



Do Short-duration Environmental Education Programmes and One-day Excursions Influence Senegalese Primary Schoolchildren 's Environmental Attitudes? Save Your Money and Stay in the Classroom

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3 1 **Do Short-duration Environmental Education Programmes and One-day**
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6 2 **Excursions Influence Senegalese Primary Schoolchildren's Environmental**
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8 3 **Attitudes? Save Your Money and Stay in the Classroom.**
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13 5 **Abstract**
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16 6 Short-duration environmental education programmes and nature excursions are commonly used
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18 7 by conservationists to influence the recipients' environmental attitudes. This study aims to
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20 8 improve this kind of approach and save often limited financial resources. It specifically
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22 9 investigates whether a 2-day environmental class and/or 1-day class followed by 1-day outdoor
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24 10 excursion lead to positive changes in Senegalese children's environmental knowledge and
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26 11 attitudes. A 10-item version of the New Environmental Paradigm scale for Children,
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28 12 complemented by 4 attitude questions related to Derby eland (*Taurotragus derbianus*)
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30 13 conservation and 3 environmental knowledge questions, were used in a pre-, post-, and long-
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32 14 term survey (n= 303). We found only a limited, positive effect of both approaches on
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34 15 influencing environmental attitudes and no benefit of outdoor excursion compared to indoor
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36 16 programme. The most positive attitudes towards the environment and its conservation both
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38 17 before and after the programme were shown by children from urban areas with formally
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40 18 educated fathers.
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48 20 **Keywords:** Evaluation; New Environmental Paradigm scale for Children; Outdoor excursion;
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50 21 West Africa; Western Derby eland; Wildlife conservation.
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23 Introduction

24 The Western Derby eland (*Taurotragus derbianus derbianus*, Gray, 1847) is a critically
25 endangered mammal (IUCN 2017), with last wild population estimated as 170 animals
26 (Renaud, Gueye et al. 2006). In 2000, conservation activities were launched by Directorate of
27 National Parks of Senegal and its partners. A semi-captive population was established in the
28 Bandia Reserve in western Senegal, as its protection could no longer be guaranteed in its natural
29 range in the Niokolo Koba national park, south-east Senegal. Nowadays, Senegal has 2 semi-
30 captive populations of Western Derby eland in the Bandia and Fathala nature reserves
31 (Brandlová et al. 2013). In both reserves, the Western Derby eland occurs together with other
32 charismatic, large herbivore species, such as the African buffalo (*Syncerus caffer brachyceros*),
33 roan antelope (*Hippotragus equinus*), white rhinoceros (*Ceratotherium simum*), plains
34 zebra (*Equus quagga*), and southern giraffe (*Giraffa giraffa*).

35 The two reserves represent a unique tool for raising awareness on environmental issues and
36 providing opportunities for direct contact of people with indigenous wildlife species. In 2008,
37 the first environmental education programmes were developed and implemented by Western
38 Derby eland conservation team in the Fathala reserve, south-west Senegal (Grůňová et al. 2017)
39 in order to make use of the opportunities it provides to influence peoples' attitudes towards
40 nature conservation (Bogner and Wiseman 2004; Infield and Namara 2001; Judy 2013). In a
41 series of repeated programmes in 2008-2009, field trips were used to raise awareness and
42 positively influence environmental attitudes of participating schoolchildren. However, these
43 efforts were not systematically evaluated for their effect on changes in environmental attitude
44 of the participants. Although the increase in conservation related knowledge was recorded after
45 the programme, some of the monitored children's environmental attitudes shifted slightly
46 positively and some slightly negatively (Grůňová et al. 2017), the lack of systematic monitoring

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3 47 makes results of such evaluation difficult to apply in different settings (Carleton-Hug and Hug
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5 48 2010; Kopnina 2011).

7 49 The programmes were not evaluated or repeated until 2015 for lack of qualified
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10 50 personnel. In 2015, based on preliminary results from evaluation of the first programmes, the
11
12 51 new education scheme was developed for schools in the proximity of the Bandia reserve. In
13
14 52 order to ensure the general applicability of the new program's evaluation, we used a validated
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16 53 measure of children's general environmental attitudes. A 10-item version of the New Ecological
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18 54 Paradigm Scale for Children (Manoli, Johnson and Dunlap 2007) was chosen for the reasons
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20 55 given below. To learn about the participants' attitudes related to nature conservation, we
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22 56 developed and appended three questions that specifically focus on conservation issues in
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24 57 Senegal: loss of natural habitat; poaching; and lack of empowerment/ belief in ones capacities
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26 58 to preserve nature, in comparison to rich countries; and perception of Western Derby eland
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28 59 conservation importance.

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33 60 Together with the Ecology Scale (Maloney and Ward 1973), Environmental Concern
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35 61 Scale (Weigel and Weigel 1978) and 2-factor Model of Environmental Values (2-MEV)
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37 62 (Bogner and Wiseman, 1999), the New Environmental Paradigm (NEP) scale (Dunlap et al.
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39 63 2000) has been the most widely used method to measure environmental attitudes of adults
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41 64 (Bogner and Wiseman 2006; Dunlap 2008; Hawcroft and Milfont, 2010). The NEP scale is the
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43 65 only one that is formulated in such a way that it does not become outdated with newly emerging
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45 66 environmental issues whereas it also does not refer specifically to western civilizations'
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47 67 environmental concerns (Milfont and Duckitt 2010). We therefore considered it to be the most
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49 68 appropriate instrument to assess the general environmental attitudes of Senegalese children, and
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51 69 any changes that may occur in them after exposure to the environmental education programme
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53 70 (Grúňová et al., 2018). The NEP scale measures whether respondents' general environmental
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55 71 attitudes correspond more to an anthropocentric (concern for humans) than to an eco-centric
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3 72 (concern for all living things) world-view (Bamberg and Möser 2007; Manoli et al. 2007; Van
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5 73 Petegem and Blicck 2006). It has been used across cultures and continents (Chatterjee 2008;
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7 74 Corral-Verdugo and Armendariz, 2000; Gangaas, Kaltenborn and Andreassen 2015; Kopnina
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9 75 2011; Schultz and Zelezny 1999; Wu,2012), while a simplified and rephrased version was
10
11 76 developed for use with children (Manoli et al. 2007). The NEP scale has already proven its
12
13 77 validity not only as an instant measure of environmental attitudes, but also as a tool to monitor
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15 78 changes in attitudes after exposure to education programmes, in both adults (Dunlap, 2008),
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17 79 and children (Collado, Staats and Corraliza 2013; Corraliza, Collado, and Bethelmy 2013;
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19 80 Manoli et al. 2007; Wu 2012) .
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24 81 In the present study, we aim to evaluate the impact of the environmental education
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26 82 programme set up in the two Senegalese administrative regions of Dakar and Thiès in 2015 as
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28 83 part of the Western Derby eland conservation strategy (Brandlová et al. 2013). General
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30 84 environmental attitudes (perception of natural world from either eco-centric or anthropocentric
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32 85 position) of participating children were measured using the 10-item NEP Scale for Children
33
34 86 developed by Manoli et al. (2007), whereas specific questions related to Western Derby eland
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36 87 conservation were designed and appended to the standard questionnaire for the purpose of this
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38 88 study. Moreover, we assessed the effectiveness of an outdoor excursion in influencing attitudes
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40 89 towards nature protection (Bogner and Wiseman 2004; Chipembele 2013; Fančovičová and
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42 90 Prokop 2011; Fernan-Vaz 2012; Liefländer and Bogner 2014; Sellmann and Bogner 2013). We
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44 91 hypothesized that:
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49 92 i. socio-economic factors (urban versus rural area schools; a child's father being
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51 93 unemployed or employed either in agriculture or crafts, or working for the state; and
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53 94 ethnic background) influence school-children's environmental knowledge and attitudes
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55 95 (Casey and Scott 2006; Kopnina 2011; Powers 2004; Tessema et al., 2010);
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3 96 ii. specific knowledge related to nature conservation in Senegal increases after
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5 97 schoolchildren have been exposed to a sensitisation programme on raising awareness
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7 98 on environmental issues, general attitudes shift from anthropocentrism to eco-centrism,
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9 99 and specific attitudes related to Western Derby eland conservation shift towards higher
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11 100 conservation awareness (Bamberg and Möser 2007; Dunlap and Van Liere 2008;
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13 101 Grůňová et al. 2017; Infield and Namara 2001; Zsóka et al.2013);
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16 102 iii. a one-day outdoor excursion positively influences specific environmental knowledge,
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18 103 and both specific and general environmental attitudes more than a alternative indoor
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20 104 programme with similar content (Bogner 2002; Frantz and Mayer 2014; Sellmann and
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22 105 Bogner 2013); and
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25 106 iv. the level of specific knowledge about nature and its protection in Senegal correlates
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27 107 positively with eco-centric environmental attitudes and positive Western Derby eland
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29 108 conservation-related attitudes (Kaiser, Roczen, and Bogner 2008).
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35 110 **Methods**

37 111 *Conservation programme, study area, and target group*

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40 112 The present study was conducted in November-December 2015 in schools and in the Bandia
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42 113 nature reserve, in western Senegal. Participants consisted of CM1-level (lower secondary)
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44 114 schoolchildren from urban and rural areas in both Dakar and Thiès regions. The criteria for
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46 115 selecting schools to be involved in the study were their distance from the nature reserve
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48 116 (maximum of 70 km), school officials' willingness to participate in the programme, and ease
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50 117 of accessibility. CM1 school grade corresponds with the first level of the so-called 'middle
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52 118 school' in Senegal, and thus theoretically comprises children in the 12-13 year age group. In
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54 119 our case, the average age of participating children was 13 (ranging from 10 to 16, with one
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56 120 exception of 17 and two who were 18 years old). This deviation in age from what is norm was
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3 121 caused either by a delayed start in primary education, or by multiple class repetitions. In total,
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5 122 we monitored 303 children in the study: 151 boys and 149 girls (three children did not mention
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7 123 their sex). Of these, 157 children attended urban schools, and 146 rural schools. Overall, 135
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9 124 children participated in a two-day, in-class programme, whereas 168 took a one-day in-class
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11 125 programme, visiting the Bandia natural reserve the second day. Most respondents belonged to
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13 126 either of 5 ethnic groups: Serer (n=100), Wolof (36), Toucouleur (9), Mandingue (7), and Fulani
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15 127 (7), with the remaining ethnic groups forming the 'minority' category.
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129 *Content of the two-day education programme*

130 The total duration of the programme varied from 7 to 8 contact hours. Lectures were
131 provided by one Senegalese and one foreign educator in French language. The lecturers used
132 verbal, demonstration and practical-work methods to engage participating schoolchildren
133 (Janiš, Kraus, and Vacek 2008). First programme day began with a discussion on elements of
134 the natural world and their connectedness. This part, along with theory of food chain, included
135 a game whereby children representing elements in the environment, such as grass, water, fly or
136 lion, end up mutually connected with a rope, demonstrating these interrelations in nature. The
137 theoretical part consisted of a presentation of the following topics: causes of loss of species
138 (poaching, deforestation, and human encroachment), soil degradation, bush fires; examples of
139 extinct species in Senegal; protected areas in Senegal and their role; the Western Derby eland
140 as a flagship species of the Senegalese natural environment and threats to the eland's survival.
141 Theoretical classes were illustrated by visual material projected on the classroom wall and
142 children were encouraged to actively participate and respond to questions about the threats to
143 nature in Senegal. At the end of the first day, children were asked to build up a story using
144 Derby eland conservation team author story-telling cards showing different forms of
145 unsustainable nature use in Senegal. Groups of children working together then shown their

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3 146 chosen cards in chosen order and told their story either to the lecturer or their teacher, whoever
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5 147 was available. During the second day, nature and wildlife in Senegal was presented using
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7 148 photographs of animals and trees projected on the lecture room wall with the 'Class-group'.
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10 149 The 'Reserve-group' observed the same animals during an outdoor excursion in the Bandia
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12 150 reserve. Children from both groups were given a species check-list and were asked to mark all
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14 151 the animals they saw on photographs or in the reserve. Children collected points for every
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16 152 animal identified. For identification they used a booklet designed by the education team '*Les*
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18 153 *animaux du Sénégal*'. 'Class-group' and 'Reserve-group' children were provided with the same
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20 154 information and participated in the same activities, only the setting (and type of exposure to
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22 155 stimuli) differed.
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28 157 **Questionnaire**

30 158 A 10-item version of the NEP Scale for Children (Manoli et al. 2007) was used to
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32 159 measure general environmental attitudes (Table 1). The scale consists of six eco-centric
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34 160 questions (concern for all living things; questions 1, 2, 4, 5 and 8; e.g. Q1 '*Plants and animals*
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36 161 *have as much rights as people to live*'), and four anthropocentric questions (concern for
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38 162 humans/utilitarian view on nature: e.g. Q7 '*People are supposed to rule over nature*', questions
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40 163 3, 6, 7 and 9). Originally, the NEP scale was designed for children of 10-12 (Manoli et al.,
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42 164 2007), but based on previous experience with environmental education programmes in Senegal,
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44 165 where younger children had difficulties writing in French (Grůňová et al. 2017), we found it
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46 166 more suitable to apply the scale on older children. The scale was therefore administered to 12-
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48 167 14 year old children. Moreover, as the 10-item NEP Scale for Children proved to be inconsistent
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50 168 as a whole or in other studies coherent clusters (Van Petegem and Blicck, 2006; Manoli et al.
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52 169 2007; Ogunbode 2013) when used on a corresponding sample (n= 782) of Senegalese children
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54 170 (Grunova et al. 2018), we evaluated the responses question by question.
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3 171 To test specific conservation attitudes relevant to Western Derby eland conservation, we
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5 172 designed an additional set of four questions (questions 11-14; see Table 1). Questions 15-18
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7 173 were appended in order to test children's specific knowledge related to nature and its
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9 174 conservation in Senegal. Q15 '*Which silhouette is of the Derby eland*', which included drawings
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11 175 of animal silhouettes, Q16 '*Name 10 wild animal species occurring in Senegal*', Q17 '*Over*
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13 176 *what time duration does a plastic bag decompose?*', and Q18 '*Name 5 Senegalese nature*
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15 177 *reserves*'.

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19 178 In overall, questions 1-14 were administered as a choice from a five-point Likert scale,
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21 179 graded from strongly agree (1) to strongly disagree (5) with value (3) meaning '*I am not sure*',
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23 180 and questions 15-18 as single-choice and open-ended questions.
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27 28 182 ***Data collection and analysis***

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30 183 Respondents were sampled using a pre-, post-, and long-term design (e.g. Barch et al.
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32 184 2007), i.e. the same questionnaire was administered to the same children before the programme,
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34 185 three weeks after the programme and one year after the programme. The NEP score was
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36 186 calculated as the sum of positive responses in the eco-centric questions and as a sum of negative
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38 187 responses in the anthropocentric questions to allow comparison of our results with those of
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40 188 similar studies. The same was done with questions on specific conservation attitudes (Q11-14).

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44 189 To explore the influence of socio-economic factors on children's knowledge, and
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46 190 attitudes towards the environment before the intervention, we tested the effects of school
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48 191 location (urban, rural), father's employment status (in the categories agriculture, labourer, or
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50 192 jobs requiring higher formal education), and respondent's ethnic origins (Mandingue, Fulani,
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52 193 Wolof, Serer, Toucouleur, and 'other') via a Repeated Measures ANOVA (Davidian, and
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54 194 Giltinan 1995) for each effect separately.
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3 195 The programme's effect on children in general, its effect on children from urban/rural
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5 196 schools, and on the participants of two forms of the programme (in-class / outdoor excursion)
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8 197 was tested with the total number of knowledge points defined as sum of points appointed to
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10 198 correctly answered Q15-18, or Likert scale values in the post-test as dependent, and school
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12 199 location or form of programme as independent variables. Tukey's HSD tests were applied to
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14 200 test significant differences in all the repeated measure ANOVAs as it applies simultaneously to
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16 201 the set of all compared values.

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19 202 In order to test correlations between total knowledge and attitude scores, we used
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21 203 Spearman's rank correlation. To test the probability that knowledgeable children, i.e. children
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23 204 with high knowledge scores will name the Western Derby eland in the post-test within wild
24
25 205 animals occurring in Senegal, we used logistic regression with the number of correctly listed
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27 206 animals in question 16 as a dependent variable and the total knowledge score as an independent
28
29 207 variable. All statistical analyses were carried out using the STATISTICA 13 package (TIBCO).

30 31 32 33 34 35 209 **Results**

36
37 210 Before the start of intervention, average knowledge scores (points gathered in Q15-18)
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39 211 of respondents reached 6.3 points on a maximum of 19. Respondents' general environmental
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41 212 attitudes on eco-centric questions where answer 'I strongly agree' (value 1 on the Likert scale)
42
43 213 meant an eco-centric positions (Q1, Q2, Q4, Q5, Q8) ranged 1.6- 2.5. On the other hand,
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45 214 respondents' attitudes on anthropocentric questions where the answer 'I strongly agree' meant
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47 215 an anthropocentric position (Q3, Q6, Q7, Q9) yielded Likert scale values between 2.2 and 2.8.
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49 216 Specific conservation attitudes ranged 2.1- 3.9 which indicated mostly positive conservation
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51 217 attitudes, with exception of question 11 (Table 1).

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58 219 Table 1 here
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5 221 *Does socio-economic background of schoolchildren influence their environmental*
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7 222 *knowledge and attitudes?*
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10 223 The pre-test knowledge scores of children whose father works in agriculture (mean
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12 224 score $5.5 \pm 0.3SE$) or as waged labourer (mean score $5.9 \pm 0.3SE$) was at the similar level, while
13
14 225 children with a father with a higher education degree (mostly worked as state employees)
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16 226 achieved significantly higher knowledge scores than the other groups (mean score $7.6 \pm 0.3SE$)
17
18 227 ($F=17$, $p<0.01$). Children with a father with higher education scored more eco-centrally and
19
20 228 less anthropocentrically, and were more supportive of conservation than children with fathers
21
22 229 working in agriculture (Q4, Q7, Q8, Q12), as a labourer (Q13) or than both, i.e. children with
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24 230 fathers working in agriculture and waged labourers (Q2, Q5, Q6, Q9, Q10, Q11 and Q14). In
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26 231 Q1, children with higher-education fathers scored significantly more anthropocentrically than
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28 232 children with a father working in agriculture (all $p<0.01$).
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33 233 There was no difference in knowledge or attitude scores of children grouped per ethnic
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35 234 group except of Q3, Q7 and Q9. in Q3, Mandingue children were shown to take an eco-centric
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37 235 position, whereas Wolof, Serer and Toucouleur appeared to be anthropocentric; in Q7,
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39 236 Toucouleur were more eco-centric than Mandingue and Fulani, respectively; in Q9, Mandingue
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41 237 were more eco-centric than Wolof and Serer, respectively (all $p<0.01$).
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45 238 Children from urban areas initially achieved higher knowledge scores (mean score
46
47 239 $6.9 \pm 0.3SE$) than children from rural areas (mean score $6 \pm 0.2SE$) ($F=7.5$, $p<0.01$). The
48
49 240 difference in pre-test attitudes between children from urban and rural schools appeared highly
50
51 241 significant in all questions except for Q3, Q4 and Q7. Urban children scored higher on eco-
52
53 242 centric attitudes (Q2, Q4, Q5, Q8, Q10, all $p<0.01$) and anti-anthropocentric attitudes (Q6, Q9,
54
55 243 $p<0.01$) and were more in favour of conservation (Q11, $p<0.01$) than rural children. Only in
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57 244 Q1, did urban children scored lower on eco-centric questions than rural children.
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3 245 Numbers of correctly named wild animals living in Senegal together with numbers of
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5 246 domesticated and alien species perceived as wild Senegalese animals are given in Table 2.
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7 247 Children from urban areas significantly listed more wild animals present in Senegal ($F=20$,
8
9 248 $p<0.001$). Moreover, while children from urban areas tended to incorrectly list non-indigenous
10
11 249 (tiger, bear) species, children from rural areas listed less non-indigenous species and included
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13 250 incorrectly more domesticated (horse, goat) ones than children from urban areas.
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19 252 Table 2 here
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24 254 ***Environmental education programme effect on environmental knowledge and attitudes of***
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26 255 ***children***

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28 256 Specific environmental knowledge points reached an average value of 6.4 in pre-test
29
30 257 (± 0.2 SE), an average of 9.6 points (± 0.3 SE) one month after the programme, and an average
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32 258 of 10.4 points one year after the programme (± 0.3 SE).
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35 259 Mean scores and frequency distribution of pre-, post- and long-term attitude scores (Q1-
36
37 260 Q10 for NEP scale for children; and Q11-Q14 on specific conservation attitudes) are given in
38
39 261 Table 1. The NEP values on questions 1, 2, 4 and 5 remained almost unchanged in the post-test
40
41 262 and the values ranged within eco-centric positions. With Q8, 5% more children answered yes
42
43 263 on '*People behave badly to the environment*' in the post-test, evidencing that the latter had
44
45 264 brought about a shift towards eco-centrism, whereas with Q10 3% less children answered yes
46
47 265 evidencing a negative shift but still in eco-centric range. In all anthropocentric questions 3, 6,
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49 266 7, 9 respondents were shown to hold utilitarian positions in pre-test, weakening in post-test.
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54 267 Respondents held pro-conservation attitudes during the pre-test, except for Q11.
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56 268 Whereas in Q11 respondents were not in favour of conservation before the programme, they
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58 269 have shifted to pro-conservation positions after the programme. Responses on Q12 remained
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3 270 almost unchanged between pre- and post-test whereas pro-conservation attitudes of respondents
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5 271 further deepened in Q13 and Q14 as evidenced in lower NEP score of Q13 and higher score in
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8 272 Q14.

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10 273 Long-term results in all eco-centric, anthropocentric and specific conservation attitudes
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12 274 were influenced by the high number of missing responses (34 - 36%). In all questions (except
13
14 275 for Q2 and Q7), the percentage of low post-test values were proportionate to the percentage of
15
16 276 low long-term values and the percentage of high values in the pre-test corresponded to the
17
18 277 percentage of high values in the long-term test. In Q2 '*There are too many people on the planet*',
19
20 278 less respondents agreed in the long term test while percentage of disagreeing respondents
21
22 279 remained similar as in the post- test. In Q7 '*People are supposed to rule over the nature*' more
23
24 280 respondents agreed in the long term test and less disagreed than in the post-test (Table 1.).
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28 281 The program had different effects on the attitudes of children from rural and urban areas
29
30 282 for Q1, Q4, Q13 and Q14 (all $p < 0.01$, Figure 1). In Q1, anthropocentric values of children from
31
32 283 urban areas weakened in post-test whereas children from rural areas moved towards
33
34 284 anthropocentric positions. In Q4, the attitudes of children from urban areas remained the same,
35
36 285 whilst eco-centric positions of rural children weakened in post-test and increased again with the
37
38 286 long-term test. Q13 post-scores of urban children moved more distinctly towards conservation
39
40 287 than those of children from rural schools. The very high initial scores in favour of conservation
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42 288 for Q14 of urban children remained almost unchanged, whilst rural children's scores further
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44 289 increased towards conservationism to reach a similar level with those of urban children.
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51 291 Figure 1 here

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56 293 ***Does participation in an outdoor excursion affect the knowledge and attitudes of children?***

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3 295 The initial knowledge of respondents in the so-called 'Reserve' and 'Class' groups differed
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5 296 significantly before the exposure ($\text{mean}_R=5.8$, $\text{mean}_C=7.3$). The knowledge of both groups
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7 297 increased to a similar level after exposure to the programme ($\text{mean}_R=9.7$, $\text{mean}_C=9.5$) and to
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10 298 $\text{mean}_R=10.4$, $\text{mean}_C=10.5$ one year after exposure.

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12 299 The attitudes of respondents in so called 'Class' and 'Reserve' groups differed significantly
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14 300 before exposure to the programme for half of the questions (Q3, Q6, Q7, Q10, Q11, Q12 and
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16 301 Q14, all $p<0.01$). The short- and long- term effect of programme location (in class or in reserve)
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18 302 on respondents' attitudes was significant in Q3 ($F=3.8$, $p<0.01$), Q6 ($F=3.7$, $p<0.01$) and Q7
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20 303 ($F=5.4$, $p<0.01$). In questions 6 and 7 the Class group weakened its anthropocentric position in
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22 304 both post- and long term tests. In question 3 the Class group weakened its anthropocentric
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24 305 position in the post-test and scored higher again during the long-term evaluation. The Reserve
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26 306 group had similar scores or slightly lowered their anthropocentric positions in post- and long
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28 307 term tests (Figure 2).

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35 309 Figure 2 here
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40 311 ***Do environmental attitudes correlate with specific knowledge related to nature conservation***
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42 312 ***in Senegal?***

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44 313 Higher pre-test knowledge scores were found to correlate with eco-centric, anti-
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46 314 anthropocentric or positive specific conservation pre-test attitudes among respondents in
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48 315 questions 2, 4, 5, 6, 9, 10, 11, 12 and 14 (Table 3).

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51 316 Most of the correlations of attitudes with knowledge that appeared in pre-test did not
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53 317 appear again in post-test. Exceptions were Q5 (Spearman $R=-0.1$; $p<0.05$); Q11 (Spearman
54
55 318 $R=0.12$; $p<0.05$); Q12 (Spearman $R=0.2$; $p<0.05$). In Q13 ('I consider protection of Derby
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57 319 eland in my country very important'), correlation between attitudes and knowledge scores did
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3 320 not appear in pre-test and appeared in post-test (Spearman $R=-0.15$; $p<0.05$). Correlation
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5 321 between knowledge and attitude scores in the long-term test remained in three questions: in
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7 322 Q10 (Spearman $R=-0.2$; $p<0.05$); Q11 (Spearman $R=0.1$; $p<0.05$); and Q12 (Spearman $R=0.2$;
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9 323 $p<0.05$).

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14 325 Table 3 here

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19 327 Children achieving higher knowledge scores in the post-test were more likely (77%
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21 328 probability) to name Western Derby eland within Senegalese wild animals, (odds ratio = 11,
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23 329 $\chi^2_{(1)} = 138$, $p<0.001$).

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332 Discussion

333 We found that children from different socio-economic backgrounds differ in knowledge
334 and attitudes in the pre-test. Children from rural schools and with father with jobs requiring
335 higher education (mostly assigned as working for the state) scored higher on knowledge
336 questions, were inclined to eco-centrism and less anthropocentric, and felt more in favour of
337 nature conservation. Only on Q1 '*Plants and animals have as much right as people to live*', did
338 this group score lower on eco-centrism than rural children and children with a father working
339 in agriculture. Answers to Q1 would seem to be influenced by closer physical contact with
340 nature of rural children and children with farming background, and at the other hand detachment
341 from natural world of urban children. In overall, we conclude that positive attitudes towards
342 environment and its conservation possibly result from level of children's education (higher in
343 urban schools in Senegal) and sociological backgrounds given by their family intellectual
344 environment (Casey and Scott 2000; Dunlap 2000; Jones and Dunlap 1992).

345 No difference was found in the attitudes of different ethnic groups (except for Q3, Q7
346 and Q9 and without any clear recognisable pattern) which could be influenced by multi ethnic
347 settings of the study area. The study was carried out in the richest regions in Senegal (Dakar
348 and Thiès), with high internal immigrant numbers, where all ethnic groups appear together and
349 thus live under comparable conditions. We therefore suggest that ethnic origin is not an
350 influential variable for shaping the knowledge and environmental attitudes of children living in
351 this multi-ethnic environment. We have to highlight that the numbers of children from different
352 ethnic groups in this study were imbalanced (Serers and Wolof being represented by over 85%
353 of respondents), which could have influenced the results.

354 The structure of responses on animals considered as wild and present in Senegal differed
355 between urban and rural children. While children from urban areas tended to incorrectly list
356 non-indigenous species (tiger, wolf), children from rural areas avoided non-indigenous species

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3 357 and included incorrectly domesticated ones such as cow, goat or horse. This difference can be
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5 358 assigned to different exposure to media, such as TV, to which the urban children have better
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8 359 access, whereas rural children spend more time outdoors surrounded by domesticated animals.
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10 360 The specific environmental knowledge of participating children increased after
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12 361 exposure to the programme from 6.4 points to 9.6 points in post-test and to 10.4 points in the
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14 362 long-term test. The increase in specific environmental knowledge in the long-term test in
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16 363 comparison to those of post-test can be assigned to respondents' higher ages and levels of
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18 364 education as well as to their increased interest in wildlife and more proactive search for
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20 365 information.
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23 366 However Senegalese children scored high on eco-centrally oriented questions both in
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25 367 pre- and post-test, they also scored high on anthropocentric questions, which was not usual in
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27 368 previous studies in western nations (Dunlap et al. 2000; Manoli et al. 2007). In western nations,
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29 369 people hold either eco-centric or anthropocentric/utilitarian positions. The so called dualism
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31 370 was challenged in developing nations, where one can hold eco-centric and anthropocentric
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33 371 positions at the same time. This is believed to be due to much more holistic approach to the
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35 372 human-environment relationship of people in developing countries than those in the western
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37 373 world (Corral-Verdugo and Armendariz 2000; Ogunbode 2013; Van Petegem and Blicck
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39 374 2006).
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44 375 The most affected eco-centric question by exposure was Q8 '*People behave badly to the*
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46 376 *environment*' where 5% more children answered positively after the programme. The
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48 377 programme was although found to have a negative effect on children's beliefs in nature having
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50 378 limits, where on Q10 '*If things don't change we will have a big disaster in the environment*
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52 379 *soon*' 3% less children answered yes during post-test phase than in pre-test. Utilitarian positions
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54 380 that children held in all anthropocentric questions Q3, Q6, Q7 and Q9 in pre-test, weakened
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56 381 after exposure to the programme, and spanned slightly to eco-centric positions in Q6 '*Nature is*
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3 382 strong enough to handle the bad effects of our modern lifestyle'. This suggests the 2-day
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5 383 environmental education programmes have a limited potential to further increase already
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7 384 existing eco-centric attitudes, and/but can weaken the anthropocentric/utilitarian positions of
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9 385 the exposed children. The higher effect of environmental education interventions on utilitarian
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11 386 factors rather than on preservation was described by Bogner (2002), and Sellman and Bogner
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13 387 (2013) who argued that this was probably due to the fact the education programme was focused
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15 388 on utilitarian topics, rather than on preservation. As in the present programme both eco-centric
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17 389 and anthropocentric issues were addressed, we assume that anthropocentrically oriented
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19 390 questions were affected because there was simply more room for change (respondents scoring
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21 391 already high in eco-centrism before the intervention). In addition to which, it is possible that
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23 392 some answers that we interpreted as eco-centric rather suggest anthropocentric positions in the
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25 393 minds the respondents (Grůňová et al. 2018; Ogunbode 2013). For instance, a previous study
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27 394 on a comparable sample of children in Senegal showed that Q2 '*There are too many people on*
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29 395 *the planet*' was not regarded as connected with environmental problems, was not seen in
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31 396 negative light and thus positive answer did not display eco-centric attitudes, as it did in western
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33 397 countries (Grůňová et al. 2018).

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40 398 Specific attitudes to conservation of the respondents in the pre-, post and long term tests
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42 399 ranged within pro-conservation positions except for Q11 '*I would prefer an amusement centre*
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44 400 *to be constructed near my village/city over a nature reserve*'. The impact of the two-day
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46 401 education programme on respondents' conservation attitudes was positive except for Q12
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48 402 where 16% of children before the programme and 17 % after the programme thought that
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50 403 '*People from their village should be authorized to hunt in the nature reserve*'. This may result
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52 404 from a misunderstanding coming from the difference in cognitive map of Senegalese children
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54 405 compared to that of the westerners who designed the programme (Chatterjee 2008), and is yet
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56 406 to be explored. It is also possible that children who agreed on hunting in the reserve against to
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3 407 children who did not agree, had already such strongly fixed beliefs that a two-day programme
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5 408 could not change. The number of children who considered protection of the Derby eland
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7 409 important in their country increased from 66% before to 89% after the programme. Considering
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9 410 that almost no respondents were familiar with the Derby eland before the programme, we assign
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11 411 the high rate of positive responses in pre-test to demand bias. Even though we limited the
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13 412 information given to the children prior to pre-test, we could not assure that their teachers did
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15 413 not communicate the purpose of the programme. It is also possible the children simply assumed
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17 414 that the Derby eland, regardless of what it is, is something of particular interest to us once we
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19 415 are asking it in the questionnaire.
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24 416 As of authors' knowledge, no systematic study had been published on effect of one-
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26 417 day outdoor excursion as a tool to foster wildlife conservation, even though the excursion has
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28 418 been widely used for this purpose (e.g. Chipembele 2013; Rakotomamonjy et al. 2014; Bobek
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30 419 2013). It was shown that although the excursion had slightly higher effect on knowledge of
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32 420 participating children, than corresponding indoor programme, there was no effect on their
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34 421 environmental or conservation attitudes. This was previously find in Bogner (2002), Frantz and
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36 422 Mayer (2014) or Sellmann and Bogner (2013) who questioned efficiency of short- term outdoor
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38 423 excursion in influencing environmental attitudes of participants and argued children are more
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40 424 focused in class and education tends to be better structured there. Given that the two groups
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42 425 ended at the similar knowledge scores level, it is also possible that potential of the programme
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44 426 to increase environmental knowledge of the participants was simply reached.
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49 427 We found that the level of specific knowledge about nature and its protection in Senegal
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51 428 correlates positively with eco-centric environmental attitudes as suggested e.g. in Kaiser,
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53 429 Roczen and Bogner (2008) in pre-test questions Q2, Q4, Q5, Q6, Q9, Q10, Q11, Q12, Q13 and
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55 430 Q14. Such a correlation did not appear in most of the questions except of Q5, Q11 and Q12 in
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57 431 post-test and Q10, Q11 and Q12 in long-term test.
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5 433 The percentage of missing responses in the long-term test (34 - 36%) suggests that three tests
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7 434 with the same questionnaire might not be the best practice. There is a possibility for responses
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9 435 to be biased by lack of concentration or motivation to respond. It might have seemed
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11 436 unnecessary to respondents to answer the same questions for the third time and they therefore
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13 437 may have skipped them in the long-term test. Expectations from the programme might not have
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15 438 been fulfilled at the end of the programme.
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21 440 **Conclusion**

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23 441 The research on Senegalese children's attitudes and the potential of educational intervention to
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25 442 affect them shows that a two-day environmental education programme positively increases
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27 443 knowledge, weakens respondent's anthropocentric attitudes and positively moderates already
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29 444 existing pro-conservation attitudes. The one-day excursion was not proven to be more efficient
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31 445 in increasing knowledge scores, enhancing eco-centric and pro-conservation attitudes or
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33 446 weakening anthropocentric attitudes, than a corresponding indoor programme. It therefore
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35 447 seems reasonable in the case of limited financial resources to suggest educating more children
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37 448 in class than to invest in any one-day excursion. Furthermore, it was shown that the higher
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39 449 education of a child's father and attendance at an urban school (regarded as a higher standard
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41 450 in education in Senegal), and a higher specific environmental knowledge score correlated
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43 451 positively with environmental attitudes, which suggests that higher general education plays in
44
45 452 favour of any conservation programme and in the case of abundant financial resources it might
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47 453 be good idea to foster it in areas of conservation programmes.
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3 590 **Tables and figures**
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8 592 **Table 1.** Frequency distributions for the revised 10 question NEP for Children (Manoli et al.,
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10 593 2007) and specific nature conservation attitudes in pre, post and long term tests, frequency
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12 594 displayed as percentages
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16 596 Notes:

18 597 EC indicates eco-centric questions (New Environmental Paradigm), AC indicates anthropocentric questions), SA
19 598 indicates specific conservation attitudes

22 599 SD = strongly disagree, D = disagree, I = indifferent, A = agree, SA = strongly agree
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26 601 * The NEP was calculated as the sum of the positive response frequencies for each item: SA plus A for the
27 602 ecological questions and (1, 2, 4, 5, 8, 10, 13), D plus SD for the anthropocentric questions and (3, 6, 7, 9)

30 603 The sum of positive responses was calculated for positively formulated specific conservation questions (13) and
31 604 negative responses for negatively formulated conservation questions were adjusted to the column NEP (11, 12,
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Question	Test	Score							Missing responses	NEP *
		mean±	SA	A	I	D	SD			
		SE								
1. Plants and animals have as much right as people to live. EC	pre	2.45±0.07	28.7	24.8	22.8	15.5	6.2	2.0	53.5	
	post	2.46±0.07	31.0	21.5	21.1	17.8	6.3	2.3	52.5	
	long	2.10±0.09	27.7	17.5	7.0	10.6	2.0	35.3	45.2	
2. There are too many people on the planet. EC	pre	1.56±0.05	56.8	33.0	5.9	2.0	1.0	1.3	89.8	
	post	1.58±0.05	54.8	35.3	5.9	1.7	1.3	1.0	90.1	
	long	1.53±0.05	41.0	19.5	1.3	2.3	1.3	34.7	60.5	
3. People are clever enough to keep from ruining the Earth. AC	pre	2.20±0.06	28.0	34.0	26.0	5.6	3.3	3.0	8.9	
	post	2.34±0.06	26.4	30.0	25.4	11.6	3.6	3.0	15.2	
	long	2.24±0.08	21.1	19.5	13.9	5.3	4.0	36.3	9.3	
4. People must obey the laws of nature. EC	pre	1.77±0.05	46.2	33.3	10.9	4.3	1.7	3.6	79.5	
	post	1.82±0.06	47.9	31.0	9.6	6.3	2.6	2.6	78.9	
	long	1.51±0.06	42.2	15.6	5.0	1.7	0.7	35.0	57.8	
5. If people pollute nature, there will be negative effects. EC	pre	2.02±0.07	43.2	25.7	13.6	9.6	4.2	3.6	68.9	
	post	2.00±0.07	44.6	24.4	15.8	8.3	4.0	3.0	69.0	
	long	1.83±0.08	33.7	18.2	5.9	4.0	3.0	35.3	51.9	
6. Nature is strong enough to handle the bad effects of our modern lifestyle. AC	pre	2.79±0.07	14.5	24.8	34.7	12.5	10.6	3.0	23.1	
	post	3.01±0.07	10.2	24.0	31.7	19.1	13.2	1.7	32.3	
	long	3.25±0.09	5.6	10.9	21.1	14.2	11.9	36.3	26.1	
7. People are supposed to rule over nature. AC	pre	2.74±0.07	15.2	25.1	33.0	12.5	9.0	5.3	21.5	
	post	2.89±0.07	13.5	2.4	34.3	16.5	11.2	2.0	27.7	
	long	2.85±0.07	11.5	12.9	21.5	10.9	7.6	35.6	18.5	
8. People behave badly to nature. EC	pre	2.37±0.07	30.0	27.4	18.5	15.2	5.3	3.3	57.4	
	post	2.31±0.07	30.4	32.0	14.9	15.2	5.3	2.3	62.4	
	long	2.27±0.08	20.5	24.4	7.6	10.2	3.3	34.0	44.9	
9. People will some day know enough about how nature works to be able to control its effects. AC	pre	2.17±0.06	29.0	37.3	23.8	3.0	5.3	1.7	8.3	
	post	2.43±0.06	19.5	33.3	31.7	7.9	4.6	3.0	12.5	

	long	2.30±0.08	17.5	20.1	20.8	2.6	3.6	35.3	6.2
10. If things don't change, we will have a big disaster in the environment soon. EC	pre	1.68±0.06	56.4	28.0	7.3	3.3	3.6	1.3	84.4
	post	1.80±0.06	52.5	28.7	6.6	5.9	4.6	1.7	81.2
	long	1.65±0.07	38.0	19.5	4.3	1.3	2.6	34.3	57.5
11. I would prefer to have an amusement centre constructed over a nature reserve with wild animals in the proximity of my city/village SA	pre	2.98±0.09	21.5	26.7	7.6	15.8	26.1	2.3	41.9.
	post	3.15±0.09	18.5	24.8	8.9	17.5	29.4	1.0	46.9.
	long	3.22±0.12	15.2	11.9	5.9	8.6	24.1	34.3	32.7.
12. I think that people from my city/village should be authorised to hunt in the natural reserves. SA	pre	3.9±0.07	5.9	9.6	13.2	29.4	40.6	1.3	70.0.
	post	3.85±0.07	8.3	8.6	12.2	30.7	39.3	1.0	70.0.
	long	3.88±0.09	5.3	6.9	7.3	16.5	29.0	35.0	45.5.
13. I consider protection of the Derby eland in my country very important. SA	pre	2.1±0.06	31.7	34.7	24.4	3.6	3.3	2.3	66.4.
	post	1.62±0.05	53.5	35.0	7.3	1.3	2.0	1.0	88.5.
	long	1.6±0.06	37.3	19.8	3.6	2.6	1.0	35.6	57.1.
14. Only rich countries should protect the environment. SA	pre	3.86±0.07	9.6	6.0	11.6	33.3	38.6	1.0	71.9.
	post	4.07±0.06	4.3	6.6	8.3	38.6	40.9	1.3	79.5.
	long	4.35±0.07	2.6	2.3	3.6	17.8	38.0	35.3	55.8.

606 **Table 2.** Mean and median number of wild, domesticated and alien animals named on request
 607 “Write names of 10 wild animals living in Senegal” in pre-test. Urban= children from urban
 608 schools, rural= children from rural schools.

	URBAN (N=152)		RURAL (N=143)	
	mean	median	mean	median
WILD	4.7	5	3.3	3
DOMESTICATED	1.0	0	1.6	1
ALIEN	0.8	1	0.4	0

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3 611 **Table 3.** Spearman rank correlation between pre-test knowledge and attitude questions. Lower
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5 612 scores in eco-centrally and positively oriented conservation attitude questions indicated eco-
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7 613 centrism, therefore the negative Spearman R indicates positive correlation of eco-centrism and
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9 614 positive conservation attitudes with higher knowledge scores.
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Question	Spearman R	p-value
1. <i>Plants and animals have as much right as people to live</i>	0.047	0.45
2. There are too many people on the planet	-0.12	0.05
3. People are clever enough to keep from ruining the Earth	0.8	0.19
4. People must obey the laws of nature	-0.11	0.65
5. If people pollute nature, there will be negative effects	-0.29	<0.05
6. Nature is strong enough to handle the bad effects of our modern lifestyle.	0.31	<0.05
7. People are supposed to rule over nature	0.11	0.090
8. People behave badly to nature	-0.85	0.17
9. People will someday know enough about how nature works to be able to control its effects	0.16	<0.05
10. If things don't change, we will have a big disaster in the environment soon	-0.2	<0.05
11. I would prefer to have an amusement centre constructed over a nature reserve with wild animals in the proximity of my city/village	0.3	<0.05

12. I think that people from my city/village should be authorised to hunt in the natural reserves	0.17	<0.05
13. I think protection of the Derby eland in my country to be very important	-0.2;	0.7
14. Only rich countries should protect the environment	0.31	<0.05

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For Peer Review Only

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3 618 **Figure 1.** Difference in effect of the programme on urban and rural children in Q1, Q4, Q13
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5 619 and Q14 ($p<0.05$). Scores are compared in pre-, post- and long-term test.
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10 621 **Figure 2.** Effect of the two types of programme on participating children in Q3, Q6, Q7
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12 622 ($p<0.05$). Class group participated the programme in school classroom the second day of
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14 623 exposure. Reserve group was exposed to the same programme, but in the natural reserve. Scores
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16 624 are compared from pre-, post- and long-term test.
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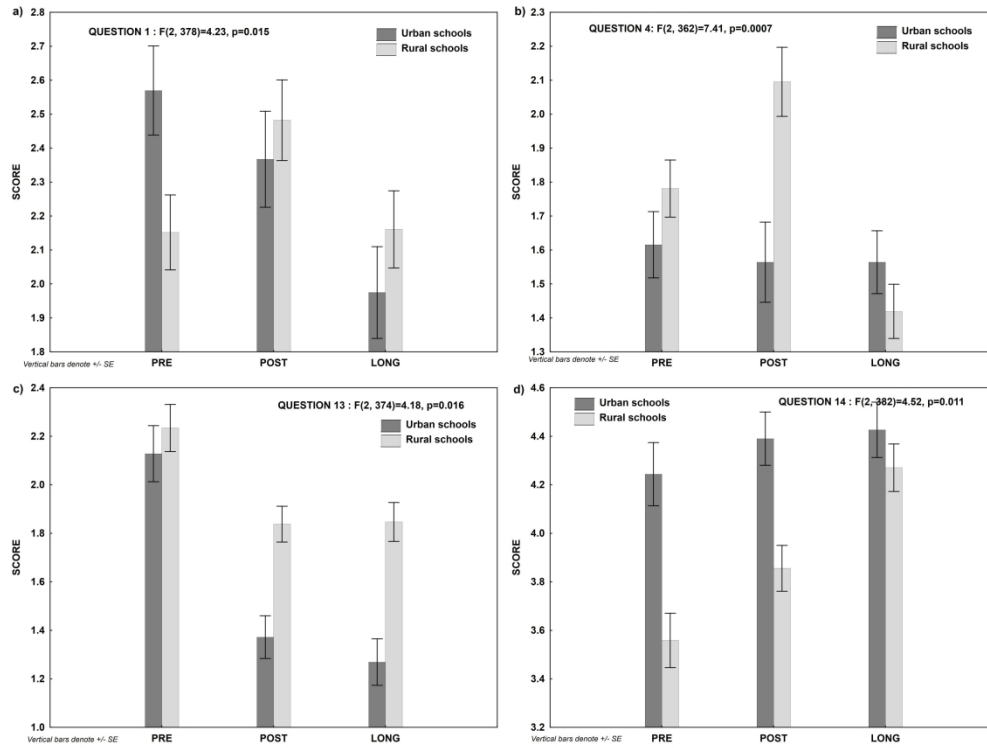


Figure 1. Difference in effect of the programme on urban and rural children in Q1, Q4, Q13 and Q14 (p<0.05). Scores are compared in pre-, post- and long-term test.

1031x773mm (96 x 96 DPI)

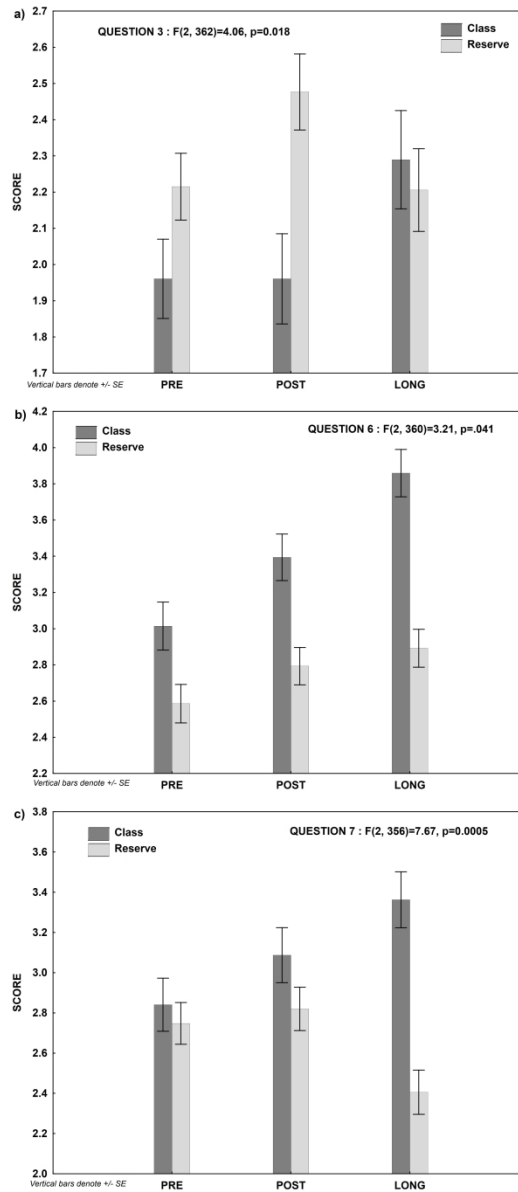


Figure 2. Effect of the two types of programme on participating children in Q3, Q6, Q7 ($p < 0.05$). Class group participated the programme in school classroom the second day of exposure. Reserve group was exposed to the same programme, but in the natural reserve. Scores are compared from pre-, post- and long-term test.

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