the Fernan-Vaz Gorilla Project (Fernan-Vaz, 2012), or Save the Rhino (Rhino, 2014) differ from conservation of other animal

**CONTACT** Pavla Hejčmanová ✉ [hejchmanova@ftz.czu.cz](mailto:hejchmanova@ftz.czu.cz) 📧 Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, Kamýcká 129, 165 21 Prague 6 - Suchbátka, Czech Republic.

Color versions of one or more of the figures in the article can be found online at [www.tandfonline.com/ueec](http://www.tandfonline.com/ueec).

© 2017 Taylor & Francis Group, LLC

groups because of their specific characteristics. In this context, Kellert, Black, Rush, and Bath (1996) found four basic interacting variables shaping one's attitudes toward wildlife and thus influencing animal conservation efforts: Individuals' basic values toward animals; Physical and behavioral characteristics of a particular animal involving its cultural and historical associations; Knowledge and understanding about a particular species and conservation awareness; and Past and present interactions with a particular species. While there is a minimal amount that can be changed regarding first two variables, the third forms a basis of conservation program education. The natural way of changing negative attitudes due to past experiences or preconceptions is to mediate positive interactions. This can be done through field trips (Bobek, 2013; Chipembele, 2013; Fernan-Vaz, 2012; Rhino, 2014) that are included in our programs.

The objective of our study was to test the following assumptions: (a) Environmental knowledge will increase after the education program and attitudes will shift positively towards nature protection; (b) Environmental knowledge and attitudes gained within the environmental education program will be retained in the long-term horizon; and (c) the age and gender of respondents will influence their environmental knowledge.

While the Western Derby eland (WDE) conservation strategy assumes that its success depends largely on the environmental behavior of the local community, the practical impact of environmental education on attitudes, behavior, and consequently on conservation activities, is not without doubts. Many talks have been led within psychologists, sociologists, and conservationists (Bamberg & Möser, 2007; Baruch-Mordo, Breck, Wilson, & Broderick, 2011; Pedro & Pedro, 2010; Zsóka, Szerényi, Széchy, & Kocsis, 2013) over the role of education in conservation attempts and we intend to contribute to this discussion with our field experience and data based research.

## Literature review

### *Western Derby eland conservation*

WDE is listed as Critically Endangered (IUCN, 2014) and the only viable wild population remains in the Niokolo Koba National Park (NKNP) in eastern Senegal, counting close to 200 individuals. In addition to this wild population, the semi-captive population of WDE has been established in the Bandia and Fathala reserves and quickly became critical for WDE conservation. This *ex-situ* conservation provides not only a gene pool and a stock of animals, but also a unique tool for fundraising and public awareness activities toward its natural biotope, the unique Senegalese savannah ecosystem of NKNP (Brandlová et al., 2013). In the last 15 years, a series of individual research and education projects naturally evolved in the complex conservation program that is recently based on three main pillars: (a) population management of the species, (b) research, and (c) education.

## ***Environmental education and conservation activities***

Can any conservation program be efficient without taking into account the local population? It has been repeatedly proved that it cannot (Andrade, 2004; Infield & Namara, 2001; Kellert et al., 1996). As the extinction of species is often caused by human activities (Dickman, 2010; Espinosa & Jacobson, 2012; Zimmermann et al., 2010), the success of any conservation action is dependent on the past, recent, and future environmental behavior of locals. It comes, therefore, as no surprise that many conservation efforts include education as integral part of their program (Andrade, 2004; Infield & Namara, 2001; Kellert et al., 1996; Rakotomamonjy, Jones, Razafimanahaka, Ramamonjisoa, & Williams, 2015).

Nevertheless, it seems to be reasonable to suppose that providing information itself does not necessarily lead to behavioral modification, as there are far more factors influencing it (Heimlich & Ardoin, 2008; Hines, Hungerford, & Tomera, 1986, 1987; Hungerford & Volk, 1990). At the same time, neither models of responsible behavior, stressing the role of environmental values leading to a feeling of moral obligation (Johnson & Manoli, 2008; Kaiser, Hübner, & Bogner, 2005; Kals, Schumacher, & Montada, 1999; P. Stern, 2000; P. C. Stern, Dietz, Abel, Guagnano, & Kalof, 1999) nor models emphasizing the role of subject norms or perceived competence (Ajzen, 1991; Hungerford & Volk, 1990), cannot exclude the role of knowledge, awareness, and attitudes as important variables.

As a result, a sound strategy for a conservation program aiming to change behavioral patterns of local citizens toward conservation of the biodiversity should adopt a well-prepared approach aiming on improving knowledge together with shaping attitudes, subject norms, or perceived conservation skills of a large scale of target groups in the community.

## ***Variables***

When designing an environmental education program and searching for the appropriate target group, it is crucial to take into account certain variables that can play an important role in shaping human attitudes. The significant variables would be gender and age. In regard to our focus group, Liefländer and Bogner (2014) found that younger students were more responsive to an attitude shaping environmental program than older students. Their possible explanation was according to Piaget's development theory in which younger children between 7 and 11 are in the "concrete operational stage" and are oriented on role models (parents, teachers) whereas their older schoolmates desire emotional autonomy and have a tendency to defy authorities (Berk, 2016; Liefländer & Bogner, 2014). Concerning the gender, it has been shown in a majority of the literature that female participants score higher on positive environmental attitudes (Bogner & Wiseman, 2004). However, as Liefländer and Bogner found no difference in the impact of their program between boys and girls, which may mean that a suitable program design can be used to influence both sexes equally.

## Methods

In 2008 and 2009 educational activities were organized as a part of the conservation program for Western Derby eland managed by the Czech University of Life Sciences Prague, the Directorate of National Parks in Senegal, and private managers of the reserve (SPEFS). Inspired by Kellert's variables shaping human attitudes (Kellert et al., 1996) and experience from similar projects, we used an outdoor excursion as a tool to mediate a link between the knowledge and attitudes of our target group (Bobek, 2013; Chipembele, 2013; Fernan-Vaz, 2012; Rhino, 2014). The education program for local elementary school children was therefore performed in two steps, theoretical and practical. The theoretical part took place in participating schools and the practical one consisted of a one-day visit to Fathala reserve guided by the researchers and local professional eco-guides.

## Study area

The study was conducted in the Fathala reserve, a fenced terrestrial section of the Delta du Saloum National Park and Biosphere reserve in Senegal, and its surroundings. The Fathala reserve is a privately managed game reserve. Since 2002 the area has been accessible to tourists. One of the priorities in the Fathala reserve has been the Western Derby eland Conservation program (Brandlová et al., 2013), which has contributed substantially to the development of ecotourism in the whole area.

## Target group

Our target group was children attending local state elementary schools in grades CE1 (elementary course first year), CE2 (elementary course second year), CM1 (intermediate course first year), and CM2 (intermediate course second year) (Senegal, 2010). The age of our target group (grade CE1–CM2) was therefore expected to be within 8–12 years. A few exceptional age deviations were found in our questionnaires and the subjects' actual age ranged from 8 to 17 years. This was probably due to delayed start of primary education or multiple doubling of school grades (e.g., Montgomery & Hewett, 2005) that occur often, especially in rural parts of Senegal.

## Data collection

The study was performed using one single form of questionnaire distributed to the children before and after the program in both years. The following data were collected: (a) knowledge and attitudes before the program (prequestionnaires), and (b) knowledge and attitudes immediately and one year after the program (postquestionnaires). The text was written in French as it is the official language of Senegal and is used in schools. The main part contained seven open-ended questions. Four of them (Q1: Write the names of four wild animals living in Senegal; Q2: Write the names of protected areas you know in Senegal; Q3: What endangered animals live in Fathala reserve; Q7: Where do we put the garbage?) focused on local

environmental knowledge; and three questions (Q4: Why is it important to protect nature?; Q5: Why is it important to keep some animals in nature reserves?; Q6: Is it good to have a forest near the village? Why?) investigated attitudes toward environmental problems directly related to the area where the respondents live.

In 2008 and 2009, a total of 924 questionnaires were filled out. In 2008, 251 pre-questionnaires and 232 postquestionnaires were filled out. In 2009, respondents filled out 203 prequestionnaires and 238 postquestionnaires. In order to evaluate the immediate impact of the education program on the environmental knowledge and attitudes of the participants, we analyzed 700 questionnaires filled out by 350 children who participated on both days in the same year (2008 or 2009). In order to evaluate the long-term duration of the environmental knowledge gained during the education program, we analyzed 41 questionnaires of children attending both years. The big reduction in number of pre- and postquestionnaires was caused by irregular school attendance common in rural areas of Senegal and a big number of questionnaires that were not filled correctly.

### **Data analyses**

To investigate the impact of our EE on respondents' actual knowledge and attitudes, we evaluated two main points: (a) the shift in knowledge and attitudes after the training and (b) the long-term (one-year) retention of the knowledge gained during the education program.

Questions Q1, Q2, and Q3 were scored according to number of points; therefore, the shift in knowledge before and after the program could be evaluated. The numbers of points in the questions were square root transformed in order to meet assumptions for use of the parametric test. To test differences in the number of points obtained for each question, we used Student's paired t-test. In order to evaluate the answers to Q7, we applied contingency tables.

The effect of the age and gender of the respondents on their environmental knowledge was evaluated for Q1, Q2, and Q3 together by summing the number of points obtained by the respondents in these questions. The sum of points had a normal distribution (tested by the Kolmogorov-Smirnov test). The effect of age was tested by simple linear regression for all children together and then for males and females separately. The effect of gender was tested by analysis of co-variance (ANCOVA), with the total number of obtained points as dependent variable, gender (male, female) as a categorical predictor and age as a continuous independent co-variable.

Three questions concerning environmental attitudes (Q4–Q6) implied answers of a categorical character and had to be classified into generalized groups. Q4 was rated YES for at least one reason why nature should be protected and NO for a meaningless reason. In Q5 the answers were consequently divided into two groups: (a) animals are dangerous, (b) animals are endangered. Responses to Q6 were divided into two main groups: (a) forest seen positively (YES) and (b) forest seen negatively (NO).

In order to evaluate the long-term persistence of the education program on the environmental knowledge of the children, we tested differences in the total numbers of points obtained in Q1, Q2, and Q3 from the prequestionnaires in the first year (pre-2008), postquestionnaires in the first year (post-2008) and prequestionnaires of the second year (pre-2009) in 41 children who participated in the education program in both years. These differences were tested by repeated measures analysis of variance with the total number of points as dependent variable and the three types of questionnaire as independent within effect predictors. This test was followed by post-hoc HSD Tukey test to reveal significant differences in the total number of points.

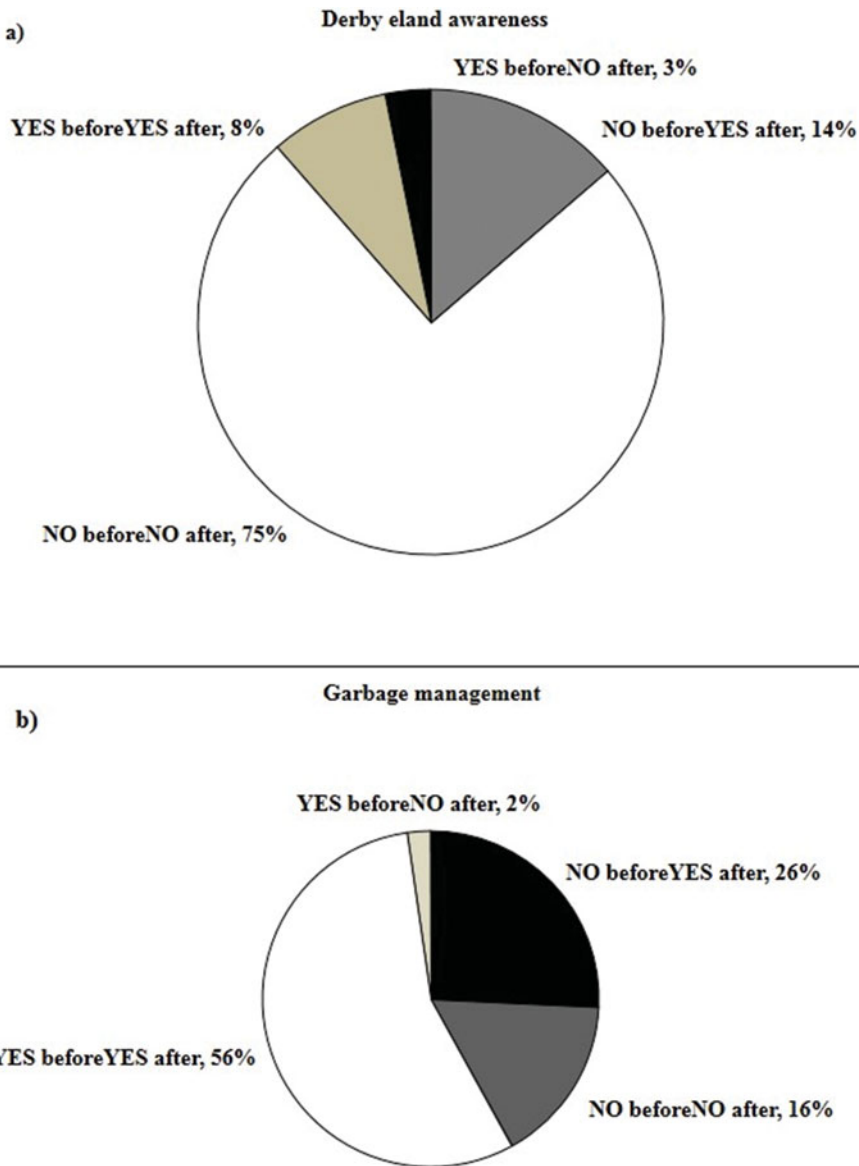
## Results

### *Environmental knowledge before and after the education program*

The number of stated Senegalese animals, Senegalese protected areas and endangered species living in the reserve reported by children in the questionnaires increased significantly after the environmental education program (all  $P < .05$ ). Responding children specifically stated correctly 2.8 animals before (ranging from 0 to 5 animals, median = 3) and 3.5 after the program (ranging from 0 to 9, median = 4). On average, 1.12 reserves (ranging from 0 to 6, median = 1) were named before and 1.80 reserves (ranging from 0 to 7, median = 2) after the program. On average, 0.77 endangered species (ranging from 0 to 3, median = 1) were stated before and 1.17 after the program (ranging from 0 to 5, median = 1). The percentage of respondents who stated Derby eland within endangered species increased ( $\chi^2 = 22.0$ ,  $df = 1$ ,  $P < .001$ ) after the education program by 11% (Figure 1a). The percentage of respondents who answered meaningfully where to put garbage increased by 24% ( $\chi^2 = 51.7$ ,  $df = 1$ ,  $P < .001$ ) after the education (Figure 1b). Among answers considered as meaningful were “into the pit”; “into the dust bin”; and “at the dumpsite.” Incorrect answers were, for instance, “into the forest”; “near/in the water well”; “in the village”; and “into the sea.”

The total numbers of points gained before and after the education program were both positively related to the age of the respondents (before:  $r = 0.35$ ,  $P < .001$ ; after:  $r = 0.26$ ,  $P < .001$ ); however, before the education respondents who were aged 1 year apart from one another differed by 0.47 points and after the education this difference decreased to 0.36 points (Figure 2).

Before the education program, male respondents gained, on average, 4.3 points (ranging from 2 to 8, median 4) in total for questions Q1–Q3 while females gained an average of 4.2 points (ranging from 1 to 8, median 4) ( $F = 13.0$ ,  $P < .001$ ). After the education program, there was no significant difference between males and females in gained points ( $F = 0.85$ ,  $P = .35$ ), with males and females gaining, respectively, an average of 7 (ranging from 3 to 13, median 7) and 6.8 (ranging from 0 to 13, median 6.5) points.



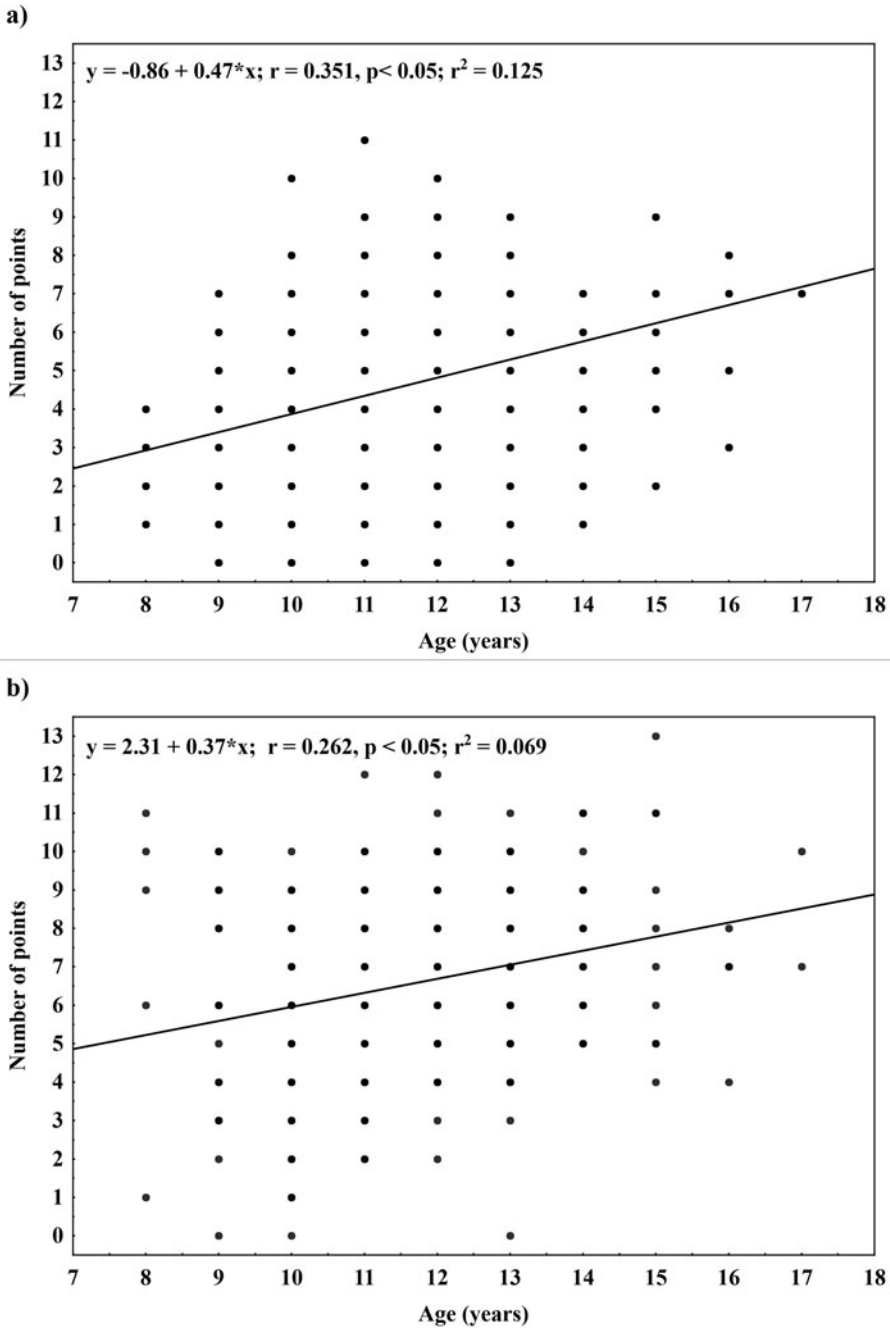
**Figure 1.** Percentage of respondents aware of (a) the occurrence of the critically endangered Western Derby eland in the Fathala reserve in their neighborhood and (b) environmentally appropriate/acceptable garbage management, both before and after the education program.

### ***Environmental attitudes before and after the education program***

The number of respondents who stated a relevant reason for the importance of nature protection increased after the environmental education program by 6%. The shift in attitude was significant ( $\chi^2 = 86.6$ ,  $df = 1$ ,  $P < .05$ , [Figure 3](#)). Frequent relevant answers were, for instance, “so that people do not kill the animals,” “so that the forest is preserved,” and “so that water resources are preserved.”

The percentage of respondents who perceived the forest positively before the course increased after the course by 5% ( $\chi^2 = 117.8$ ,  $df = 1$ ,  $P < .05$ ). Common

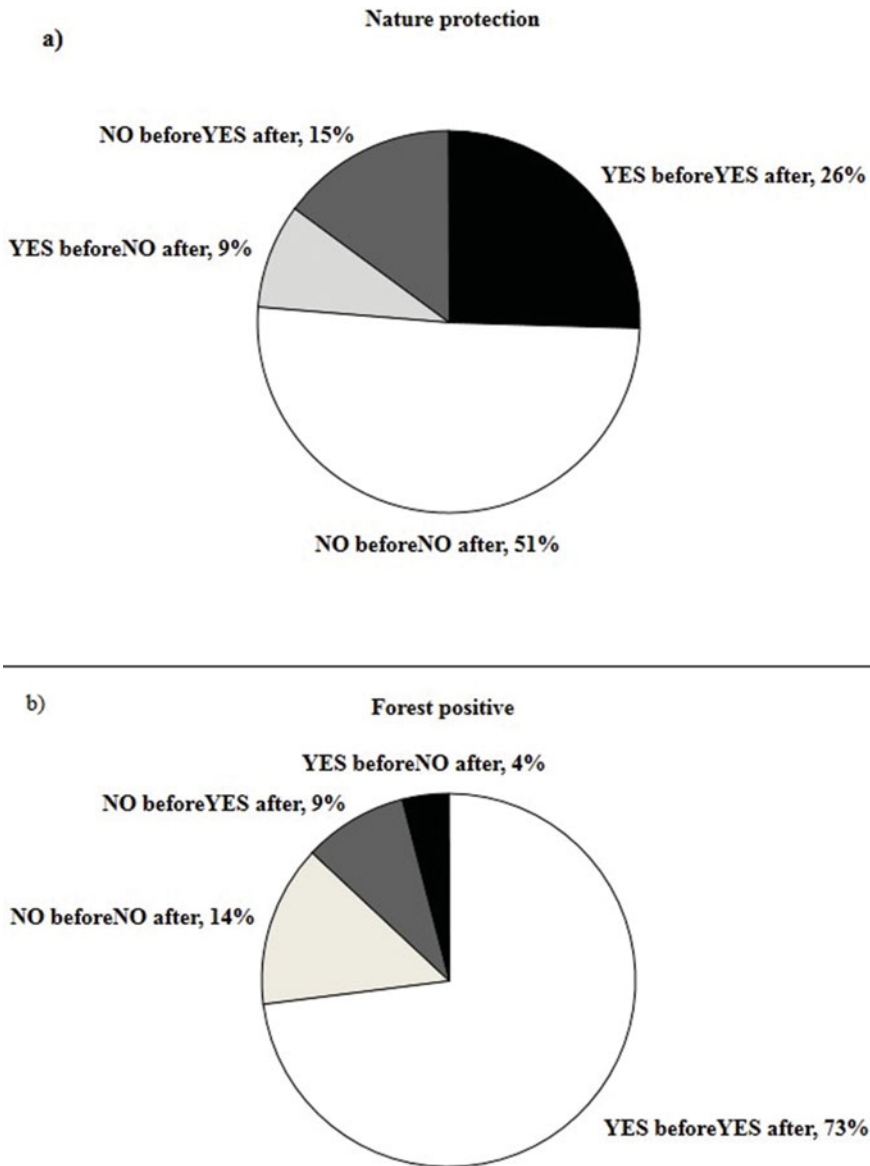




**Figure 2.** Effect of the age of the respondents on the number of points gained in (a) pre- and (b) postquestionnaires.

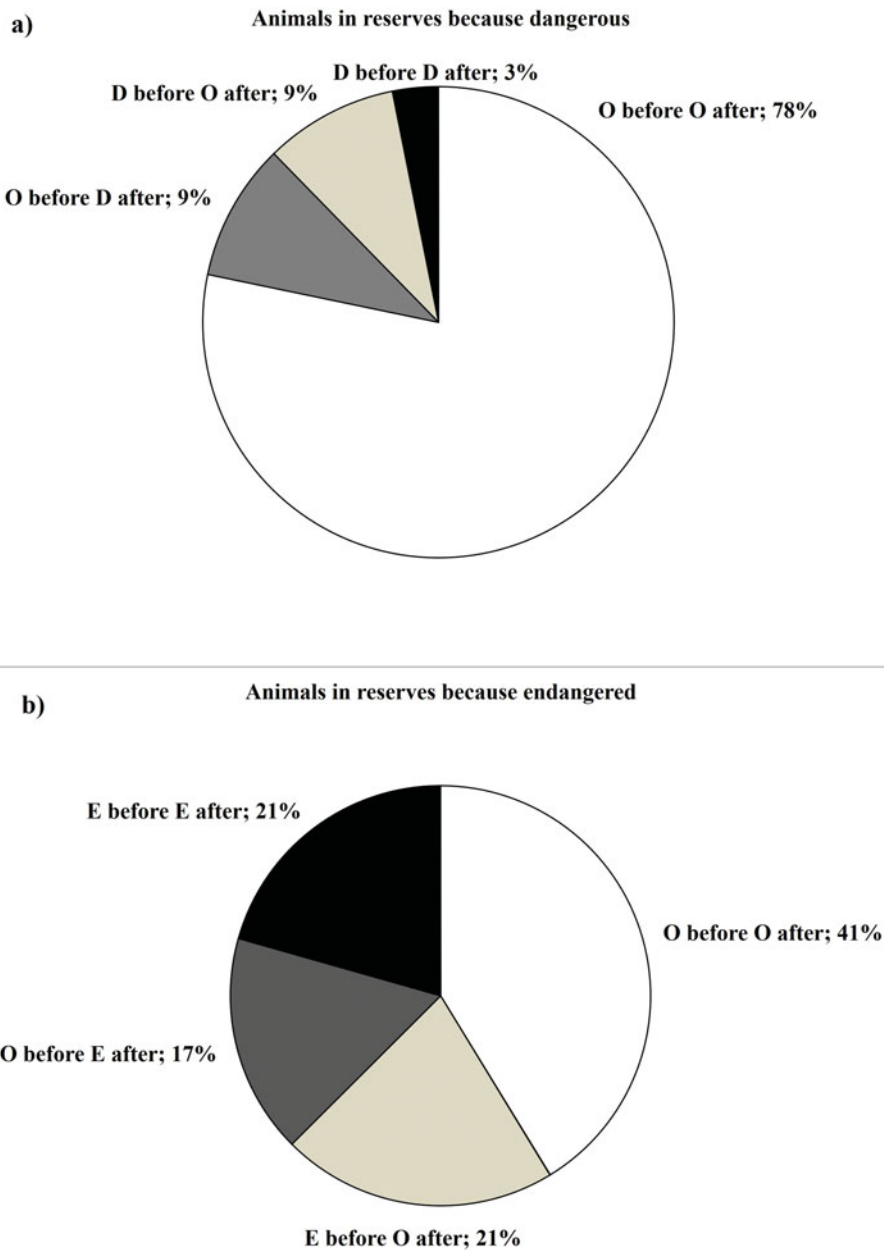
answers were “because animals and plants occur there” and “because it brings us water.”

Most of the respondents had various explanations for the importance of animals being in reserves such as “because there is vegetation”; “so that people can better see



**Figure 3.** Percentage of respondents who claimed (a) the importance of nature and (b) the presence of forest near their village as positive protection, both before and after the education program in the Fathala reserve.

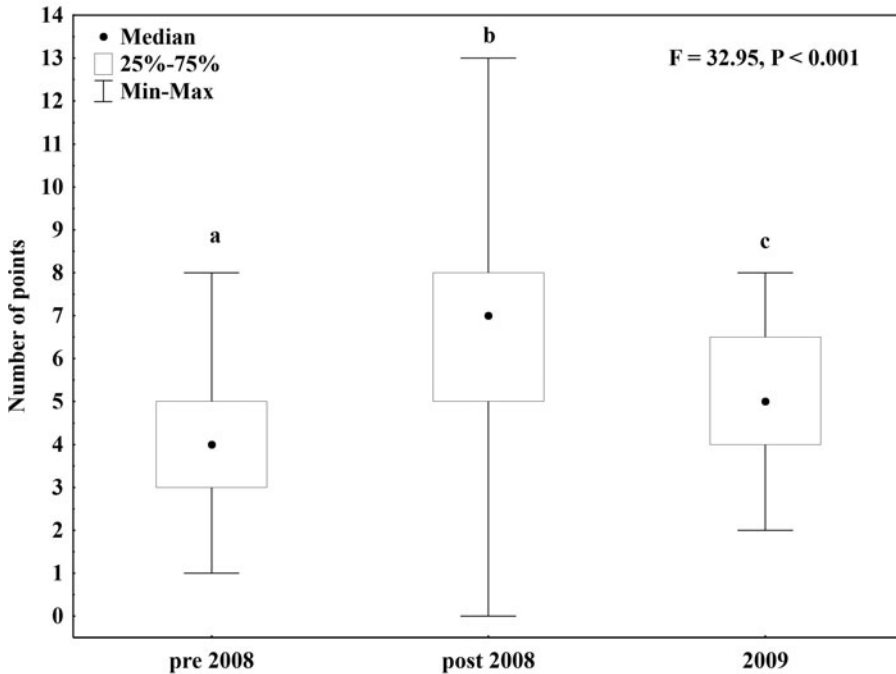
them”; and so forth. Two consistent groups of opinions appeared. They stated that animals were in reserves in order to be protected (21% of respondents) or because they were dangerous (9% of respondents). Whereas 9% of respondents changed their opinion after the education and stated that the importance lay in protection rather than in the dangerousness of the animals, another 9% went the other way around ( $\chi^2 = 239.9$ ,  $df = 1$ ,  $P < .05$ ; [Figure 4a–b](#)) and the final percentage of respondents explaining the importance of animals being in reserves “because they are dangerous” remained the same before and after the education.



**Figure 4.** Percentage of respondents seeing animals in reserves as (a) dangerous and (b) reflecting their need to be protected. Abbreviations: D = dangerous; E = endangered; O = other reason.

***Impact of the EE program one year after participation***

The knowledge of children measured in Q1–Q3 increased immediately after the course. Although one year later a decrease in the number of points was recorded, it did not return to the original level (Figure 5). Males indicated before, immediately after and one year after the program, on average, 3, 4.1, and 3.5 wild animals, whereas females stated 2.8, 3.7, and 3.3 wild animals in the consecutive questionnaires. In Q2



**Figure 5.** The number of points from questions 1, 2, and 3 answered by the same children before the education program in 2008 (pre-2008), immediately after the program (post-2008) and one year later in 2009 (2009). Different letters indicate a significant difference in the number of points tested by Tukey HSD test.

males indicated, on average, 0.8, 1.7, and 2.0 protected areas in Senegal compared to females naming 0.9, 2, and 1. Males named, on average, 0.7 protected animals before the education, 1.3 immediately after and 1 one year after in Fathala reserve. On the same question females named, on average, 1, 1.1 and 1.3 protected animals in Fathala reserve.

## Discussion and conclusion

### *Environmental knowledge before and after the education program*

Responses after the EE showed an increase in children knowledge in line with the content of the EE program, not only quantitatively (number of points), but also qualitatively. For instance, wild animals that were named after the program (Q1) seemed to be related to the animals that the children could see in the reserve. However, the occurrence of the Fathala reserve in Q2, as the area where the program was held, increased unselectively as well as other reserves named in prequestionnaires. Also, knowledge of the conservation status of animals (Q3) increased, including the incidence of the critically endangered WDE within them. This increased environmental knowledge carries the potential to support the conservation activities of Fathala reserve management, particularly for the conservation of the flagship species WDE.

The age difference between children appeared to play an important role in results before the education program (prequestionnaires), whereas after the education this impact diminished. Those results are in line with Liefländer and Bogner (2014), who found younger students more responsive to an environmental program than older students (Berk, 2016). The fact that there was a shift in the children's knowledge and also that the shift was more significant in younger children can show that our program successfully filled the gap.

Gender appeared to influence neither number of points gained before nor after the education. This fact shows both a relatively high gender equality in Senegalese primary education (World Bank, 2017) as well as the success of the program in addressing all participating gender categories unselectively (Bogner & Wiseman, 2004).

### ***Environmental attitudes before and after the EE program***

As a response to the common failure to reach the wall between knowledge and attitudes in EE programs (Baruch-Mordo et al., 2011; Pedro & Pedro, 2010) we used the outdoor excursion (Kellert et al., 1996). Nevertheless, we recorded a much less powerful influence of EE on attitudes than we expected. This result however, supports findings of a problematic link between knowledge and attitudes (Baruch-Mordo et al., 2011; Pedro & Pedro, 2010; Rodríguez-Barreiro et al., 2013) of which one reason could be low awareness level among the adult population, which has been proven several times during interactions between local inhabitants and reserve management.

### ***Long-term effect of the EE program***

The knowledge of children increased immediately after the course and, even though a decrease in the number of points was recorded one year later, it did not return to the original level. Although we can attribute this success to our education techniques, including outdoor excursions, we should not forget the simple fact that the respondents were one year older, thus more mature and more experienced one year after. Therefore, we recognize the need for a reference group in evaluating education programs as claimed by Carleton-Hug and Hug (2010) and as lacking in our study.

The observation of insufficient number of answered attitudes related questions, advocates for the use of multiple-choice questions, ordering items, binary items, and supply items from open-ended questions (Slavík, 2012) when measuring attitudes.

### **Acknowledgments**

We are grateful to the Directorate of National Parks in Senegal and to managers and staff of the Fathala Reserve for their help with organizing the environmental educational program.

## Funding

The research was supported by the Ministry of Environment of the Czech Republic, Grant RP10/2007, Faculty of Tropical AgriSciences at the Czech University of Life Sciences Prague, project IGA 20165010, and the Derbianus Conservation NGO.

## References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211.
- Andrade, S. E. (2004). *Evaluation of an environmental education program for the Andean Bear in an Ecuadorian protected area* (Master's thesis). University of Florida, FL.
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, 27(1), 14–25.
- Baruch-Mordo, S., Breck, S. W., Wilson, K. R., & Broderick, J. (2011). The carrot or the stick? Evaluation of education and enforcement as management tools for human-wildlife conflicts. *PloS one*, 6(1), e15681.
- Berk, L. (2016). *Development through the lifespan*. Boston, MA: Pearson Education India.
- Bobek, M. (2013). *We help them survive- the way towards the wondering bus*. Paper presented at the WAZA Annual Conference in Orlando, Orlando, Florida.
- Bogner, F., & Wiseman, M. (2004). Outdoor ecology education and pupils' environmental perception in preservation and utilization. *Science Education International*, 15(1), 27–48.
- Brandlová, K., Mallon, D., Hejcmanová, P., Regnaut, S., Jůnková Vymyslická, P., Fedorova, T., & Ndyiaye, S. (2013). *Western Derby Eland (Taurotragus Derbianus Derbianus): Conservation Strategy*. Prague, Czech Republic: Czech University of Life Sciences.
- Carleton-Hug, A., & Hug, J. W. (2010). Challenges and opportunities for evaluating environmental education programs. *Evaluation and Program Planning*, 33(2), 159–164.
- Chipembele. (2013). *Conservation education*. Retrieved from <http://chipembele.com/do#Conservation%20Education>
- Dickman, A. (2010). Complexities of conflict: The importance of considering social factors for effectively resolving human–wildlife conflict. *Animal Conservation*, 13(5), 458–466.
- Espinosa, S., & Jacobson, S. K. (2012). Human-wildlife conflict and environmental education: Evaluating a community program to protect the Andean bear in Ecuador. *The Journal of Environmental Education*, 43(1), 55–65.
- Fernan-Vaz Gorilla Project. (2012). *Conservation education*. Retrieved from <http://gorillasgabon.scd-conservation.com/education>
- Heimlich, J. E., & Ardoin, N. M. (2008). Understanding behavior to understand behavior change: A literature review. *Environmental Education Research*, 14(3), 215–237.
- Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of Environmental Education*, 18(2), 1–8.
- Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The Journal of Environmental Education*, 21(3), 8–21.
- Infield, M., & Namara, A. (2001). Community attitudes and behaviour towards conservation: an assessment of a community conservation programme around Lake Mburo National Park, Uganda. *Oryx*, 35(1), 48–60.
- IUCN. (2014). *Tragelaphus derbianus ssp. derbianus*. The IUCN Red List of Threatened Species. Retrieved from <http://www.iucnredlist.org/details/22056/0>

- Johnson, B., & Manoli, C. C. (2008). Using Bogner and Wiseman's model of ecological values to measure the impact of an earth education programme on children's environmental perceptions. *Environmental Education Research*, 14(2), 115–127.
- Kaiser, F. G., Hübner, G., & Bogner, F. X. (2005). Contrasting the theory of planned behavior with the value-belief-norm model in explaining conservation behavior. *Journal of Applied Social Psychology*, 35(10), 2150–2170.
- Kals, E., Schumacher, D., & Montada, L. (1999). Emotional affinity toward nature as a motivational basis to protect nature. *Environment and Behavior*, 31(2), 178–202.
- Kellert, S. R., Black, M., Rush, C. R., & Bath, A. J. (1996). Human culture and large carnivore conservation in North America. *Conservation Biology*, 10(4), 977–990.
- Liefländer, A. K., & Bogner, F. X. (2014). The effects of children's age and sex on acquiring pro-environmental attitudes through environmental education. *The Journal of Environmental Education*, 45(2), 105–117.
- Montgomery, M. R., & Hewett, P. C. (2005). *Poverty and children's schooling in urban and rural Senegal*. Policy Research Division Working Paper no. 196.
- Pedro, Á. S., & Pedro, V. M. (2010). Developing sustainable environmental behavior in secondary education students (12–16) Analysis of a didactic strategy. *Procedia-Social and Behavioral Sciences*, 2(2), 3568–3574.
- Rakotomamonjy, S., Jones, J., Razafimanahaka, J., Ramamonjisoa, B., & Williams, S. (2015). The effects of environmental education on children's and parents' knowledge and attitudes towards lemurs in rural Madagascar. *Animal Conservation*, 18(2), 157–166.
- Rhino, S. T. (2014). Supporting activities. Retrieved from [http://www.savetherhino.org/africa\\_programmes/save\\_the\\_rhino\\_trust\\_namibia/supporting\\_activities](http://www.savetherhino.org/africa_programmes/save_the_rhino_trust_namibia/supporting_activities)
- Rodríguez-Barreiro, L. M., Fernández-Manzanal, R., Serra, L. M., Carrasquer, J., Murillo, M. B., Morales, M. J., ... Valle, J. D. (2013). Approach to a causal model between attitudes and environmental behaviour. A graduate case study. *Journal of Cleaner Production*, 48, 116–125.
- Senegal. (2010). Ministère de l'Éducation National. Retrieved from [http://www.education.gouv.sn/root-fr/files/systeme\\_educatif.php](http://www.education.gouv.sn/root-fr/files/systeme_educatif.php)
- Slavík, M. (2012). *Vysokoškolská pedagogika* [Pedagogy for academics]. Grada.
- Stern, P. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, 56(3), 407–424.
- Stern, P. C., Dietz, T., Abel, T. D., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review*, 6(2), 81–97.
- World Bank. (2017). *Senegal overview*. Retrieved from <http://www.worldbank.org/en/country/senegal>
- Zimmermann, A., Baker, N., Inskip, C., Linnell, J. D., Marchini, S., Odden, J., ... Treves, A. (2010). Contemporary views of human–carnivore conflicts on wild rangelands (pp. 129–151). In J. T. du Toit, R. Kock, & J. Deutsch (Eds.), *Wild rangelands: Conserving wildlife while maintaining livestock in semi-arid ecosystems*. Oxford, UK: Blackwell Publishing Ltd.
- Zsóka, Á., Szerényi, Z. M., Széchy, A., & Kocsis, T. (2013). Greening due to environmental education? Environmental knowledge, attitudes, consumer behavior and everyday pro-environmental activities of Hungarian high school and university students. *Journal of Cleaner Production*, 48, 126–138.