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Students and Scientists Connect with Nature in Uganda, East Africa

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We studied the impact of environmental education (EE) workshops on Ugandan youth's (N = 84) perceptions of their relationship with nature, self efficacy, and civic attitudes and skills. Two nature-related measures and two measures related to social competencies were administered before and after EE workshops that were designed to educate youth about environmental conservation through field experiences with university scientists and inquiry-based activities with environmental educators. Pre- and post-workshop scores were analyzed using Mixed Design ANOVAs to determine if EE workshop program format length and setting differentially affected male (n = 43) and female (n = 41) participants' perceived benefits of EE workshops. Participants' scores increased following EE workshops, except those in the urban setting, who reported a decrease in their connections to nature compared to those in the rural setting. Longer workshops with more field experiences had the most profound impact on participants' feelings of connection to nature, social competencies, and commitment to civic action. Males showed increases in self efficacy in the rural workshop and greater connectedness to nature in the longer workshops compared to females. Results underscore the importance of considering geographical and cultural contexts when developing and evaluating EE.

Keywords: environmental education, culture, mentorship, field experience, Africa

Introduction

A greater understanding of nature creates a fertile ground for a deep appreciation of nature, which can inspire youth to work for environmental change. Environmental education (hereafter EE) programs are a major conduit in becoming aware of threats to the environment, and it is through EE programs that youth can learn to make informed decisions to conserve and improve their surroundings. But, what components of EE programs influence youth's connections to nature, ecological values and motivation to act as environmentalists? Not surprisingly, researchers and educators advocate for outdoor experiences in nature for children and youth. Carrier (2009) showed that children in outdoor school yard settings developed stronger positive attitudes towards the environment compared to those in indoor classroom settings. Research supports the importance of green spaces and natural landscapes to children's cognitive and psycho-social development, including emotional regulation, perceived self-worth, creativity, concentration, and motor skills (see Clayton & Myers, 2009 for a discussion of these findings). Adults reported that their childhood experiences in natural settings were a significant influence on their personal commitment to protect the environment (Chawla, 1999). Taken together, these studies suggest that experiences in natural environments support the development of a person's environmental identity, and that a pedagogy emphasis for EE programs for youth should include experiences in natural settings that encourage connections to nature.

Firsthand outdoor experiences alone, however, are not sufficient for young peoples' understanding of the complexity of ecology or developing social competencies that will translate into civic action and leadership. We agree with Smith-Sebato and Cavern (2006) that more research is needed to determine what pedagogy elements produce EE benefits that will translate into civic action and leadership. Bhandari and Abe (2000) reviewed EE efforts in 36 countries in the Asia-Pacific regions. Despite EE being found in multiple content areas, the dominant pedagogy style, "chalk-and-talk" was geared toward passing science examinations rather than real world application of EE knowledge in youth's communities. Field experiences can reinforce students' grasp of science based environmental content and linkage between science curricula that can result in a pro-environmental stance. Students studying biology who engaged in nature activities demonstrated greater knowledge of environmental content and positive attitudes towards the environment (Tikka, Kuitunen, & Tynys, 2000). Effective EE pedagogy should not only emphasize the interdisciplinary and dynamic dimensions of science and ecology, but also provide a platform for youth initiative, dialogue, and debate. Self efficacy, that is the perception of one's sense of personal agency, coupled with collective efficacy, or one's sense of group empowerment, are necessary for youth to conceptualize environmentalism as a social justice concern.

Cultural differences in self and collective values and societies' relationship to the natural environment call for region specific approaches to EE best practices. Ghanaian youth studied culturally relevant environmental issues by constructing eco-profiles that considered production, use, and disposal of goods in their particular ecosystem (Mueller & Bentley, 2009). EE that is context specific may encourage youth to value ancestral knowledge of indigenous cultures and champion their communities' natural heritage (Browne-Nunez & Jonker, 2008). No doubt, false generalizations about environmentalism on the African continent have impeded EE driven by foreign aid. Unlike Westerners who romanticize the human-wildlife relationship, most indigenous Africans do not consider wild animals as national treasures, rather they are viewed as predators of people and livestock and pests who raid and destroy crops (Johnson-Pynn, Morales-Murillo, Johnson, & Darden, 2012).Youth who are members of environmental clubs, however, have been shown to have more favorable attitudes towards wildlife than non-members (e.g., Wildlife Clubs of Kenya, Kassilly & Tsingalia, 2008), and they advocated for community-based conservation efforts that considered locals' concerns, a markedly different approach than the

fortress model of conservation with its haphazard park boundaries (Johnson-Pynn & Johnson, 2005, 2010).

Our previous research revealed that field trips to national parks and wildlife sanctuaries functioned as gate ways to environmental activism in Ugandan youth. Educational experiences in natural settings were shown to have the potential to increase youth's motivation to continue conservation efforts despite grave challenges to their school-based EE projects (Johnson-Pynn & Johnson, 2005; Johnson, Johnson-Pynn, Kityo, & Lugumya, 2013). At the same time, however, we found that Ugandan youth, though hungry for information, had a limited understanding of ecology. Although youth recognized the need to conserve wet lands, for example, they could not provide a scientific rationale. We concluded that making connections to relevant academic and vocational areas as well as a sense of place would be an educational strategy that may broaden youth's understanding that conservation is connected to the socio-cultural milieu. This approach advances EE in Uganda from a natural science curriculum to a framework for environmental studies.

The Current Study

Recognizing the importance of social and personal dimensions, or what Strife refers to as 'the human element' in EE program development, the current study aimed to meet Ugandan youth and community needs by providing a unique educational experience that complemented nationalized and standardized school science curricula. Youth participated in one of three EE workshops with university scientists to conduct biodiversity assessment of two national forests in central Uganda. Scientists mentored youth in field-based data collection methods in order to advocate for the preservation of these bio-diverse forests as important natural resources in the catchment region of Lake Victoria, the second largest lake in the world and the source of the Nile River. We utilized a pre-post-test design to measure the impact of workshop outcomes on youth's connection to nature, self-efficacy, and civic attitudes and skills, including leadership, interpersonal communication, and commitment to social justice (Strife, 2010, p. 180; see also Kyburz-Graber, R., Hofer, K., & Wolfensberger, B., 2006). More specifically, we predicted that youth's scores on standardized measures assessing these psychological constructs would increase following the workshops, and that greater numbers of field experiences with scientists would result in greater gains following workshops. We hypothesized that students who attended the workshop in the rural setting (i.e., within the park boundaries of a large forest reserve) would show more pronounced pre- to post-workshop impact in their connectivity to nature compared to those attending the workshop held in the urban setting (i.e., in a town adjacent to a small forest reserve). In contrast, we predicted that those students attending the urban setting workshop would show greater improvements in their civic attitudes and skills given the saliency of community-based work and volunteerism in the tourist, parks, and wildlife sectors.

Additionally, we sought to determine whether there were gender differences in workshop outcomes. There is evidence in some studies that females self-report more pro-environmental behavior compared to males (e.g., Tikka et al., 2000; Rickinson, 2001). There is also contradictory evidence that females are less likely than males to consider wildlife as valuable to the nation (Kassilly & Tsingalia, 2008).Thus far, however, findings on males' and females' conceptions of the environment, environmental knowledge and fears, and support for environmental protections are inconclusive (see Carrier, 2009 for a discussion of gender and EE). Given that societal roles in Uganda have strict gender divisions and that males have more opportunities for secondary education (i.e., high school) and recreational time outdoors, we predicted that male students would show greater gains in their connectivity to nature and their capacity to be civically engaged compared to female students. We expected that female students would show greater improvements in self efficacy compared to male students because of their experiences with EE professionals in our program, some of whom were females who did not

display typical gender roles (i.e., traditionally, primary responsibilities of females lie with maintenance of the home and family garden plot and caring for children). We reasoned that EE scientists and staff would be role models for all participants, but that females especially would report an increased sense of personal agency as a result of mentorship in science field-based activities outside their traditional social roles as homemakers.

Research Methodology

Participants and EE Workshops

Ugandan youth (67 males, 66 females) whose ages ranged from 16 to 24 years (M = 19.63 years) were recruited from secondary schools to participate in EE workshops. We point out that in contrast to youth in American high schools, the age range of youth in Ugandan secondary schools is generally higher because oftentimes youth's school is disrupted, delaying their graduation. This occurs for several reasons, including: 1) economic hardship, especially for females who assist in maintaining the home and subsistence farming plots; 2) civil unrest, which has resulted in abduction and forced conscription of youth as soldiers for rebel insurgent groups in neighboring Sudan and Democratic Republic of Congo; 3) transportation difficulties, which occur because many youth attend boarding schools as their home villages are too remote to maintain permanent schools.

We recruited youth to participate in one of three workshops, two of which were held in an urban setting at the Uganda Wildlife Education Center, next to Kitubulu National Forest, adjacent to Lake Victoria, and one that took place in a rural setting, the forest reserve Mpanga National Forest, which lies west of Uganda's capital city, Kampala. We requested that all participants be members of a national youth environmental organization, Wildlife Clubs of Uganda (hereafter WCU) for at least one year so that we could set a baseline for EE experiences prior to the workshop program. WCU's purpose is twofold, to raise awareness of the importance of conserving Uganda's wildlife and eco-systems and to promote sustainable development. WCU members engage in experiential and service learning activities that facilitate the development of self-determination and positive attitudes towards nature and conservation (Johnson-Pynn & Johnson, 2005, 2010). We desired WCU members as participants because we reasoned that apprenticeship with the university scientists would be more effective in the weekend immersion workshop format if youth had some prior knowledge of ecology and environmental issues in their communities.

Forty-nine participants who attended the Mpanga workshop either were not members of WCU or had recently joined the club, a situation that was beyond the researchers' control. (Mpanga is a remote location and not accessible to many WCU members). These youth participated in the same Mpanga workshop activities as the members (n = 12), but their data are not compared to participants attending the other workshops for several reasons: 1) they did not meet our criteria for baseline EE experience; 2) their pre-workshop scores were significantly lower for all measures; 3) their pre- to post-workshop data were significantly more variable than the members attending the other workshops (Levene's test, $p < .05$). Thus, in the remainder of this paper, we restrict our report to the 84 WCU members (43 males and 41 females) who had a year or more of active membership in club activities (Qualitative data from the entire sample of participants is reported in Johnson, Johnson-Pynn, Lugumya, & Kityo, 2013).

Given the challenges of conducting research in a developing country with little infrastructure, a lack of schools with a history of supporting academic research, and unfamiliarity of survey methods, it was not feasible to randomly sample from Ugandan schools or to include a control group in our study (see also Browne-Nunez & Jonker, 2008). A convenience sample was recruited from secondary schools in the Lake Victoria Basin region. The sample was generated from EE programs that were part of a larger study assessing biodiversity of forest reserves. It would not have been culturally appropriate to gather a sample of youth for the sole purpose of

administering surveys as a null treatment. This would be perceived as exporting data without consideration of benefitting the community, which is also inconsistent with the national body approving all research in Uganda, the Uganda National Council on Science and Technology.

EE workshops provided immersion field experiences based on constructivist and service learning pedagogies (Eyler, Root, & Giles, 1998). EE program objectives common to all workshops included: 1) enhancing youth's knowledge of local and global environmental issues; 2) providing opportunities for youth to be mentored by scientists and environmental educators; 3) engaging youth in service learning activities related to biodiversity assessment; 4) enhancing youth's pro-environmental attitudes and feelings of connection with nature; 5) increasing their self efficacy and perceived skills necessary for effective civic engagement, including environmental activism.

Two workshops were held at the Uganda Wildlife Education Center (hereafter UWEC) adjacent to Kitubulu National Forest. This forest reserve borders the northern part of Lake Victoria and is considered an urban forest due to its proximity to Entebbe town, the site of Uganda's international airport. Participants of Kitubulu I and II workshops resided in dormitories at UWEC and walked to Kitubulu forest (about a half mile from UWEC) for field experiences. A single workshop was held at Mpanga National Forest due to it being in a more remote, rural setting. Participants at this workshop camped in tents in the reserve, and all EE activities took place within the park borders. Workshops took place in the summer of 2007 at the end of the academic year. This time period happened to follow Uganda's first environmental protest that occurred in April as a response to the government's proposal to sell part of Mabira National Forest to a foreign company to plant a sugarcane plantation.

Instructional methods at all workshops included hands-on experience conducting meaningful biodiversity assessment field research under the mentorship of Makerere University scientists. In field research experiences, youth learned how to locate, identify, and assess the health of animal species, including monkeys, bats, rodents, birds, butterflies, reptiles, and also plants, including grasses, shrubs, trees, and medicinal plants. Youth were taught to assess water quality of Lake Victoria and Kitubulu Stream, and streams and swamps in Mpanga forest using methods that determined ph, turbidity, and the presence of micro-organisms. Recording observations and processing and categorizing samples were common activities.

Table 1 outlines the varied forms of programming at each of the three workshops. The number of field excursions differed depending on the length of the workshop as did evening programming. In the urban setting, we showed former Vice President Al Gore's award winning film *An Inconvenient Truth.* In this documentary, scientific evidence of climate change, which is often poorly understood due to its abstractness, was presented in humanistic and ecological contexts that facilitated knowledge acquisition and affective responses of viewers. In the rural setting, traditional drumming, song and dance were performance by local residents. The performance showcased Uganda's culture and wildlife, such as the totem animals of particular tribes, part of legends that may function to encourage natural resource balance, intercultural harmony and stewardship of nature (Robert Kityo, personal communication). Both the performance and film EE program formats encompassed personal, social, and cultural dimensions of environmental issues, which are more likely to engender understanding, personal meaning (Strife, 2010) and happiness (Zelenski & Nisbet, 2014), forming a pathway for motivation to work for the environment. All workshops included environmental based games, debates, and discussions of what youth learned from their field experiences and evening programming.

Data Collection Procedure, Measures, and Analysis

After arriving and being briefed about the schedule and rules, the workshop staff introduced the American researchers and their Ugandan colleagues who would be conducting the evaluation.

Youth who agreed to participate after reading and signing a consent form were given a survey containing four self report measures that have been used widely with U.S. samples, two pertaining to one's perceived relationship with the natural world and two related to one's perceived self efficacy and civic attitudes and skills.

Four measures were selected because together, they inform our understanding of the environmental attitude-behavior relationship, which is a multi-dimensional construct (Thapa, 2010). In order to understand how environmental concern and positive environmental attitudes shape and predict pro-environmental actions, we must examine not only an individual's relationship and connection to nature, but also her perceived competency to affect change in self and others (Strife, 2010).

Table 1. Characteristics of Three Environmental Education Workshops inTwo Forest Reserves of Central Uganda

Workshop Location and Length	Workshop Setting	Day Programming	Evening Programming	Participant Sample
Kitubulu I 3-day workshop at Uganda Wildlife Education Center (UWEC) adjacent to Kitubulu Forest Reserve	Urban setting; borders Lake Victoria; adjacent to school, fish processing plant, and flower farms; forms of encroachment include sand mining, washing bay for motor vehicles, and waste disposal	8 field experiences over 3 days; environmental games; presentation on the role of science in conservation initiatives	Film showing of *An Inconvenient Truth*, followed by group activity of making posters and discussing concerns raised by film; students stay overnight in dormitories at UWEC	*N* = 43 From 2 schools in Entebbe town
Mpanga 3-day workshop in Mpanga Forest Reserve	Rural setting; contains a swamp and stream; adjacent to an ecotourism site; forms of encroachment include poaching and tree harvesting	7 field experiences over 3 days; environmental games; presentation on the role of science in conservation initiatives	Traditional drum-ming and dance performance by residents of the local village; discussion of sustainable development and eco-tourism; students stay overnight in tents in forest reserve	*N* = 12 (49 excluded from analysis) From 2 schools in Mpambire village
Kitubulu II 2-day work-shop; same location as Kitubulu I	Same as setting as Kitubulu I	3 field experiences over 2 days; environmental games; presentation on the role of science in conservation initiatives	Film showing of *An Inconvenient Truth*, followed by discussion; students stay overnight in dormitories	*N* = 29 From 1 school in Entebbe town

Two measures assessed an individual's relationship with the natural world. The Inclusion of Nature in Self Scale (hereafter INS; Shultz, 2001) is a series of seven Venn diagrams consisting of different levels of relationships between self and nature. Respondents are asked to choose one of the seven Venn diagrams that best indicate their interconnectedness to the natural world, with scores ranging from one (no relationship between self and nature; circles are adjacent to each other) to seven (highly immersed between self and nature; circles overlap completely). The Connectedness to Nature Scale (hereafter CN; Mayer & Frantz, 2004) is a 14 item Likert-scale questionnaire with scores ranging from one (strongly disagree) to five (strongly agree). The CN includes items such as, "I often feel disconnected from nature," and "I often feel a kinship with animals and plants."

Two measures assessed a person's perceptions of agency, social competencies and dispositions. The General Self Efficacy Scale (hereafter GSE; Schwarzer & Jerusalem, 1995) is a 10 item Likert-scale questionnaire that measures an individual's general sense of self efficacy. Respondents indicate if items are "not at all true" (score of 0); "sometimes true" (= 1); "usually true" (= 2); or "exactly true" (= 3). GSE items include, "I am confident that I could deal efficiently with unexpected events" and "I can solve most problems if I invest the necessary effort." The Civic Attitudes and Skills Questionnaire (hereafter CASQ; Moely, Mercer, Illustre, Miron, & McFarland, 2002) consists of 44 items measuring an individual's leadership and communication skills and dispositions towards diverse peoples and social justice. The items are grouped into six subscales assessing an individual's: 1) Civic Action, interest in becoming more involved in the community (e.g., "I plan to become more involved in programs to help clean up the environment."); 2) Interpersonal Problem Solving, ability to work with others to listen and communicate with others to solve problems (e.g., "I can communicate well with others."); 3) Political Awareness, knowledge of local and global political issues (e.g., "I am aware of the events happening in my local community."); 4) Leadership Skills, ability to be an effective leader (e.g., "I have the ability to lead a group of people."); 5) Social Justice, belief regarding poverty and misfortune and solutions to these social ills (e.g., "We need to change people's attitudes in order to solve social problems" and reverse coded items, "People are poor because they choose to be poor."); 6) Diversity Attitudes,attitudes towards relating to culturally different people (e.g., "I enjoy meeting people who come from backgrounds very different from my own."). The Likert-based responses include, 1 = Disagree strongly, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Agree strongly.

Additionally, there were two questions that asked participants to indicate their level of WCU involvement (0 = not at all; 1 = fairly active; 2 = regularly active; 3 = very active; 4 = extremely active, with leadership roles) and hours per week of club activity (0 = < 1; 1 = 1-3; 2 = 4-6; 3 = 7-9; 4 = 10-12; 5 = > 12).

The researchers instructed participants to complete the survey independently, but they were permitted to ask clarification questions related to the items on the measures. This is because the wording was English, which although most secondary students in Uganda are fairly competent in reading and writing, there remain language barriers. Moreover, the majority participants were not experienced at completing survey type assessments. The same procedure was followed to collect post-workshop data.

Four separate Mixed Design ANOVAs, one for each of the four measures (GSE, CASQ, INS, CN), were used to determine if participants' scores improved from pre- to post-workshop (within subjects variable) and whether there were differences between males and females. Two additional between subjects variables related to workshop program format included length (two day, three day) and setting (urban, rural). The CASQ grand mean scores were used when participants were compared according to workshop length and setting. Pairwise comparisons were used to determine if there were significant differences between the six subscales of the CASQ when comparing the pre- and post-workshop scores for the entire sample. Eta squared (n^2)

was used to report effect sizes for all significant results and to control for sampling error attributed to differences in sample sizes between comparison groups.

Results

Participants averaged being WCU members for 2.62 years, with most falling in the 1-5 year range. There were several who had been members since primary school (8-11 years). As shown in Table 2, there were no differences in the level of club involvement between participants attending the different workshops (ANOVAs, $p > .05$) or hours per week spent in WCU activities. Participants reported being "regular, fairly active members"or "very active members" (scale values 3 and 4, respectively) and averaged 1-3 or 4-6 hours per week in club activities (scale values 1 and 2, respectively).

Table 2. Wildlife Clubs of Uganda Members' Levels of Involvement

Workshop Program	Club Activity (scale 0-4) M (SD)	Hours per Week (scale 0-5) M (SD)
Kitubulu I (n = 43)	2.81 (.83)	1. 52 (1.11)
Kitubulu II (n = 29)	2.72 (.92)	1.54 (.88)
Mpanga (n = 12)	3.00 (.74)	1.58 (.90)

Note. Club Activity (0 = not at all; 1 = fairly active; 2 = regularly active; 3 = very active; 4 = extremely active, with leadership roles) and Hours per Week (0 = < 1; 1 = 1-3; 2 = 4-6; 3 = 7-9; 4 = 10-12; 5 = > 12). Forty-nine non-Wildlife Clubs of Uganda members at Mpanga workshop were excluded from analysis because they did not meet our criteria of being a member for at least one year, and their data were significantly different from members' data.

Overall, WCU member participants rated their connectedness to nature, self efficacy, and civic attitudes and skills as being strong, with grand means for two measures being close to the high ends of the scales (INS, GSE), and the other being above neutral (CN, CASQ). Pre-workshop scores reflected a range of responses, including those closer to the low end of the scales. Post-workshop scores, on the other hand,tended to be in the middle to high range of scores for the measures.There were significant increases from pre- to post-workshop in three of the four measures (all but CN), and on two of the six CASQ subscales, Political Awareness and Leadership Skills (See Table 3). In the following sections, we provide results for participants' pre- and post-workshop scores for the nature and dispositions measures for the three between subjects variables: workshop length, setting and gender. We note that discrepancies in the degrees of freedom indicate missing data for some of the 84 participants.

Workshop Length

As shown in Table 4, workshop length differentially affected participants' ratings on the nature measures following EE workshops. For the INS, participants rated their self-nature relationship higher if they completed the 3-day compared to the 2-day workshop, F (1,75) = 6.15, p = .02, n^2 = .10. Similarly, there was a significant increase from pre- to post-workshop on the CN scale for the 3-day workshop, but scores decreased significanlty from pre- to post-workshop in the 2-day format, F (1,75) = 5.64, p < .0001, n^2 = .21. Scores were in the expected direction for both disposition measures and workshop length formats, but only the CASQ showed significant increases in the 3-day format, F (1, 80) = 7.72, p =.01, although the magnitude of the effect was small, n^2 = .09.

Table 3. Members'AttitudesTowards Nature and Their Social Competencies Before and After Environmental EducationWorkshops

Measure (scale range)	Pre-workshop M (SD)	Post-workshop M (SD)
INS (1-7)	5.76 (.25) *	6.52 (.16) *
CN (1-5)	3.72 (.43) ns	3.71 (.44) ns
GSE (0-3)	2.12 (.41) +	2.23 (.41) +
CASQ (1-5)	3.89 (.36) +	4.01 (.35) +
Civic Action	4.55 (.07) ns	4.55 (.08) ns
Interpersonal Problem Solving	4.09 (.09) ns	4.18 (.09) ns
Political Awareness	3.39 (.14) *	3.69 (.12) *
Leadership Skills	3.74 (.11) +	3.97 (.10) +
Social Justice	3.75 (.08) ns	3.77 (.07) ns
Diversity Attitudes	3.74 (.14) ns	3.95 (.12) ns

Note. An asterisk (*) denotes p< .01, and a plus sign (+) denotes p< .02; ns is a non-significant difference.

Table 4. Workshop Length: 2-day vs. 3-day program format

Measures (scale range)	Pre-workshop M (SD)	Post-workshop M (SD)
Nature measures:		
INS (1-7) +		
2-day	5.71 (.27)	5.19 (.17)
3-day	5.79 (.21)	6.56 (.13)
CN (1-5) *		
2-day	3.50 (.36)	3.24 (.27)
3-day	3.80 (.42)	3.90 (.39)
Disposition measures:		
GSE (0-3) ns		
2-day	1.88 (.36)	2.00 (.37)
3-day	2.24 (.39)	2.35 (.41)
CASQ (1-5) *		
2-day	3.86 (.39)	3.90 (.39)
3-day	3.91 (.34)	4.09 (.33)

*Note.*Significant interaction effects, 2-way ANOVA (pre- post-workshop X workshop length) are denoted by an asterisk (*) $p< .01$, and a plus sign (+) $p< .05$; ns is a non-significant difference.

Workshop Setting

As shown in Table 5, scores increased similarly from pre- to post-workshop in both rural and urban settings in all but one measure, CN, where the mean score increased significantly in the rural setting and decreased significantly in the urban setting, $F(1,75) = 4.74$, $p = .03$. This difference, however, was not substantial in that the magnitude of the effect was small, $n^2 = .06$.

Table 5. Workshop Setting: rural vs. urban program format

Measures (scale range)	Pre-workshop *M* (*SD*)	Post-workshop *M (SD)*
Nature measures:		
INS (1-7)ns		
Rural	5.90 (1.7)	6.82 (.97)
Urban	5.71 (1.3)	6.23 (.71)
CN (1-5) +		
Rural	3.84 (.39)	4.10 (.34)
Urban	3.69 (.44)	3.64 (.50)
Disposition measures:		
GSE (0-3) ns		
Rural	2.24 (.30)	2.39 (.41)
Urban	2.09 (.43)	2.21 (.41)
CASQ (1-5)ns		
Rural	3.91 (.30)	4.10 (.35)
Urban	3.88 (.37)	3.98 (.36)

*Note.*A significant interaction effect, 2-way ANOVA (pre- post-workshop X workshop setting) is denoted by a plus sign (+) $p < .05$; ns is a non-significant difference.

Table 6. Males' and Females' Connections to Nature Were Impacted Differently by Environmental Education Workshops

Measures (scale range)	Pre-workshop *M* (*SD*)	Post-workshop *M (SD)*
Nature measures:		
INS (1-7)		
Males	6.00 (.30)	6.62 (.19)
Females	5.50 (.39)	6.42 (.25)
CN (1-5) *		
Males	3.73 (.43)	3.84 (.53)
Females	3.70 (.44)	3.56 (.42)
Disposition measures:		
GSE (0-3)		
Males	2.16 (.37)	2.25 (.38)
Females	2.07 (.47)	2.21 (.45)
CASQ (1-5)		
Males	3.96 (.33)	4.11 (.36)
Females	3.82 (.38)	4.10 (.35)

Note. An asterisk (*) indicates a significant interaction effect, $p < .02$, 2-way ANOVA (pre-post-workshop X gender).

Gender Differences in Program Impact

Males' and females' scores were impacted differently in that males' connections to nature increased, whereas females reported a decrease in connection to nature. In the other measures, the genders showed similar increases following EE workshops (See Table 6). Closer inspection of these findings revealed that although females' scores declined, the difference was not significant. Males' scores, on the other hand, increased significantly in the 3-day workshop format, F (1, 75) = 5.64, p = .02, although the increase was not substantial, n^2 = .07 (See Table 7). Workshop setting differentially affected males' and females' reported self efficacy before and after the workshops. Males' GSE scores increased, but not significantly in urban or rural settings. Females' scores decreased significantly following EE workshops in the rural setting, F (1, 80) = 5.21, p = .02, although not to a great degree, n^2= .06 (See Table 8). We note that the Greenhouse Geisser correction was applied because females' scores were significantly more variable than males' in the rural setting for the GSE measure.

Table 7. Males' Connection to Nature Benefitted in the 3-day Workshop Format

Workshop Participant Group	Pre-workshop *M* (*SD*)	Post-workshop *M (SD)*
2-day (n = 29)		
Males	3.47 (.40)	3.17 (.23)
Females	3.52 (.35)	3.28 (.29)
3-day (n = 55)		
Males	3.84 (.40) *	4.12 (.34) *
Females	3.85 (.46)	3.79 (.38)

Note. The CN scale ranges from 1 (strongly disagree) to 5 (strongly agree). An asterisk (*) indicates p< .02, 3-way ANOVA (pre- post-workshop X length X gender).

Table 8. Females' Self Efficacy Decreased in the Rural Setting Workshop

Workshop Participant Group	Pre-workshop *M* (*SD*)	Post-workshop *M (SD)*
Rural (n = 12)		
Males	2.25 (.29)	2.52 (.21)
Females	2.22 (.35) *	2.12 (.61) *
Urban (n = 72)		
Males	2.14 (.38)	2.19 (.38)
Females	2.05 (.48)	2.22 (.44)

Note. The GSE scale ranges from 0 (strongly disagree) to 3 (strongly agree). An asterisk (*) indicates p< .02, 3-way ANOVA (pre- post-workshop X setting X gender).

Discussion

Collectively, results from our evaluation of EE workshops show that Ugandan students gained in connections to nature, as well as civic attitudes and skills to work towards environmental conservation and sustainable development, elements necessary to develop environmentally literate and responsible citizens. Students' expressed gains in their ability to solve problems, attain goals, and work collaboratively are common outcomes in programs utilizing an

experiential service learning approach (Billig, 2000; Covitt, 2002; Flanagan & Van Horn, 2001). This has been documented in international research as well (Johnson, Johnson-Pynn, & Pynn, 2007; Johnson-Pynn, Johnson, Sweeney, Hamblin, & Anglin, 2010; Schneller, 2008). In their EE field experiences, students were cooperating with scientists to collect data so that biodiversity in the forest reserves could be documented. This workshop component was supported by a Conservation Trust Grant from The National Geographic Society to the administrators of the workshops. The youth recognized that their service was not only for scientific and conservation stakeholders, but also an expressed need by local communities who planned to use this information to advocate for maintaining the protected status of these forests, which were currently under threat of being degazetted by the Ugandan government. Biodiversity assessment of the forests through experiential service learning is authentic in its relevance to Uganda's natural resources and ultimately to the viability of youth's tribes and villages.

Taken together, the results for the CASQ indicate an increase in civic attitudes and skills. Except for Civic Action, which remained the same following the EE workshop, all of the scores on the other subscales increased. Only Political Awareness and Leadership Skills, however, showed statistically significant gains. This could be because of the salience of an ongoing public-government standoff over selling part of Mabira National Forest to a foreign owned sugar cane production company. Just a month prior to the EE workshops, Uganda had its first public environmental protest over this issue. The demonstration turned violent, as clashes between protestors displaying posters, police wielding tear gas and clubs, and army soldiers in tanks roused a fury of arson, looting, and stoning, resulting in three deaths. This incited environmental debate in the Ugandan media, with citizens voicing their opinions on talk radio, in the newspapers, and public meeting venues. Mabira Forest was supposed to be one of the field sites for our EE workshops, but we had to cancel because of the Ugandan President's orders to close the forest to the public temporarily. Participants at all workshops brought up this topic in discussions. The youth voice on this issue could also explain why Civic Action remained unchanged after the workshop. This was the highest scored subscale, and youth may have perceived themselves to be civically engaged, indicating a possible ceiling effect on this measure. Nonetheless, these findings are encouraging because some have argued that communication and collective efficacy may be as much or more important than private actions in affecting environmental change (Chawla & Cushing, 2007; Gardner & Stern, 2002).

Despite our participants' expressed motivation for environmental protection, it could be the case that the disadvantaged youth in our study will not exhibit the same high levels of conservation behavior as disadvantaged youth in other countries because social conventions restrict them from doing so. Obedience to one's parents and community elders, authority figures in Ugandan society (i.e., authoritarian parenting style), may trump the youth voice that is encouraged in cultures where the childrearing style encourages independence and self expression (i.e., authoritative parenting style). Chawla and Cushing (2007) make the case that authoritative parenting models the democratic process, providing a platform for political action and self determination that are crucial for environmental protection. Our finding that social justice ranked low in the CASQ scales and showed no significant gain, and that Political Awareness, although increasing significantly, was reported the lowest scores both pre- and post-workshop, which makes sense when one considers that Uganda is a relatively new democracy, emerging from the brutal dictatorships of Idi Amin and Milton Obote that spanned nearly three decades. Differences between American and Ugandan youth's perceived social competencies and civic identity may be attributed to different conceptions of social responsibility. In American society, children and youth are socialized to confront inequities, while in Uganda, collectivist ideals are valued, and social responsibility is an imperative.

Contrary to what we expected, female students' self-efficacy did not improve more so than male students. The lack of any pervasive gender difference in self efficacy may be because the scientists, who are familiar with educating males and females in a university setting, were

more deliberate in instructing, modeling, and reinforcing youth without gender biases. Females' self efficacy, however, did decrease in the rural setting. We speculate that this is due to the harsher conditions of residing and working in Mpanga forest. Most Ugandan females are not accustomed to camping or strenuous activities in the forest (although most engage in other physically demanding activities like gathering wood and water, and farming families' subsistence plots), and they may have experienced fatigue and doubted their capabilities.

Notable increases in the INS measure, however, indicate participants' increased affinity with their natural surroundings. D'Armaoto and Krasny (2011) report a similar experience with youth in outdoor adventure courses who mentioned that the wilderness ignited discrepant thoughts and unpredictability, followed by reflection, a newfound understanding of ecology, and motivation to protect the environment. Responses on the CN measure were less conclusive. Males'connection to nature increased, and even more so in the three day workshop format; whereas, females reported less connectivity to nature in the rural workshop setting. Our explanation of why females' connection to nature scores decreased is similar to what Smith-Sebasto and Cavern (2006) suggest might happen in a residential EE outdoor program. That is, a naïve favorable impression of the outdoors can become dampened by the challenging reality of adapting to non-appealing conditions, such as the physical demands of extensive hiking and waiting required to track animals, conducting observations during thunderstorms, and collecting samples from expansive stretches of forest and water catchment areas. Male students in our study may have shown marked increases in their connection to nature because the frequency and setting of field experiences was more consistent with their prior experiences in natural settings as well as their learning preferences, which favor action-based, student-centered lessons. This explanation is consistent with research showing that male students benefit from authentic outdoor lessons compared to traditional teacher-centered classroom settings (Carrier, 2009).

Items on the CN scale may be interpreted differently, both by males and by Ugandan youth in general compared to U.S. samples. To illustrate, the items, "I recognize and appreciate the intelligence of other living organisms" and "When I think of my place on Earth, I consider myself to be a top member of the hierarchy that exists in nature" may be construed differently by Ugandan youth. For one, there is no uniformly agreed upon conceptualization of intelligence in Western cultures, and secondly, it could be the case that cultural understanding of living creatures does not impart (or emphasize) intelligence of organisms as a value. The notion of a hierarchy in nature could also be fraught with ambiguity because of its association with both cultural beliefs and traditions (e.g., as represented in legends and folktales that are various orders of the natural world) and religious beliefs (e.g., the "Great Chain of Being" viewpoint expressed in some Christian faiths). In contrast, the item "I think of the natural world as a community to which I belong" may have more cross-cultural equivalence in meaning. Achieving equivalence of meaning in a culture's interpretation of measurements (external validity) and in the measurements themselves (internal validity) is paramount for understanding people's attitudes towards the environment. Differential responses to the nature measures may not have occurred had we selected typical assessments of a pro-environmental orientation, or those focusing on resource use, pollution, and land and water quality, but we thought it was important to attempt to gain insight into the deeper, emotive qualities of human-nature interactions (see Khan, Ruckert, Severson, Reichert, & Fowler, 2010 for a similar assertion).

Exporting survey research methodology to other cultures also has potential to inform the reliability of our research methods if we consider issues such as interview training, sampling techniques, and documentation of non-response and response biases (Heath Fisher, & Smith, 2005). There are great challenges in adhering to rigorous methodology in developing countries. Researchers are often dependent on locals to recruit samples and arrange data collection sites, which lack the control possible in other settings. The lack of infrastructure and the desire to be culturally sensitive impacts procedural aspects of research such as travel (e.g., roads may close due to poor conditions; rebel insurgents in the area may restrict travel to an area) and data

collection (e.g., a focus group interview of 10 youth can quickly turn into a spectacle with many villagers gathering to observe and sometimes join the group). In the case of the current study, the lack of a control group (i.e., a sample that received no 'treatment' or EE workshop) limits claims that we can make regarding the effectiveness of EE program workshops on youth's ratings of their self efficacy, civic engagement, and connectivity to nature.

Nonetheless, we should strive for high standards that we expect from research in the U.S. We should continue to champion research that accounts for respondents' diversity and considers the diversity of EE programs as well. There is no one size fits all approach to EE. O'Donoghue (2006) implores that pedagogies should be "contextually-constituted and historically informed" and that we should not assume that peoples' conception of the environment is the same. Geographical and cultural contexts should inform EE program formats and best practices. For most Ugandan youth, appreciative activities like bird-watching and hiking are less common than consumptive ones such as hunting and fishing. Positive effects on environmental attitudes and behaviors after mentoring with scientists in the field align with U.S. recreationists showing greater environmental concern and action if their most important activities were appreciative rather than consumptive (Thapa, 2010).

Ecological Considerations of EE in Uganda, East Africa

Unarguably, the African continent is comprised of economically marginalized nations, and its indigenous peoples are not the chief beneficiaries of globalization (The World Bank, 2011). The marked challenges that most Africans face, including feeding their families, caring for those afflicted with diseases, and supporting their children's education, are socio-cultural and ecological-specific situations. We agree with Strife (2010) that'profit, planet, people,'pedagogy, which is centered on a human benefits approach that imparts positive, but informative messages, may be a successful way to reinvigorate support for EE by schools and governments in Western countries, however, this may not be a relevant EE approach for those living in developing countries. Reframing EE as a means to spurring green technology and businesses and improving and safeguarding children's health is more applicable to industrialized nations with greater purchasing power and educated citizens who can garner both natural and human resources to become more sustainable. Ugandans, like many Africans, are living in poverty, which dampens their capacity to be global players in the green movement.

Notwithstanding, the rise of recreation and tourism in Uganda presents opportunities to develop environmental consciousness towards resource management and sustainable development in its populace. If Ugandan youth are afforded more opportunities for nature activities with role models, such as parents, teachers, or community leaders, they may be more likely to take an interest in the environment, join an environmental club, and further their knowledge about environmental issues, all of which have been shown to be antecedents of pro-environmental behavior and activism in youth (Chawla & Cushing, 2007). In fact, the scientists in our study referred to childhood experiences as being influential in their education interests and career choices, which is a common finding in retrospective research on peoples' significant life experiences and environmentalism (Chawla, 2007).

Conclusion

A general outcome of our study of EE for Ugandan youth is that science literacy arouses and ethic of taking care of natural places. Scientific exploration in natural settings is less constrained by boundaries that are often present in conscripted classroom-based EE activities. This, in turn, raises the possibility for emancipatory learning, which has high student engagement and choice (Wals, Geerlin-Eijiff, Hubeek, van der Kroon, & Vader, 2008), as well as transformative learning (O'Sullivan & Taylor, 2004), in which beliefs are modified because of novel and profound experiences that provoke analytical thinking and socio-cognitive reorganization. We maintain

that youth should be given opportunities to improve their science literacy through educational field experiences in natural environments to promote inquisitiveness, tenacity, and insightful thought, qualities that are not only essential for sustainable thinking, but also for civic engagement and leadership that will ultimately be essential for addressing environmental problems (Sterling, 2010) . Mentorship and inquiry-based field experience models of EE service learning have the power to mold character, work ethic, ingenuity, and resourcefulness, engendering youngsters to pursue lives of purposeful passion and environmental citizenship.

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