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Conservation Education Using Elephant Cognition

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Abstract. We evaluated whether the inclusion of elephant cognition in an education program resulted in changes in attitudes towards elephants and elephant conservation and the effect of rurality, gender, and age on attitudinal change. The study group was comprised of villagers living in and around Bannerghatta National Park. We found that adolescents had more favourable attitudes towards Asian elephants than adults, and participants in urban areas had more favourable attitudes than those in rural areas. No gender differences were observed. Overall, using elephant cognition as an educational tool did not result in more favourable attitudes towards elephants and elephant conservation.

Introduction

Human-elephant conflict (HEC) is on the rise due to habitat loss and a multitude of factors (Pandey *et al*. 2024). Community education plays a vital role in mitigating HEC, with numerous studies reporting positive changes in attitudes towards conservation after implementation of education programs (Hungerford & Volk 1990; Kwamboka 2013; Burnett *et al*. 2015). However, it is important to investigate the types of educational content that result in effective attitude change. The public is fascinated with animal minds (cognition), which can be a useful educational tool (e.g. Bielick & Karns 1998; Helton & Helton 2005; Harley *et al*. 2010; Bowler *et al*. 2012; Maust-Mohl *et al*. 2012; Carey 2018; Barrett *et al*. 2019; Callahan *et al*. 2021; Davis *et al*. 2023). However, Makecha *et al*. (2021), on assessing adult male villagers' attitudes in a high HEC landscape, Bannerghatta National Park (BNP) in Karnataka, India, found that including elephant cognition in an education program did not produce significant differences in attitudes towards elephants and their conservation.

Different types of cognitive information may vary in effectiveness regarding attitude change. For example, Davis *et al*. (2023) found that college students rated different species as more interesting, intelligent, and emotionally complex when given different types of cognitive information about them. This effect was strongest after receiving information about the species' emotional abilities, especially when these abilities were highlighted positively (e.g mourning dead conspecifics) versus negatively (engaging in emotionally hurtful behaviour towards conspecifics). Menor-Campos *et al*. (2018) reported similar results in Spanish primary school children, where positive attitudes towards animals were related to animals' ability to feel emotions.

Factors such as gender, age, and rurality may influence the outcome of educational programs. Makecha *et al*. (2021) only focused on adult male villagers due to their role as the primary decision maker in the family. However, Bandara & Tisdell (2003) reported that rural women in Sri Lanka expressed more negative attitudes towards elephants than men, due to elephants' "destructive" nature (e.g. loss of family members to elephant attacks, loss of income), resulting in the disruption of family life and mental well-being. Mabeluanga *et al*. (2016) also found that women in BNP have more negative opinions towards elephants than men, potentially due to their role as the primary caretaker of the family, and thus being more sensitive to income loss due to HEC. However, such effects are likely to be area/community

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specific, as other studies have reported no gender differences (Kideghesho *et al*. 2007; van de Water & Matteson 2018) or, in one case, women reported more favourable attitudes towards elephants (Nath *et al*. 2015).

Also, people who depend on agriculture are the most affected by HEC (Bandara & Tisdell 2003; van de Water & Matteson 2018; Sampson *et al*. 2021) and the study from Makecha *et al*. (2021) was limited to individuals from rural areas whose primary source of income was agriculture. Bandara & Tisdell (2003) reported that in Sri Lanka, urban populations had more positive attitudes toward elephant conservation and rural populations had more mixed attitudes. Additionally, van de Water & Matteson (2018) reported that individuals who rely primarily on agriculture are less likely to support elephant conservation.

Finally, younger individuals may have more malleable attitudes towards wildlife and may also have experienced less human and wildlife conflict than older individuals. However, current findings on age are mixed. For example, no differences in attitude towards tigers and elephants were found between different age groups in Western Ghats, India (Kanagavel *et al*. 2014). Heinen & Shrivastava (2009) found similar results in communities surrounding Kaziranga National Park, India for large mammals (e.g. tigers, rhinoceroses, elephants). In contrast, Arjunan *et al*. (2006) found that younger individuals living near Kalakkad Mundanthurai Tiger Reserve, India were more likely to show strong support for conservation in general.

Given the above, the current study assessed whether an elephant education program centred on elephant cognition, including elephant emotions, resulted in more positive attitudes towards elephants/elephant conservation, and whether gender, rurality, and age of participants influenced attitudinal change.

Materials and methods

Study area and participants

BNP is a fragmented but important elephant habitat with a dense human population (~107,000 individuals) in the area surrounding the national park (~260 km^2), along with three elephant corridors for wild Asian elephants (*Elephas maximus*) (Ramkumar *et al*. 2017). Participants in the study consisted of 122 adults (above 18 years) and 118 adolescents aged 12–14 years, of which 138 (57.7%) were males and 101 (42.3%) females. One participant was not used for the gender analysis because the gender was not recorded. Participants were also sampled from rural, semi-rural, and urban areas (Table 1). The participants were assigned to one of three elephant education programs or a control group receiving a non-related education program (see below).

Education programs

Two of the education programs included elephant cognition, with one focusing on elephant problem-solving and cooperation and the other focusing on elephant emotions (hereafter referred to as the 'cognition - problem solving/cooperation' program and the 'cognition - emotion' program, respectively). The third elephant education program did not incorporate any information on elephant cognition (hereafter referred to as the 'non-cognition program').

All three programs included information on the physical features of elephants, what elephants eat, where elephants can be found in India,

Table 1. Area definitions and participant information by area.

Area	Definition	N	Adults	Adolescents
Rural	Villages in the southern and eastern parts of BNP (furthest away from urban areas)	79	40	39
Semi-rural	Villages in the northern and western part of BNP (close to urban areas)	80	41	39
Urban	Villages located less than 5 km from BNP's boundary	81	41	40

Karnataka, and BNP, their approximate population size, their social structure, and why elephants are important for the ecosystem. The non-cognition program placed extra emphasis on elephant social structure and included a video of an elephant family (adult females, subadults, juveniles, and calves) and another video of a solitary adult male. Participants in this program also took part in an activity where they labelled a photograph of an elephant herd with different age classes.

The cognition problem-solving/cooperation program contained additional information on how elephants are like us, such as how they protect their young, play, etc. Participants engaged in a brief activity where they had to solve a cooperation task (modified from Plotnik *et al*. 2011). After solving this task, they were asked if they thought elephants could solve this task and then shown a brief video of elephants solving the task (BBC Earth 2017) from the Plotnik *et al*. (2011) study. The information on how elephants are like us, as well as the activity and video on cooperation/problem-solving, comprised the cognitive component of this program.

The cognition-emotion program talked about how elephants are like us as well as the emotional complexity of elephants. This was achieved by displaying two different photos and asking participants to describe what they thought was happening in the photos (the activity portion of the program). In the first photo, a calf that was struggling was supported by its mother. In the second photo, a mother elephant was shown carrying the body of her dead calf. The participants were informed that she carried the body for two days, only setting it down to eat. After discussing the photos with the participants, they were told that elephants have been reported to approach dying companions and touch them, both before and after death, including helping their dying companions and guarding the dead bodies (Douglas-Hamilton *et al*. 2006; Goldenberg & Wittemyer 2020). Two videos were also shown in the cognition-emotion program, one where a mother elephant was trying to wake up her dead calf, and the other where elephants were helping a calf cross a river.

The fourth program was for the control group and focused on BNP and its characteristics (landscape, wildlife, zoological park, etc.) and included an activity as well as a video. The programs and the included videos in all four programs were equal in length (~5–10 minutes, depending on the number of participant comments throughout the presentation).

Procedure

Data collection took place from May to June 2023 to avoid the high HEC season in BNP. Data was collected with the aid of two local translators who spoke Kannada, the local language. Participants in each area (rural, semi-rural, urban) were approached opportunistically and asked if they were willing to participate in a brief educational presentation and survey (both in Kannada). Educational presentations were displayed using Microsoft PowerPoint. All participants were told that their participation was voluntary and that they could withdraw at any point.

After the educational presentations, participants were surveyed on their attitudes towards both elephants and elephant conservation using two 9-item scales: Attitudes Toward Elephants Scale (AE) and Attitudes Towards Elephant Conservation Scale (AEC) (see Makecha *et al*. 2021). Internal consistency was $\alpha = 0.67$ ($\alpha = 0.70$ for adults, $\alpha = 0.63$ for adolescents) for the AE scale while internal consistency of the AEC Scale was $\alpha = 0.49$ ($\alpha = 0.61$ for adults, $\alpha = 0.32$ for adolescents). The internal consistency of the AEC Scale was limited, especially for the adolescent sample, and the results of this scale were interpreted with caution.

Both the AE and AEC scales were orally administered by the translators. Answers were recorded on a 4-point Likert scale (Yes, Maybe Yes, Maybe No, No). Demographic information (date, time, weather, gender, village/town/city, GPS location, perceived level of conflict, age, primary source of income, and level of income) was also recorded. Although there were two translators who interacted with participants in the study, the multivariate test indicated that the translators did not affect participants' attitudes toward elephant conservation and attitudes to-

ward elephants, Wilks' lambda = 0.989, $F_{(2,234)}$ = 1.34, p = 0.264.

Analyses

The data analyses were conducted using jamovi (Version 2.5). A series of four multivariate analyses of variance (MANOVAs) were conducted with the two attitude scales as dependent variables. To test the first research question, we tested program type (cognition emotion, cognition problem-solving/cooperation, non-cognition, control) as an independent variable. To test the second set of research questions, we tested gender (males and females), rurality of the area of residence (rural, semi-rural, and urban areas), and age group (adolescents and adults) as independent variables in separate MANOVAs.

Results

Program types

The multivariate test did not support the effect of intervention types on the attitudes toward elephant conservation and toward elephants (Wilks' lambda = 0.989, $F_{(6, 464)}$ = 0.447, p = 0.847). Thus, participants in the cognition problem-solving/cooperation program, cognition emotion program, non-cognition program, and control group did not differ significantly in their attitudes after program completion (Table 2).

Gender

The multivariate test indicated that participant gender did not affect their attitudes toward elephant conservation and elephants (Wilks' lambda = 0.978, $F_{(2,233)}$ = 2.61, p = 0.076).

Rurality of area of residence

A multivariate test indicated that participants' areas of residence influenced their attitudes toward elephant conservation and elephants (Wilks' lambda = 0.849, $F_{(4,466)}$ = 9.91 p < 0.001). Univariate tests (Welch's test for unequal variances) showed that participants in rural, semi-rural, and urban areas varied in their attitudes toward elephant conservation ($F_{(2,154)}$ = 4.32, p = 0.015) as well as their attitudes toward elephants ($F_{(2, 156)}$ = 20.60, p < 0.001). The Games-Howel post-hoc test (for unequal variances) indicated that the participants in urban areas reported significantly more favourable attitudes toward elephant conservation than those in rural areas ($t_{(142)}$ = -2.86, p = .013). Participants in urban areas were more favourable toward elephants than those in semi-rural ($t_{(158)}$ = -4.88, p < 0.001) and rural areas ($t_{(154)}$ = -6.02, p < 0.001).

Age

A multivariate test indicated that adults and adolescents differed in their attitudes toward elephant conservation and elephants (Wilks' lambda = 0.974, $F_{(2,234)}$ = 3.09, p = 0.048). Univariate tests (Welch's test for unequal variances) showed that adults and adolescents varied in their attitudes toward elephants ($F_{(1,235)}$ = 5.96, p = 0.015) but not in their attitudes toward elephant conservation ($F_{(1, 224)}$ = 3.15, p = 0.077). Specifically, adolescents reported more favour-

Table 2. Means and standard deviations (SD) of the four different educational groups' attitudes on the AE and AEC scales.

Attitudes	Program type	N	Mean	SD
Toward elephant conservation	Control	60	3.06	0.553
	Cognition emotion	60	3.09	0.532
	Cognition problem-solving/cooperation	58	3.17	0.368
	Non-cognition	61	3.03	0.566
Toward elephants	Control	59	2.72	0.580
	Cognition emotion	60	2.74	0.595
	Cognition problem-solving/cooperation	59	2.75	0.621
	Non-cognition	60	2.74	0.664

able attitudes toward elephants (M = 2.83) than adults (M = 2.64).

Discussion

Although information on animal cognition can have positive results when used in conservation education programs), we did not find a difference in attitudes towards elephants and elephant conservation between the different education programs. Our results are similar to Makecha *et al*.'s (2021) study in the same area, which used only adult males as respondents. The absence of attitudinal change in both studies may be because participants already had knowledge of elephant cognition, especially those in high HEC areas. For example, elephants often find new ways around barriers, such as electric fences, where they use their tusks or trees to bring down fences without shocking themselves (Sukumar 2003; Choudhury 2004; Barrett *et al*. 2019). Additionally, elephants can become desensitised to the scaring and chasing methods farmers use to deter elephants, resulting in continued crop-raiding (Bandara & Tisdell 2003). Individual elephants may be considered "more bold" by people and labelled as "troublemakers" (Mumby & Plotnik 2018; Barrett *et al*. 2019). Therefore, people in high HEC areas may consider elephants as cognitively complex and flexible and, as a result, more dangerous, which may result in a negative view of elephants and elephant conservation. For example, older adults living around Way Kambas National Park in Sumatra viewed elephants as smart, acknowledging that they can think and feel like humans, but also associated this intelligence with their ability to cross barriers set up to prevent raiding. Therefore, knowledge of the elephant 'mind' does not necessarily promote willingness to coexist with elephants, especially in older, more experienced populations. In contrast, studies that have reported positive outcomes when using animal cognition for outreach were conducted with Western audiences and species (e.g. primates, dolphins) that did not pose any conflict risk to these particular audiences (Bielick & Karns 1998; Helton & Helton 2005; Harley *et al*. 2010; Bowler *et al*. 2012; Maust-Mohl *et al*. 2012; Barrett *et al*. 2019; Davis *et al*. 2023).

One possible limitation of our study and Makecha *et al*. (2021), could be the comparatively brief duration of the education programs, which may have led to the lack of attitudinal change. Education programs may be more successful in changing attitudes the lengthier and more interactive they are (Sponarksi *et al*. 2016, 2019). For example, in a nine-week recreational program measuring children's belief in the animal mind, eight socio-economically challenged children participated in activities involving horses and other farm animals. All except one child reported greater awareness of animal minds and emotions, with one child reporting, "Now I think all animals have feelings and thoughts of their own (Tardiff-Williams & Roma 2022). Most studies reporting positive outcomes from the use of animal cognition content were either focused on visitors at an exhibit or had educational programs incorporating cognition over longer periods of time. Visitors were also found to spend more time at exhibits when they had the opportunity to observe the animals at the exhibit engage directly in cognitive research and learn about it (brown capuchin and squirrel monkeys (Bowler *et al*. 2012); bottlenose dolphins (Harley *et al*. 2010)).

In our study, adults did not view elephants as favourably as adolescents, possibly due to adolescents having less experience with conflict at their younger age. Adults in Ardiantiono *et al*.'s (2021) study also were less likely to view elephants as important and pleasant, a finding also reported by van de Water & Matteson (2018) in villages near the Salakpra Wildlife Sanctuary in western Thailand. Therefore, it may be better to focus on the younger generation when developing educational programs, who also tend to be more enthusiastic.

When looking at rurality in our study, participants in urban areas reported significantly more favourable attitudes toward elephant conservation than those from rural areas and significantly more favourable attitudes toward elephants than those in semi-rural and rural areas. Those living in rural areas, especially farmers, experience wildlife conflict, while urban residents typically do not and are therefore more likely to support conservation efforts (Bandara

& Tisdell 2003). Bandara & Tisdell (2003) reported that in Sri Lanka, 94% of rural participants in their study supported the statement: "The current wild elephant population in Sri Lanka is between 3,000 and 5,000 animals. It does not matter if this number is reduced by 50% to provide more land for agriculture and human settlement" but in contrast, 94% of urban participants did not support the statement. Similarly, they found 81% of urban participants did not support the statement "Local farmers in the vicinity of nature reserves should be allowed a greater freedom to control 'problem elephants' which cause crop and property damage", while 79% of rural participants supported it. Sampson *et al*. (2022) reported that in Myanmar, both urban and rural residents held positive views of elephants, but that rural communities were less likely to think that coexistence between humans and elephants was possible and they were more likely to view elephants as pests. We found that semi-rural and rural participants did not significantly differ in their attitudes towards elephants although the level of conflict experienced by semi-rural participants may have been less. This points to the role that other factors, such as intensity of conflict and/or proximity to rural areas, and word of mouth, may also play in influencing attitudes towards elephants. Overall, our findings are consistent with that of previous studies assessing the effects of rurality on people's attitudes to conservation and elephants.

When examining gender differences, we did not find any significant differences in attitudes towards elephants and elephant conservation, demonstrating that men and women in and around BNP did not differ in their views towards elephants. However, Mabeluanga (2016) reported that women held more negative views towards elephants in BNP than men, while Venkataramana *et al*. (2015) found that men in BNP expressed more fear of elephants than women, most likely due to the potential of experiencing direct conflict with them. They also found that the majority of women did not support conserving elephants, possibly due to the severity of potential indirect effects from conflict (Venkataramana *et al*. 2015). Differences in the findings between our study and the others could be due to changes in attitudes over time, as our study was conducted eight years later and over the past decade, both genders may have come to share similar levels of negativity towards elephants. However, the causation of negativity is likely to differ between the sexes, as men experience more direct conflict, and women experience more indirect effects such as the loss of the breadwinner of the family. These views are also reflected by Venkataramana *et al*. (2015).

Conclusions and future directions

Although the education programs in ours and Makecha *et al*.'s (2021) study did not result in significant differences in attitudes towards elephants and elephant conservation, information on the elephant mind may be a useful educational tool in different contexts. Thekaekara *et al*. (2021) reported that certain indigenous communities in South India view the elephant as "other-than-human persons". This view characterises elephants as having personhood, personality, agency, and moral values akin to human values, a view that can be especially useful for promoting and accepting coexistence. However, given the complexity involved in promoting coexistence, the efficacy of varying educational programs will differ, depending on the community and species being targeted. Therefore, affecting attitudinal change requires a tailored approach to designing studies, taking into consideration the specific attributes of the target community and its relationship with the species concerned.

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