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"Thank you, Marojejy:" affective learning outcomes of student participants in place-based field trips to Marojejy National Park

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ABSTRACT

Evaluations of conservation education programmes are most often concerned within the cognitive domain, where logical learning takes place. In place-based education, emphasis is instead placed on learning in multiple domains, including the cognitive and affective domains. Here, we quantitatively and qualitatively evaluate student learning in the affective domain following a series of short educational trips to Marojejy National Park, Northeast Madagascar. Student responses to the prompt "write about your trip to Marojejy" were evaluated for content, including emotional responses using cultural consensus, saliency scoring, and qualitative evaluation. The most salient term used in responses were "a good trip". when tested 1.5 to 2 weeks after their trip. Students wrote about the emotional impact of the trip in four out of five levels of the affective domain. Our findings highlight the value of place-based education for learning in the affective domain. We demonstrated that even over a brief period of three days, place-based conservation education can have a marked impact on the values and emotions of participants.

RÉSUMÉ

Les évaluations de programmes d'éducation en matière de préservation sont le plus souvent axées sur le domaine cognitif, là où s'effectue l'apprentissage logique. Dans l'éducation effectuée sur place, l'accent est au contraire mis sur un apprentissage multidisciplinaire, qui inclut à la fois les domaines cognitifs et affectifs. Ici, nous évaluons de façon quantitative et qualitative l'apprentissage des étudiants dans le domaine affectif en suivant une série de brèves excursions à but éducatif au Parc national de Marojejy, dans le Nord-Est de Madagascar. Les réponses des étudiants à l'instruction « Parlez-nous de votre excursion à Marojejy » ont fait l'objet d'une évaluation tenant également compte des aspects émotionnels, sur la base du consensus culturel, du score de saillance et du point de vue qualitatif. L'expression la plus saillante utilisée dans les réponses a été « bonne excursion » dans les tests effectués 1,5 à 2 semaines après leur retour. Les étudiants ont relaté l'impact émotionnel de l'excursion dans quatre des cinq niveaux du domaine affectif. Nos résultats mettent en évidence la valeur d'une éducation sur place pour un apprentissage au niveau affectif. Nous avons démontré que même après une brève période de trois jours, l'éducation en matière de préservation peut avoir, lorsqu'elle est effectuée sur place, un impact significatif sur les valeurs et les émotions des participants.

INTRODUCTION

Educational trips to national parks are built on a pedagogy of place-based education. Place-based education focuses on the interactions of learners with a particular place, including their cognitive, emotional or affective, and physical or psychomotor interactions (Sobel 2004, Semken and Freeman 2008). It considers a learner's past experiences and present way of being in a place as indivisible from the learning process, making it particularly applicable to places like Madagascar, where spiritual values and cultural knowledge such as taboos, or fady as they are known in Madagascar, are a significant force for understanding one's place in the world (Schachenmann 2006, Jones et al. 2008). Place-based education aims to form a bond between learner and place and in the case of place-based conservation education, aims to encourage environmental protection through the formation of this bond (Smith 2002, Semken and Freeman 2008).

The affective domain is concerned with learners' feelings, emotions, and values, and is termed the 'gateway to the learning process' (Eiss and Harbeck 1969 pp 9–17, Iozzi 1989, Savickiene 2010). Learning in the affective domain is structured into a taxonomy of five levels. The pyramidal structure of this taxonomy suggests that learning at one level must be achieved before the learner can progress to the next. The levels—receiving, responding, valuing, organisation, and internalisation—move from recognising new values, to incorporating those values into one's existing moral structure, and finally to shaping one's behaviour in response to those values (Eiss & Harbeck 1969 pp 9–17, Savickiene 2010).

While place-based educational pedagogy asserts that learning in the affective domain is critical to achieve educational outcomes,

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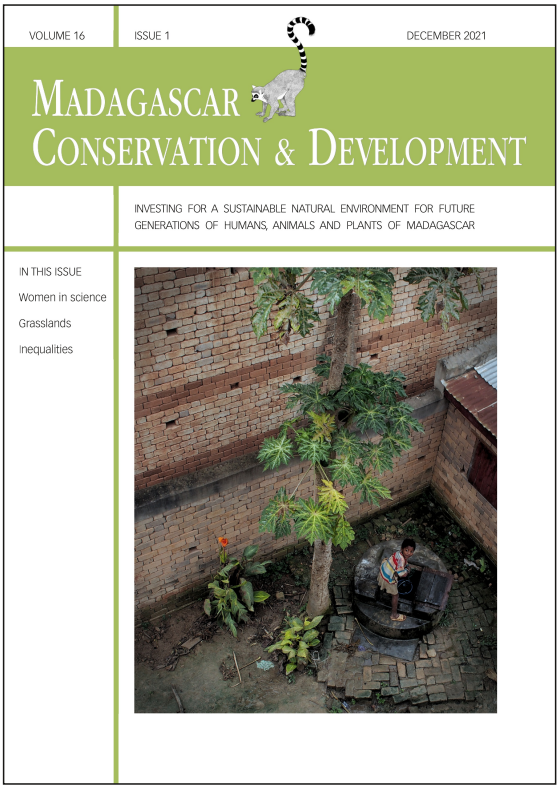

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many conservation education programs assume that knowledge rather than emotion is the entryway into pro-conservation behaviour change (Sobel 2004). As a result, many programs do not assess learners' affective response independent of their cognitive response (Wright et al. 2017). Given that achievement in the affective domain is theorised to promote behavioural changes in line with internalised values, it follows that a goal of conservation education, which aims to induce change towards pro-conservation behaviour, should be impactful learning in the affective domain. Many conservation education programs state affective engagement as a goal (Kals et al. 1999, Reis and Roth 2009, Jacobs and Harms 2014, Powell and Bullock 2014); however, evaluation of these programs primarily assesses learning in the cognitive domain (Kuhar et al. 2010, 2012, Nekaris 2018).

In many wild places throughout the Madagascar, organisations offer learners the opportunity to engage with the biodiversity of the island nation through trips to the forest; however, evaluations of the learning outcomes of these trips are limited. Ormsby (2008), details a participatory action research methodology for developing an education program in Masoala National Park. Patel et al. (2005) describe a preliminary framework for an education programme that would eventually become the initiative detailed here. Reibelt et al. (2014) present a detailed analysis of the state of environmental education in the Lac Aloatra region. While these frameworks and analyses are essential for developing sustainable and scalable conservation programmes throughout the country, evaluations of their efficacy, as represented in this paper, are also necessary for determining which aspects of an education programme work in practice and the results they produce.

As a result of the conservation pressures in Madagascar, including significant threats to largely endemic, highly diverse species and environments (Myers et al. 2000, Ganzhorn et al. 2001), education is increasingly identified as an important component of a nation-wide conservation strategy (Schwitzer et al. 2013). Ninety percent of Malagasy people do not live near a forest. According to Ratsimbazafy (2003), most Malagasy students knew more about lions, giraffes, and polar bears than they do their own endemic species. Conservation education aimed at introducing Malagasy people to the nature that surrounds them may be an effective means of promoting conservation (Dolins et al. 2010).

Here, we provide analyses of students' affective responses independent of their cognitive responses to a place-based education program in Northeast Madagascar designed to foster pro-conservation knowledge and attitudes and instill students with wonder about the natural world. We hypothesised that students who had learning experiences stimulating the affective domain, they would likely write about these in response to the open-ended prompt; "write about your trip to Marojejy National Park" and that analysis of these responses would reveal learning at various levels of the five domains of affective learning.

METHODS

STUDY SITE. The "Marojejy protected area complex", is one of the largest and least disturbed rainforest landscapes in Madagascar. Marojejy (E049°42', S14°27') is 60,050 hectares and is located in the SAVA (Sambava - Antalaha - Vohémar - Andapa) region of Northeast Madagascar around the Marojejy Massif, one of the tallest mountain ranges in Madagascar. Marojejy was among the first protected areas in Madagascar, established in 1952 as a strict nature reserve or Réserve Naturelle Intégrale (RNI) N. 12, in 1998 as a National Park, and listed in 2007 as part of the UNESCO World Heritage Site "Rainforest of the Atsinanana" (Garreau and Manantsara 2003, Goodman et al. 2018 pp 701–715, Rainforests of the Atsinanana https://whc.unesco.org/en/list/1257). Tsimihety and Betsimisaraka are the predominant ethnicities of local residents around the park who first began to arrive in the late 19th Century (Loudon et al. 2017). Due to its unique elevational range (75–2132m), Marojejy harbors enormous botanical diversity including 1302 plant species of which 84 are only found in Marojejy. Fauna are equally remarkable with 84 reptile species, the highest of any protected area in Madagascar. Also present are 119 bird species, 74 amphibian species, 21 species of tenrecs, and 11 lemur species including the Critically Endangered silky sifaka (*Propithecus candidus*) (Goodman et al. 2018 pp 701–715). As the only National Park in the SAVA region, Marojejy is a major tourist destination and provides livelihoods for up to one hundred local guides, porters, and cooks. Documented conservation challenges in the last two decades include selective logging for rosewood, ebony and other native hardwoods, swidden or slash-and-burn agriculture, bushmeat hunting, and movement of the park demarcation signs or "bournes" (Patel 2007, Loudon et al. 2017).

PARTICIPANTS. Between 2016 and 2019, The nonprofit Lemur Conservation Foundation, henceforth LCF, took Malagasy students on three-day, two-night forest trips. to protected areas in Northeast Madagascar, including Marojejy National Park. LCF is a conservation NGO based in the USA and Madagascar. In Madagascar, LCF supports conservation research, family planning, sustainable agriculture, reforestation and LCF's forest education program. During this time, sixty students in primary and secondary schools in the city of Sambava participated in forest trips to Marojejy between May 2019 and July 2019. Sambava (E050° 10', S14° 16'), an urban centre in Madagascar, is located approximately 50 km east of Marojejy National Park in the SAVA region of Northeast Madagascar.

The collaborating schools—Lycée Mixte Sambava, Lycée Privé Orchidée, and Collège d'Enseignement Général—were chosen due to their pre-existing relationships with LCF. Students from Lycée Mixte Sambava and Lycée Privé Orchidée ranged in age from 15 to 22 and students from Collège d'Enseignement Général ranged from 13 to 17. Students were members of the environmental clubs at their respective schools. The focus of these clubs was to learn about and help take care of the environment. Many participated in environmental celebrations, such as World Environment Day, and activities such as beach clean-ups and plantings around their school and Sambava. Club members were chosen to go to Marojejy based on their marks and their never having been to the Park before, although due to the small size of some of the clubs and the prominence of Marojejy in the SAVA region, some students had already been to the Park. They were accompanied by two experienced guides employed by Marojejy National Park and LCF and engaged in various lessons in rainforest ecology, animal behaviour, and conservation, as well as creative endeavours and focused discussions over the course of the three-day trips. During trips, students, slept, ate, learned, and played outside. For many, it was their first-time camping!

EDUCATIONAL CURRICULUM. Participants learned about the forest through educational and exploratory trail hikes. Guides led students through the Park, stopping at interesting plants, ani-

mals, fungi, and landscapes to explain their ecology, behaviour, appearance, or significance. After their initial introduction, students were actively encouraged to explore the forest themselves by finding and asking questions about the things that interested them rather than being told what to learn about by the guides. This method gave students agency over their own learning process and allowed them to bring their own knowledge, experiences, and circumstances to their learning and exploration (Smith 2002, Sobel 2004). In an effort to foster active participation, we asked students to collect small samples of plants, fungi, or fruit that they found interesting during our hikes. Then, during a discussion at camp, students explained why they picked the plant while guides gave more information about it, effectively engaging the three domains of cognitive (The guides taught me…), affective (I like this because…), and motor (I gathered this…).

During free time, we gave students the option to engage in creative learning activities, such as making drawings based on species in the Park, making and decorating lemur masks, and making and decorating puppets. During the evenings, students sang songs, reflected on the events of the day, and participated in guide-led discussions on the history of the Park and the importance of its conservation. We offered a variety of different activities to appeal to different learning styles and intelligences that groups of students may possess. For example, singing songs appeals to musical intelligence, while group discussions employ interpersonal experiences, self-reflections appeal to intrapersonal intelligence, and drawing activities use bodily-kinaesthetic intelligence. By appealing to multiple learning styles and intelligences (Gardner 1983), we aimed to engage all students in the learning process. By presenting information in a variety of formats, we also aimed to facilitate multiple revisions of information, which adds in the learning process (Jacobson et al. 2006).

STUDENT EVALUATIONS. Students' knowledge and awareness of Marojejy were evaluated before and after their trip. Here, we only include post-trip evaluations as students could not reflect on the things they felt during the trip to Marojejy prior to visiting. For full list of questions asked, please see Supplementary Material. In order to assess students' affective engagement as a result of the trips, participants were asked to respond to the prompt "write about your trip to Marojejy" during an evaluation given 1.5–2 weeks following their trip. Students were given 1.5 hours to respond to this question as well as other questions given during their post-trip evaluation. Writing in their preference of French or Malagasy, they could answer with as much or as little information as they liked in their open-ended response. They were not permitted to share ideas with each other or to look at pictures or notes on their phones or in their notebooks. The authors conducting the evaluations stressed to students that they were interested in knowing what students thought about the trip and that they should not try to simply please the researchers with their answers; however, the possibility that students wrote positive answers for the researchers cannot be overlooked. Evaluations were conducted in classrooms in students' respective schools in Sambava. We translated all written responses from Malagasy or French to English.

QUANTITATIVE ANALYSES. To quantitatively assess the responses of students to their trips, we used cultural consensus analysis and saliency analysis. Cultural consensus is a method for measuring the collective awareness and feelings of a group (Weller 2007). The free lists in the form of essays that students created in response to the question, "write about your trip to Marojejy" were used to evaluate the collective knowledge of the group of students regarding their trip. While not expressly asking about their feelings about the trip, the prompt assumed that if emotions and attitudes were a salient feature of their trip, they would be mentioned in response to a general question about the trip. We loaded matrices of students' responses into UCINET version 6.682 and analyzed them using minimum residual factor analysis. We compared the eigenvalues of the first two factor groupings. A three-to-one ratio of the first to second eigenvalues indicated cultural consensus within the group, meaning the group reached agreement that the domain can be represented by students' responses within the first factor grouping (Weller 2007).

In addition to cultural consensus, we used Smith's S saliency to quantitatively measure the importance and familiarity of the ideas represented in students' responses (Smith 1993, Nekaris 2018). Ideas that are mentioned more frequently and earlier in their writing are said to be more salient among the study group. In addition to cultural consensus analysis, saliency analysis helps to determine the ideas, such as feelings and emotions, that students think are most important regarding their Marojejy trip.

QUALITATIVE. In order to further evaluate the affective learner students reported in their essays, we categorized their responses into the different domains of affective learning, as outlined by Eiss and Harbeck (1969 pp 9–17). To do this, raw phrases written by students were evaluated for meaning. For example, one student wrote, "The trip to Marojejy was amazing to me. Everything went well. No one got sick or broken. We lived on fresh and clean air. A calm place. In short, everything was great. So for me, this forest should always be protected in order to give fresh air and clean water."

Raw ideas from students' essays were categorised into the taxonomy of affective learning (Eiss and Harbeck 1969 pp 9–17). Categorisation was completed by Sorenson. To ensure intra-observer agreement, Sorenson repeated the classification of raw statements from essays into the affective domains at two different points in time, revealing 84% agreement between the two measures. In order to conduct saliency and cultural consensus analysis, raw statements were coded by their general ideas.

RESULTS

There was no consensus among students about their trip, as revealed by cultural consensus analysis. Some of the most prominent domains, as revealed in the eigenvalues of the cultural consensus were that students liked the guides and would like to go again, that Marojejy should be protected, and that it was a nice trip. The most salient idea represented in students' responses to trips

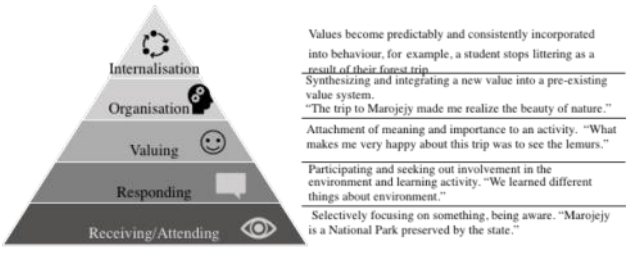

Figure 1. The five domains of affective learning. (Modified from Allen and Friedman (2010))

to Marojejy between May and July 2019 was "a good trip" (saliency=4.152, Table 1).

In their written responses, 13.3% of students' ideas (n=123) were in the receiving domain, 20.2% were in the responding tier, 42.2% were in the valuing tier, and 24.3% percent were in the organisation tier (Table 2). Students did not write about changes in their typical and consistent behaviour as a result of the Marojejy National Park trip; therefore, none of their responses were categorised in the highest domain of affective learning, internalisation (Table 2). Of the responses to which we ascribed a positive or negative value, the majority of responses included words such as *liked*, *fantastic*, *loved*, *marvellous*, and *great*. Students described that they enjoyed the trip, that the guides, cooks, and trip leaders were kind to them, and that the Park was clean and had fresh air. Only four students expressed negative feelings about their trip to the Park—these related to physical challenges experienced and the terrestrial leeches found in the Park.

In addition to expressing observations about their trip, such as "everyone followed the rules" students wrote about how the trip influenced their thinking and their future plans. For example, one student wrote "We loved it, and no one regrets going. We even want to come back. Thank you, Marojejy." Another wrote, "I will never forget what I saw there." A third wrote, "I hope we can continue [these trips] for future generations." Students' responses in the domains of receiving/attending, responding, valuing, and organisation, covered a wide range of aspects of the trip, from the food students ate to the teaching they received and the rules they followed.

LEVEL 1 RECEIVING/ATTENDING. Students (n=60) wrote 23 different ideas that could be classified as selectively attending to different elements of the trip. Responses were classified into seven different categories. The most frequent observations in this category were about Marojejy National Park ("I have seen Marojejy Mountain chains") and the people on the trip ("[the guides and cooks] took care of us" (Table 2). Statements in this level were, by nature of the first level of the affective domain, neutral in tone and emotion.

Table 1. The 20 most salient ideas reported by students (n=60) after their three-day educational trip to Marojejy National Park in Northeast Madagascar. Student participants, aged 13–22, came from three schools in the city of Sambava, Northeast Madagascar.

Student idea	Saliency
Good trip	4.152
See new things	0.831
We learned	0.814
Many animals	0.729
Many plants	0.712
Fresh air	0.593
Journey details	0.508
Nice people	0.492
Followed rules	0.356
Took care of us	0.322
Enough food	0.305
Safety	0.288
Got along	0.271
Protect forest	0.271
We played	0.237
Even though	0.220
Clean water	0.203
Made me happy	0.203
Good food	0.186
Good teaching	0.153
We swam	0.152
Good place	0.136
Good for health	0.119
Dinta	0.119
I want to go back	0.119
Glad to experience park	0.102

Table 2. Frequency of students' ideas categorised into the five levels of learning in the affective domain. Bold numbers represent the total frequency for each domain category.

Affective domain category	Frequency of responses
Receiving/attending	0.133
Responding	0.202
Valuing	0.422
Organisation	0.243
Internalisation	0

LEVEL 2 RESPONDING. 30 phrases written by students could be classified as participating and seeking out involvement in different aspects of the trip, including statements such as; "we increased our awareness and knowledge." Plants ("we also learned different trees and their uses and saw different trees that we have never seen before") were the most frequently discussed topic in this category (Table 2), while animals ("we learned about bamboo lemurs") and teaching ("we have learned many things because we get different lessons."). The remainder of the responses were largely neutral or slightly positive ("we saw fantastic animals.") Responses in this category are most frequently things that the group did: "we learned," "we saw," "we sang," "we swam." The majority of the statements in this category describe the activities of the group using 'we' rather than individual statements employing 'I.'

LEVEL 3 VALUING. Students (n=60) wrote 49 ideas that could be classified as valuing in the affective domain. This level contains the largest number of students' responses. Responses including evaluative reflections on the experience ("the trip was nice"), the people who accompanied them ("the cooks had prepared hot soup for us, they treated us very nicely") and animals ("what makes me very happy about this trip was to see the lemurs") (Table 2).

LEVEL 4 ORGANISATION. Students (n=60) represented a total of 23 ideas in their written responses that could be categorised as organisation in the affective domain. These responses, in which students demonstrate they are beginning to integrate values learned on the Marojejy National Park trip into their existing moral framework, reflected the trip ("it changed my whole life") and animals students observed ("I encountered many species that I had never seen") At this level of affective learning, students expressed the importance of protecting the forest and the organisms therein. Students reflected on the fact the Marojejy National Park is a special place.

LEVEL 5 INTERNALISATION. Students did not represent ideas in their responses that indicated they had reached the highest level of learning in the affective domain, internalisation.

DISCUSSION

As a result of educational trips to Marojejy National Park, our hypothesis that students would achieve learning in the affective domain was supported. Indeed, student participants demonstrated learning in four out of five levels of the affective domain: receiving, responding, valuing, and organisation. The intermediate level of affective learning, valuing, was most frequently indicated in students' responses.

While not written in their responses, informal conversations with students revealed that they shared ideas they brought back from the Park with their friends and family members. They told them about the things they saw on their trip and that nature is precious and must be protected. Research into conservation education has demonstrated that when children bring home conservation lessons and messages to share with their parents, their parents are more likely to engage in pro-conservation behav-

iours (Damerell et al. 2013, Rakotomamonjy et al. 2015). Moreover, we have anecdotal evidence that students continue to engage in thinking about the Marojejy National Park trips. Personal observations afterwards revealed that the participants shared pictures, poetry, and paintings influenced by the trip, suggesting internalising behaviours. In order to foster growth in the domains of affective learning, students should be exposed to longer-term education that builds on the emotions and knowledge they experienced over the course of their trip (Wallis and Lonsdorf 2010). In future trips, LCF should continue to prioritise student agency in learning, while also incorporating learning goals that reflect those of the National curriculum of Madagascar in collaboration with schools in the region. The efficacy of this method has been demonstrated in the Masoala Peninsula of Northeast Madagascar by Ormsby (2008) and provides added benefit for teachers, students, and conservation, as it aligns government prescribed learning with activities that promote the importance of the local environment.

There is evidence that positive childhood experiences are associated with later care for the environment (Tanner 1980, Chawla and Derr 2012). An evaluation of the effect of emotions on self-regulated learning found that positive emotions contributed to positive achievement and motivation (Mega et al. 2014). While research suggests that positive environmental experiences lead to pro-environmental sentiments in all ages of children, younger children are typically more responsive to these influences (Sobel 1996, Lieflander and Bogner 2014). In the future, LCF should expand its educational outreach to include younger primary school children in addition to the students represented in our study.

While the vast majority of affective experiences reported by students were positive, a few reported negative emotions. These negative feelings mainly concerned novel stimuli such as the terrestrial leeches found in the forest and the hiking and trails in the Park. The presence of these reported experiences does not undermine the utility of the educational experience. As Kellert (1983) and Sebba (1991) conclude, the utility of nature as a learning tool is due in part to the fact that nature is unpredictable and challenges learners by provoking not only positive feelings, but also fear and anxiety stemming from this unpredictability. Navigating these emotions and environments promotes critical thinking and creativity (Kellert 1983, Louv 2008). Anecdotally, we can confirm that these negative emotions promoted critical thinking in students—students that did not like being food for leeches used their critical thinking skills to develop ways to avoid them, including covering their legs with salt and inventing a leech-removal sponge with the help of one of the guides. Promoting these skills in youth will be critical if they are to navigate and develop creative solutions to the environmental challenges they are likely to face.

We utilised both qualitative and quantitative methodologies to analyse the ways in which our free-response evaluation could be used to assess affective learning. Results demonstrated students' personal association or value assignment to the Marojejy National Park trip via both methods. While saliency measures elucidated the ideas students most frequently written about, including personal values, and observations of the trip, qualitative analyses were required to categorize statements into taxonomic levels of the affective domain. Qualitative studies are frequently used in evaluating the outcomes of conservation education, as Alerby (2000), Bettinger et al. (2010), and Hughes (2013) demonstrated that nuanced thinking can be revealed and contextualized through holistic analyses in settings designed to understand students' perceptions of threatened species and local environments. Quantitative analyses, such as the cultural consensus and saliency measures used here, may be reductive (Kuhar et al. 2010, 2012). In future research, continued use of these mixed quantitative and qualitative analyses will retain the positives and minimise the limitations of both types of analyses.

The importance of learning in the affective domain is supported by a wide range of fields, from nursing education to general university education to environmental education (Bolin et al. 2005, Cazzell and Rodriguez 2011, Pearson et al. 2011). We demonstrated that even over a brief period of three days, place-based conservation education can have a marked impact on the values and emotions of participants. This is in accordance with Bogner (1998), who found that short-term outdoor environmental education can have long-term impacts on environmental attitudes. Place-based education is designed to engage cognitive, affective, and psychomotor learning domains (Semken and Freeman 2008). While many educational evaluations are concerned with cognitive domain, the affective is often ignored or minimised. While we acknowledge that the cognitive domain is where thinking and processing occurs (Osler 2013); we assessed affective domain as a means unto itself, demonstrating that learning experiences in nature largely resulted in positive emotions. It is likely that the relationship between these two domains ultimately facilitates students' achievement of learning goals (Osler 2013). Future research should investigate the learning outcomes that result from the interaction of these two domains. At Marojejy, LCF plans to continue these programmes. At time of publication, travel to the parks is restricted due to the COVID-19 pandemic, but education will resume when allowed. As previously mentioned, we recommend that LCF focus on bringing younger students to the forests as well, and that they focus on creating curriculum goals for the trip that align with the learning standards of local schools. To create these lessons and meet the needs of the local communities, LCF should collaborate with the communities with whom they engage in education using a participatory model. Involving Malagasy students and teachers in the planning and development process not only ensures that lessons and learning are culturally relevant, but also gives agency to the participants (Ormsby 2008, Reibelt et al. 2014) This helps them to recognise that they, not outside researchers and educators, have power and ownership of their environment and their education. Participants therefore develop skills in critical and creative thinking, and also create a model of environmental education that is sustainable even after outside educators and researchers move on from the project. The organization should aim to follow-up with students who attended these forest trips 6 months to one year after their programme to assess what they have retained from the trip. In addition to these formal education programmes, LCF engages in education that benefits the environment through their family planning outreach with the Marie Stopes Foundation and their sustainable wood stove distribution with ADES. Future research within the organisation should aim to assess the short-term and long-term environmental impacts of these programmes.

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