


RESEARCH ARTICLE

Evaluating the effect of a year-long film focused environmental education program on Ugandan student knowledge of and attitudes toward great apes

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Films, as part of a larger environmental education program, have the potential to influence the knowledge and attitudes of viewers. However, to date, no evaluations have been published reporting the effectiveness of films, when used within primate range countries as part of a conservation themed program. The Great Ape Education Project was a year-long environmental education program implemented in Uganda for primary school students living adjacent to Kibale National Park (KNP) and Bwindi Impenetrable National Park (BINP). Students viewed a trilogy of conservation films about great apes, produced specifically for this audience, and participated in complementary extra-curricular activities. The knowledge and attitudes of students participating in the program from KNP, but not BINP were assessed using questionnaires prior to ($N = 1271$) and following ($N = 872$) the completion of the program. Following the program, students demonstrated a significant increase in their knowledge of threats to great apes and an increase in their knowledge of ways that villagers and students can help conserve great apes. Additionally, student attitudes toward great apes improved following the program. For example, students showed an increase in agreement with liking great apes and viewing them as important to the environment. These data provide evidence that conservation films made specifically to address regional threats and using local actors and settings can positively influence knowledge of and attitudes toward great apes among students living in a primate range country.

KEYWORDS

chimpanzee, conservation education, conservation films, gorilla, primate conservation

1 | INTRODUCTION

Uganda's population of primates is diverse and distributed through 10 of the country's national parks. Most notable are Kibale National Park (KNP) and Bwindi Impenetrable National Park (BINP) both located in southwestern Uganda. KNP is home to 13 species of primate, including more than 1,200 chimpanzees (*Pan troglodytes schweinfurthii*) (Otali, Hartel, Machanda, Wrangham, & Ross, 2016) and BINP is home to 10 species of primate including chimpanzees and nearly half ($n = 400$) of the world's critically endangered mountain gorillas (*Gorilla beringei beringei*) (Roy et al., 2014). Despite each park's protected status, the survival of the primate populations in both protected areas is under

threat. KNP has historically experienced little to no hunting of primates (Stuhsaker, 1975), though the hunting of other mammals with snares has impacted the chimpanzee population (Otali et al., 2016). However, recently the trade of primate bushmeat has become a growing concern (Kibale Chimpanzee Project, 2013). Deforestation and forest fragmentation (Chapman, Balcomb, Gillespie, Skorupa, & Struhsaker, 2000; MacKenzie, Chapman, & Sengupta, 2011; Onderdonk & Chapman, 2000), as well as conflict with humans outside of the park (Naughton-Treves, 1998) also have threatened the primate population within KNP. In addition, as human populations around the park continue to grow, increasing pressure will be placed on the park, and ultimately its nonhuman primate population

(Hartter & Southworth, 2009). Similarly, the primate population in BINP is threatened by snaring and other human disturbances, including timber extraction and honey gathering (McNeilage et al., 2006; Olupot, Barigiyira, & Chapman, 2009). The presence of people and livestock surrounding BINP in particular has been associated with disease transmission in BINP's mountain gorilla population (Rwego, Isabirye-Basuta, Gillespie, & Goldberg, 2008).

Given the complexity of threats to primates, multiple approaches to their protection have been undertaken, including the creation of protected areas (Chape, Harrison, Spalding, & Lysenko, 2005), law enforcement (Tranquilli et al., 2012), use of economic incentives associated with primates (e.g., ecotourism; Kruger, 2005), and conservation education programs (Padua, 2010). Considering the concerns about primate conservation in Uganda (McNeilage et al., 2006; Olupot et al., 2009; Otali et al., 2016) and the limited availability of funding, it is imperative that conservation initiatives are regularly evaluated to ensure objectives are met and adjusted based on the most up-to-date information. While many forms of conservation action are lacking in any systematic evaluation (Ferraro & Pattanayak, 2006), environmental education programs may be one of the most neglected. A recent meta-analysis found that less than one third of reviewed programs contained an environmental education evaluation component (Carleton-Hug & Hug, 2010). Environmental education programs are becoming increasingly common in primate range countries. As these programs continue to develop, regular evaluation is critical for measuring their success, and for informing the success of environmental education programs that follow.

Environmental education programs can be conducted in traditional classroom settings (Savage, Guillen, Lamilla, & Soto, 2010), as well as more informal settings such as interactive forest walks (Kuhar, Bettinger, Lehnhardt, Osuo, & Cox, 2010), nature clubs (Borchers et al., 2014; Breuer & Mavinga, 2009), story/comic book distribution (Dolines et al., 2010), and theatre performances (Boesch et al., 2008). Although films have been utilized in conservation programs since the 1960's (Mitman, 1999), they are becoming an increasingly common practice (Wright, 2010). Conservation films have the potential to be highly effective for primate conservation. First, they can be distributed widely. Second, in rural areas surrounding many primate range areas films are a novel activity, which may increase interest in participation. Third, the visual component of films may have strong impacts on viewers in terms of their attitudes toward primates by providing an opportunity to view more intimate aspects of primate behavior. Having the opportunity to view live primates has been shown to improve attitudes toward primates in school children (Rakotomamonjy, Jones, Razafimanahaka, Ramamonjisoa, & Williams, 2015), though limited empirical evidence is available to support if viewing primates in films has the same positive outcome as live viewing (Wright, 2010).

Viewing wildlife films has been correlated with taking positive conservation action. For example, Arendt and Matthes (2016) found viewing a wildlife film resulted in increased donations for nature related causes compared to viewing a control film. In addition, Clark (2006) reported that individuals who viewed conservation films more frequently had an increased rate of several conservation actions

including not purchasing products from companies believed to be destructive to the environment, donating money to wildlife organizations, volunteering for wildlife organizations, and supporting political candidates who advocated for protecting wildlife. However, it is unclear if wildlife films are the direct cause of these observed behaviors, or if individuals who engage in more frequent pro-environmental behavior are more likely to watch wildlife films. In addition, there are data which suggest that viewing wildlife films does not increase one's connectedness to nature (e.g., one's perception that they are part of nature), which is an important step in developing pro-environmental behavior (Arendt & Matthes, 2016). In contrast to films that focus on wildlife in general, films that focus principally on issues of conservation (Bousè, 2000), have received less evaluation. In the only published empirical evaluation, Pearson, Dorrian, and Litchfield (2011) found that a conservation film had greater effect on the conservation action of Australian university students, as measured by student's recording their own behavior than a lecture on the same topic. Wright (2010) has anecdotally reported on the effectiveness of conservation films in both Cameroon and Indonesia but no peer-reviewed publications are available. Given the recent prevalence of the use of film in primate conservation education programs, systematic evaluations are needed to determine their effectiveness (Ferraro & Pattanayak, 2006; Jacobson, 2010; Kuhar et al., 2010).

To contribute to the primate conservation within KNP and BINP, four organizations, North Carolina Zoo's UNITE for the Environment (UNITE), the Kasiisi Project (KP), Nature for Kids (NFK), and the Max Planck Institute of Evolutionary Anthropology (MPI-EVAN), partnered on a year-long environmental education program called the Great Ape Education Project (GAEP). The main component of this project was the production of a trilogy of conservation films that focused on great ape conservation. The films, as well as almost two dozen additional extra-curricular activities including art projects, class debates, and forest walks, were produced for primary school students living adjacent to KNP and BINP. The purpose of this study was to systematically evaluate the effectiveness of the GAEP on improving student knowledge of and attitudes toward great apes. This represents one of the few large-scale evaluations of an environmental education program in a primate range country, the results of which can inform current and future environmental education and primate conservation programs.

2 | METHODS

2.1 | Study site and subjects

The subjects of this study were primary school children living in communities around KNP and BINP, who were participating in ongoing environmental education programs (UNITE and KP for KNP, MPI-EVAN for BINP). UNITE and KP had been working at KNP since 2001 and 1997, respectively. MPI-EVAN has been working in BINP since 1998, with education programs beginning in 2008. Student participation required formal enrollment in the program which resulted in 10 primary (grade level P4-P7, age 9–12 yrs) and one secondary school (grade level S1–S2, age 13–14 yrs) enrolling through UNITE, 14

wildlife clubs (primary school students) through KP, and eight primary schools through MPI-EVAN. Formal enrollment of these schools and clubs in the GAEP provided a large sample size of students for study and ensured that those viewing the films also participated in at least one additional GAEP activity. Due to a discrepancy in survey labeling, data will be reported for KNP (UNITE and KP) only and not BINP (MPI-EVAN).

This research adhered to the American Society of Primatologists Principles for the Ethical Treatment of Primates. Permission and protocols for research using students were approved by the North Carolina Zoo and complied with the laws of Uganda.

2.2 | Project description and implementation

The GAEP was designed around three films produced by the nongovernmental organization NFK (www.natureforkids.nl). The films were made in communities around KNP and all actors were local community members. The films were produced in English and translated into Runyakitara (a combination of Rukiga and Rutooro—the two dominant languages in the region) using voice overs. Student magazines, a poster and a “how-to” guide for more sustainable livestock and agriculture practices accompanied each film. All materials were distributed to students after each film viewing and all materials were available in both English and Runyakitara. In addition, a training manual that included background information and activities was produced to assist teachers in further implementing the educational messaging of the films in their classroom lessons.

The film’s main character was a young boy named Ajani, who worked to protect gorillas and chimpanzees living near his fictional

hometown of Fish and Greens, Uganda. Each of the three films focused on one specific threat to great ape populations: habitat loss, snaring, and the bushmeat trade. Each film was approximately 20 min in length and had the same 2 min introductory segment that highlighted who Ajani was, his fictional hometown, and the adjacent gorilla and chimpanzee communities (the films can be viewed at; <https://vimeo.com/natureforkids>). The films were shown over one year with the habitat loss film airing in June 2013, the snaring film airing in September and October 2013 and the bush meat film airing in March and April 2014. In total, 27,386 students and 6,294 community members viewed the films. In addition, 17,324 students participated in 21 additional activities, such as forest walks, debates, guest lectures, and poem/song writing contests, aimed at supplementing the learning objectives of the films.

2.3 | Data collection

Students completed a questionnaire that assessed their knowledge of, and attitudes toward great apes prior to the showing of the films and within 3 months of the third film. Questionnaires contained four write-in questions, two Likert scale (5 item) questions and one Yes/No question (Table 1). When administering the questionnaires, GAEP partner staff members read each question aloud in both English, and the specific village language (Rutooro or Rukiga) to provide additional clarification to students. Students were given an opportunity to write answers in their local language. Each survey was then processed by GAEP staff, translating any non-English answer into English. All questionnaires were completed anonymously.

TABLE 1 Questionnaire information and pre/post averages for each question by program

Question	Question type	Answer type	Program	Mean proportion of desirable answers (SE)		
				Pre-GAEP	Post-GAEP	<i>p</i>
How are great apes similar to humans?	Conservation knowledge	Open ended	UNITE	0.94 (0.01)	0.97 (0.007)	0.005
			KP	0.99 (0.01)	0.99 (0.003)	0.206
Name threats to great ape survival.	Conservation knowledge	Open ended	UNITE	0.85 (0.01)	0.86 (0.01)	0.560
			KP	0.94 (0.01)	0.98 (0.01)	0.033
How can villagers conserve great apes?	Conservation knowledge	Open ended	UNITE	0.68 (0.02)	0.95 (0.01)	<0.001
			KP	0.77 (0.02)	0.93 (0.01)	<0.001
How can you conserve great apes?	Conservation knowledge	Open ended	UNITE	0.69 (0.02)	0.98 (0.006)	<0.001
			KP	0.75 (0.02)	0.92 (0.01)	<0.001
Mean attitude score (SE)						
How do you feel about great apes?	Attitude	Likert ^a	UNITE	4.38 (0.05)	4.51 (0.04)	0.550
			KP	4.10 (0.09)	4.62 (0.04)	0.001
Great apes are frightening.	Attitude	Likert ^b	UNITE	3.75 (0.07)	3.37 (0.07)	<0.001
			KP	3.34 (0.08)	3.22 (0.09)	0.014
Great apes are important to the environment.	Attitude	Yes/No ^c	UNITE	1.90 (0.01)	1.96 (0.009)	<0.001
			KP	1.92 (0.01)	1.97 (0.01)	0.409

^a5 item: 1 = Strongly dislike, 2 = Dislike, 3 = Neutral, 4 = Like, 5 = Strongly like.

^b5 item: 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.

^cYes = 2, No = 1.

Statistically significant ($p \leq 0.05$).

2.4 | Data analysis

Questionnaires were coded by staff and research volunteers at the Cleveland Metroparks Zoo (CMZ), Cleveland, OH. A subset of questionnaires used for inter-observer reliability testing ($N = 20$) were coded by AL. All those that coded surveys had greater than 90% agreement with this subset of questionnaires. For write-in questions, responses were categorically coded by answer type. These categories were determined by randomly selecting approximately 200 surveys and summarizing common answer types. For analysis, these categories were condensed into “desirable” or “undesirable” answers based on the educational objectives of the program. For example, when asked how students can conserve great apes, the answer “feed them” was scored as undesirable, whereas the answer “do not cut trees in forest” was scored as desirable. Both desirable and undesirable answers were coded to track student learning as well as to understand misinformation the students had prior to and following the program. For Likert scale and Yes/No questions, answers were coded on a 1–5 (1 = strongly dislike/disagree; 5 = strongly like/agree) and a 1–2 scale (1 = No, 2 = Yes), respectively. For any Likert or Yes/No question for which a student selected multiple answers, the answer was removed from analysis.

For write-in answers, the proportion of desirable answers was compared. This was calculated by dividing the total number of desirable answers given by the total number of answers given (desirable plus undesirable). For Likert and Yes/No answers, the mean survey scores were compared to measure changes in attitude from baseline. Baseline and post-film questionnaire answers were compared using non-parametric statistics (α set at 0.05) conducted using SPSS Version 23 (Chicago, IL). Students were compared within their respective program only (UNITE, KP). While there are likely differences between the study groups, the anonymous and voluntary nature of student participation did not allow us to control additional variables such as student sex, age, grade level, or school. Thus, any differences between programs would be difficult to interpret, and ultimately was

not a goal of this study. It is recognized that these are different populations and thus the programs are analyzed separately, and no comparisons were made to explain potential differences between these populations.

3 | RESULTS

3.1 | Great ape knowledge

A total of 1,271 baseline (UNITE, $N = 904$; KP, $N = 367$) and 872 post questionnaires were completed (UNITE, $N = 549$; KP, $N = 323$). When asked to name ways great apes are like humans, there was a significant increase in the proportion of desirable answers following the completion of the program for UNITE (Mann–Whitney, $U = 178352.00$, $z = -2.75$, $p = 0.005$), but not for KP (Mann–Whitney, $U = 50249.00$, $z = -1.39$, $p = 0.21$). This difference is probably best explained by the higher proportion of correct responses in the baseline by KP compared to UNITE, providing limited opportunity for improvement. Nevertheless, students in both programs showed a high proportion of desirable answers in both the baseline (KP = 0.99; UNITE = 0.94) and post program surveys (KP = 0.99; UNITE = 0.97) (Table 1). An increase in the percentage of students providing desirable answers relating to primate anatomy and behavior, which were topics of the film and extracurricular activities, were observed to increase post program (Primate Anatomy, Pre = 9.8%, Post = 52.00%; Behavior, Pre = 3.2%, Post = 15.1%). Overall, the percentage of students providing undesirable answers was low (Pre = 1.3%; Post = 3.4%). Undesirable answer categories were highly variable, and included attributing monkey anatomy such as “they have tails” to great apes (Table 2).

When asked to identify threats to great ape survival, KP students had a significant increase in their proportion of desirable answers following the program (Mann–Whitney, $U = 44176.00$, $z = -2.01$, $p = 0.03$), whereas UNITE students did not differ between conditions

TABLE 2 Percentage and count of answers to the questions “Name threats to great apes” and “How are great apes similar to humans?”

Question	Condition	Answer categories					
		Poaching, hunting, snaring	Deforestation and/or bush burning	Disease	People	Other desirable	Undesirable
Threats to great apes.	Pre	48.1%	48.8%	9.4%	3.5%	23.7%	13.2%
		($n = 573$)	($n = 620$)	($n = 120$)	($n = 44$)	($n = 301$)	($n = 168$)
	Post	61.1%	70.1%	3.2%	6.5%	12.3%	10.1%
		($n = 533$)	($n = 611$)	($n = 28$)	($n = 57$)	($n = 107$)	($n = 88$)
How are great apes similar to humans?	Pre	32.4%	9.8%	3.2%	5.2%	1.3%	4.9%
		($n = 412$)	($n = 125$)	($n = 41$)	($n = 66$)	($n = 16$)	($n = 62$)
	Post	28.6%	52.0%	15.1%	4.9%	3.4%	2.0%
		($n = 249$)	($n = 453$)	($n = 132$)	($n = 43$)	($n = 30$)	($n = 17$)

Students were allowed to write multiple answers, percentages are representative of the number of students who provided an answer for each answer category respectively.

(Mann–Whitney, $U = 180686.00$, $z = -0.59$, $p = 0.56$). Similar to the previous question, students in both programs had a high proportion of desirable answers in both the baseline (KP = 0.94; UNITE = 0.85) and post program questionnaires (KP = 0.98; UNITE = 0.86) (Table 1). An increase in the percentage of students providing desirable answers relating to deforestation, snaring, and bush meat increased following the program. Overall, the percentage of students providing undesirable answers was low (Pre = 13.2%, Post = 10.1%). Categorically answers were highly variable but included answers such as behavior that may put great apes in conflict with humans, such as “they destroy crops” and “they eat people” (Table 2).

When asked how villagers can conserve great apes, both KP and UNITE students had a significant increase in their proportion of desirable answers following the program (Mann–Whitney, KP, $U = 35893.50$, $z = -6.29$, $p < 0.001$; UNITE, $U = 132170.50$, $z = -12.51$, $p < 0.001$). Unlike the two previous questions, the baseline proportion of desirable answers for both programs was not as high (KP = 0.77; UNITE = 0.68), allowing for more growth following the program (Table 1). Overall, an increase in the percentage of students providing desirable answers related to reducing deforestation, snaring, and bush meat consumption increased following the program, in addition to other desirable answer categories, such as plant trees and teach conservation. The percentage of students providing undesirable answers decreased from 35.5% to 9.4%. For example, students decreased in their answer “feed great apes” by a factor of more than 3 (Pre = 17.4%; Post = 5.2%) and other undesirable answers, which included a variety of answers to variable to categorize, by a factor of 5 (Pre = 16.9%; Post = 3.3%) (Table 3).

When asked how students themselves can conserve great apes, both KP and UNITE students had a significant increase in their proportion of desirable answers following the program (Mann–Whitney, KP, $U = 37051.00$, $z = -5.42$, $p < 0.001$; UNITE, $U = 117072.00$, $z = -13.04$, $p < 0.001$). Similar to the previous question, the proportion of desirable answers was low in baseline (KP = 0.75; UNITE = 0.69), allowing for more growth post program (Table 1). An increase in the percentage of students providing answers related to reducing deforestation, hunting, and bush meat use was observed, in addition to an increase in desirable answer categories, such as plant trees, teach conservation, and raise domestic animals/improve agriculture practices. Most notable was the decrease in the frequency of undesirable answers. The most frequent undesirable answer was “feed great apes”, which decreased from 15.1% of students to 3.4% (Table 3).

3.2 | Attitudes toward great apes

When asked how students felt about great apes, there was a significant positive change in attitude toward great apes following the program for KP (Mann–Whitney, $U = 34143.50$, $z = -3.45$, $p < 0.01$), with a baseline mean attitude score of 4.10 (SE = 0.09) increasing to 4.62 (SE = 0.04; Strongly Dislike = 1, Strongly Like = 5). UNITE students showed no change (Mann–Whitney, $U = 138930.00$, $z = -0.58$, $p = 0.55$) between baseline ($\mu = 4.38$, SE = 0.05) and post program ($\mu = 4.51$, SE = 0.04) (Figure 1). This may relate to the

fact that UNITE had a higher baseline score, providing limited opportunity for growth, as post scores for both programs were similar (KP = 4.62; UNITE = 4.51).

When asked, if great apes are frightening, there was a significant change in attitude for both programs after viewing the films (Mann–Whitney, KP, $U = 56438.50$, $z = -2.53$, $p = 0.014$; UNITE, $U = 229328.00$, $z = -3.74$, $p < 0.001$). Following the program, a decrease in the belief that great apes are frightening (KP, $\mu = 3.22$, SE = 0.09; UNITE, $\mu = 3.37$, SE = 0.07) compared to baseline was documented (KP, $\mu = 3.34$, SE = 0.08; UNITE, $\mu = 3.75$, SE = 0.07; Strongly Disagree = 1, Strongly Agree = 5) (Figure 1).

Student agreement with the statement that great apes are important to the environment improved significantly for UNITE following the program ($\mu = 1.96$, SE = 0.009; Mann–Whitney, $U = 191011.00$, $z = -4.28$, $p < 0.001$) compared to baseline ($\mu = 1.90$, SE = 0.01). Agreement did not differ for KP (Baseline, $\mu = 1.92$, SE = 0.01; Post, $\mu = 1.97$, SE = 0.01; Mann–Whitney, $U = 51665.00$, $z = -0.83$, $p = 0.409$). Again, this may be explained by the fact that KP had a higher baseline score compared to UNITE allowing for less growth post program, as both programs had similar scores following the films (KP = 1.97; UNITE = 1.96).

4 | DISCUSSION

Conservation films are a convenient and commonly used tool to portray complex conservation issues to large audiences. As the main component of a year-long environmental education program, the purpose of this study was to conduct a large-scale evaluation of the effectiveness of conservation films to improve the knowledge of and attitudes toward great apes of school children living adjacent to great ape range areas in Uganda. We examined students participating in two programs, one by UNITE and the other KP. We found differences between the two subsets of students who participated in this program; however, many of these differences were related to differences in baseline knowledge between each program by question. These differences are best explained by different points of emphasis in the educational content these students were exposed to prior to the GAEP, as both participating programs were run by trained professionals, had been working in the area for over a decade and all surveyed students had previously partaken in each program's respective educational program. Despite both programs' students coming into the GAEP with high baseline knowledge, the GAEP was still associated with increased student knowledge of and improved attitudes toward great apes.

Improved knowledge of conservation issues are an important first step in increasing the likelihood of an individual taking conservation action (Frick, Kaiser, & Wilson, 2004; though see Ajzen, Joyce, Sheikh, & Cote, 2011). In the present study, we saw a significant increase in knowledge of both the threats to great ape survival (e.g., deforestation, snaring, and bush meat) and ways that local community members can help conserve great apes (e.g., plant trees, stop hunting, stop deforestation, teach conservation). This is the first time that the use

TABLE 3 Percentage and count of answers to the questions “How can villagers conserve great apes?” and “How can you conserve great apes?”

Question	Desirable answers	Plant trees	Stop poaching, hunting, snaring, bush meat	Stop deforestation, bush burning	Teach conservation	Protect/ conserve animals and/or forest	Raise domestic animals for Ffood and/or improve agricultural practice	Other desirable
How can villagers conserve great apes?	Pre	20.9%	33.3%	38.6%	0.9%	7.4%	0.2%	6.9%
		(n = 265)	(n = 423)	(n = 491)	(n = 11)	(n = 94)	(n = 3)	(n = 88)
	Post	41.1%	45.5%	61.6%	5.0%	6.2%	3.8%	12.8%
		(n = 358)	(n = 397)	(n = 537)	(n = 44)	(n = 54)	(n = 33)	(n = 112)
How can you conserve great apes?	Pre	26.0%	21.3%	24.6%	7.2%	9.4%	0.4%	5.7%
		(n = 331)	(n = 271)	(n = 313)	(n = 91)	(n = 119)	(n = 5)	(n = 72)
	Post	39.6%	38.3%	42.9%	31.2%	7.0%	9.6%	16.9%
		(n = 345)	(n = 334)	(n = 374)	(n = 272)	(n = 61)	(n = 84)	(n = 147)
	Undesirable answers	Feed great apes	Build fence around park	Give great apes medicine	Other undesirable			
How can villagers conserve great apes?	Pre	17.4%	0.5%	1.5%	17.0%			
		(n = 221)	(n = 6)	(n = 19)	(n = 216)			
	Post	5.2%	0.0%	0.9%	3.3%			
		(n = 45)	(n = 0)	(n = 8)	(n = 29)			
How can you conserve great apes?	Pre	15.1%	0.0%	1.7%	16.9%			
		(n = 192)	(n = 0)	(n = 21)	(n = 215)			
	Post	3.4%	0.0%	0.7%	3.6%			
		(n = 30)	(n = 0)	(n = 6)	(n = 31)			

Students were allowed to write multiple answers, percentages are representative of the number of students who provided an answer for each answer category respectively.

of conservation films, in conjunction with extra-curricular activities, has been systematically evaluated to assess knowledge of primate conservation among students living in a primate range country. While the data were analyzed as a proportion of desirable answers covering all issues related to primate conservation, we were also able to document an increase in the percent of students providing desirable answers that directly tied to the themes of the conservation films. This demonstrates that a large number of students comprehended the intended messaging of the films. Additionally, we saw a decrease in the frequency of undesirable answers (Table 3). Undesirable answers are not often reported in conservation education outcomes. Documenting changes in both desirable and undesirable answers after viewing the

films is critical for assessing knowledge of conservation issues, as understanding what students learned, and where additional growth is needed are imperative for future program development and goal setting.

In addition to increased knowledge of primate conservation, an increase in the knowledge of how great apes and humans are similar was observed following the program. Although this may seem to be a minor point in comparison to conservation knowledge, recent research has shown that an affective connection to animals can correlate with increased pro-environmental behaviors (Grajal et al., 2017). Awareness of the similarities between humans and great apes may be a first step in developing such a connection.

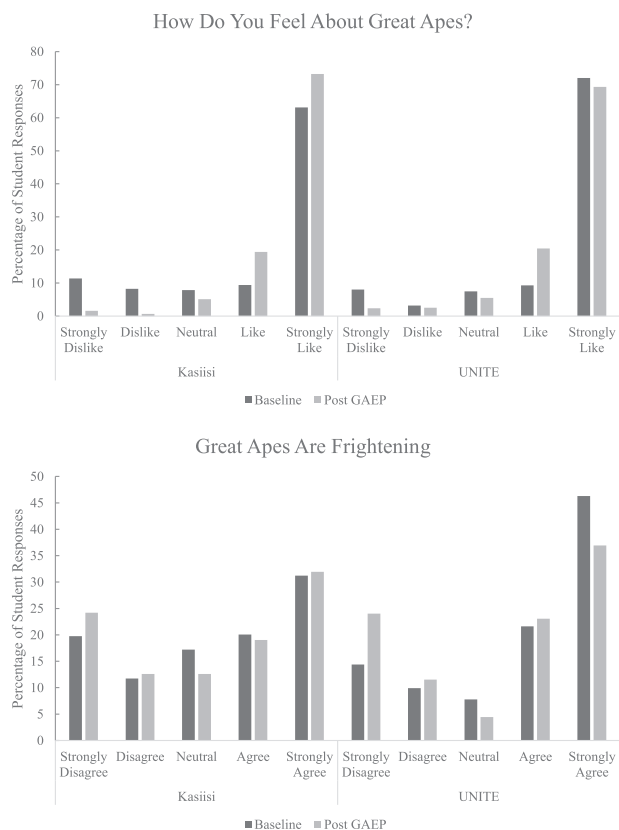


FIGURE 1 Overall student responses to “How do you feel about great apes?” and “Great apes are frightening

This study did not evaluate direct conservation action, but did pose the question: what actions will you take at home to help conserve the great apes? Assessing action, especially with such a large data set, can be challenging. “This question” provided a way for students to reflect on their knowledge and theoretically apply what they have learned to their daily lives. We saw an increase in the percentage of students correctly answering this question using themes presented in the films (habitat destruction and hunting of primates). However, the percentage of students answering with the films’ themes were slightly lower (42.89% and 38.30%), when describing their own potential actions as compared to when describing what villagers can do to conserve great apes (61.58% and 45.53%). Nonetheless, the overall increase in desirable answers was similar across questions. This may reflect that the students view adults as the main contributors to habitat destruction and the hunting of primates, and thus view adult contribution to minimizing these actions as more significant than their own.

In response to the question “how can students and villagers help conserve great apes,” a decrease in the number of undesirable answers was observed. Prior to the program, undesirable answers were primarily “feed great apes,” “give great apes medicine,” “removing trees,” and “go see the great apes.” After viewing the films, these types of answers decreased. Similar strong decreases in undesirable answers occurred for the questions such as “name threats to great apes” and “how are great apes similar to humans.” This finding is significant and indicates that using local actors, in-country primate species, age appropriate content, and native languages in our films provided the

appropriate cultural contexts and thus delivered desirable outcomes (Wright, 2010). While this process is more time and resource intensive, it is necessary to ensure that misinformation is minimized and that the intended learning objectives are met. Future evaluations of the effectiveness of conservation films need to address conservation action beyond self-reporting or reflection as we provided here. Home visits and follow-up interviews would allow for more direct evaluation of changes in conservation actions and are currently being used by UNITE to evaluate other aspects of their programming.

For people living with or adjacent to wildlife, primates can be viewed as pests, threats, and even bad omens (Lee & Carrol, 2005; Naughton-Treves, 1998; Seiler & Robbins, 2016; Simmons & Meyers, 2001). Thus, maximizing positive attitudes of those in primate range countries is significant to their conservation. At KNP, people living in the park’s vicinity have high favorability of the park (Harterter & Goldman, 2011), and though primates can be viewed as pests due to crop raiding, surveyed individuals still prefer to live closer to, rather than farther from, KNP (Harterter, 2009). However, primates do account for almost three-quarters of crop raiding events around KNP, and almost two-thirds of farmers guard their crops (Naughton-Treves, 1998). This is likely to result in conflict and persistent negative perceptions of primates around KNP.

The use of films may be effective for improving these negative attitudes because they can be used to present primate behavior in a positive light and in ways not normally seen. The films used in this study included footage of wild chimpanzees and gorillas engaged in mother-infant interactions, grooming, and play—all positive images that show the intricacies of their social behavior. Following completion of the program, we saw a positive change in attitudes toward great apes, with an increase in students liking great apes and a decrease in students finding great apes frightening. However, even after observing films, the overall percentage of students reporting great apes as frightening remained greater than those finding them not frightening. This may be due to the story line of the films. To reinforce the danger of entering the park, the films include encounters with both gorillas and chimpanzees that were presented as dangerous to humans and included dialogue such as “(the chimpanzees) looked and sounded menacing” and “I am glad the chimpanzees moved on, what if they had attacked us?” By demonstrating that great apes can potentially be dangerous and should be left undisturbed it is possible that the films also portrayed great apes as frightening. Similarly, anecdotal evidence suggests that viewing chimpanzees up-close may increase how frightening they are perceived to be in high school age students (unpublished data, UNITE). This may explain the high number of students still reporting great apes as frightening following the program and has caused us to rethink how best to portray primates in conservation films. It should be noted that in the production of these films, it was felt that viewing great apes as dangerous would be positive, with the ultimate goal of discouraging students to enter the park. However, presenting primates as frightening (Rakotomamonjy et al., 2015; Simmons & Meyers, 2001) or dangerous both have produced unintended negative outcomes (Pooley, Fa, & Nasi, 2015).

A major component of the GAEP was integration of other activities so as not to rely entirely on films for the presentation of

educational messages. The films were accompanied by almost two-dozen additional educational experiences that complemented the messages of the films. This is an important distinction between this evaluation and other assessments of films for educational purposes. In a study of university student's knowledge of AIDS, it was found that there was no practical difference in knowledge between those who viewed an educational film on AIDS and those who viewed a control video (Gilliam & Seltzer, 1988). Vameghi, Mohammad, Karimloo, Soleimani, and Sajedi (2010) compared women's knowledge and practice of infant health care during pregnancy and child infancy across three conditions: those who received no training, viewed an educational movie, or received a more traditional face-to-face educational experience. Both experimental groups had significantly greater knowledge than the control group, with no difference between experimental groups. However, the face-to-face group practiced what they learned significantly more than the control and movie group. While this was not explicitly tested here, it appears that the success of educational films may rely at least in part on complementary experiences that further reinforce educational objectives of the films, similar to what was done by the GAEP.

It is important to note that both student subsets had engaged in conservation education programs prior to this study. This involvement was identifiable from the pre-program evaluations and may explain the limited magnitude of changes in attitude and perspective for this study. Further study is needed to examine how films affect populations with lower exposure rates to conservation education. Future research, whether with novel or ongoing education programs, should also aim to include demographic information in their data collection protocols. The present study conducted anonymous surveys which allowed for a larger sample size; however, using this method we were unable to control for several critical variables, such as age, sex, grade level, and school, that are likely to impact the effectiveness of the education programs. In addition, this study focused on students because the study population was easily accessible through the existing programs. Data are still needed to assess, if these same films are equally as effective in influencing the knowledge and attitudes of adults. Research focused on adults should compare the effectiveness of using the same messaging on learning outcomes of adults and children.

The use of conservation films in primate range countries is popular as they are an easily delivered medium by which to share conservation messages with large audiences. More evaluation is needed, but this study provides evidence that conservation films can improve the knowledge of and attitudes toward great apes in students living in a primate range country. It is important to note, however, that these films were made with this specific student audience in mind and more mass-market films (e.g., traditional wildlife documentaries) may not have the same effect. The impact of these films on a broader audience is still unknown and in need of empirical investigation.

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