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Promoting Health-related Quality of Life in Minority Youth through Environmental Education and Nature Contact

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Abstract: Few studies have examined the relationship between environmental sustainability education and health outcomes in youth. The purpose of this study was to examine health-related quality of life over a 13-week time period in a sample of urban minority youth who participated in an environmental education program with a nature contact component. Health-related quality of life (HRQoL) was measured using a survey comprising five items (physical activity, emotional functioning, school functioning, family support, and social functioning). The overall HRQoL score was determined as the sum of the scores on the five items, with higher scores indicating better HRQoL. A pre-test/post-test within-subjects study design was used to evaluate changes in HRQoL. A total of 53 students (ages 10 to 14 years) participated in the environmental education intervention; 46 (87%) of those students completed HRQoL questionnaires before and after the program. There were statistically significant improvements in overall HRQoL scores and in the family support HRQoL domain scores. Engaging in the natural environment through environmental education may promote HRQoL in youth. Larger, prospective studies are warranted to further investigate these initial findings.

Keywords: health-related quality of life; nature contact; environmental education; sustainability; children; environmental justice

1. Introduction

In the United States, awareness of environmental issues among youth has decreased since the mid-1970s [1]. Nature-deficit disorder, a term coined to describe youths' decreasing interaction with nature, is thought to be associated with this decline in environmental awareness [2]. Concern about declines in environmental exposure and awareness have led to increased research on environmental education for youth [2,3]. Environmental education studies have examined a variety of outcomes, including whether these educational initiatives influence youth attitudes towards the environment, eco-affinity, environmental knowledge, and whether environmental education increases youth exposure to the natural [4]. Several studies have reported racial and ethnic disparities in environmental awareness and concerns, with white students exhibiting higher levels of eco-awareness than their black counterparts [4].

In addition to disparities in environmental education, there are well-documented racial disparities in access to and contact with nature [5–7]. African American youth have been reported to experience less exposure to the natural environment than white youth [4]. There is also evidence that, compared to high-income populations, residents of low-income households and neighborhoods have unequal access to the natural environment [8,9]. These disparities in nature contact may have implications for inequalities in youth behavior, personal skills, and overall health [10–13]. Nature contact has proven to be beneficial in youth development and social change [10]. Furthermore, there is a growing body of evidence that increasing youth's nature contact reduces their risk for mental health disorders, such as depression, anxiety, and ADHD, especially among lower socioeconomic groups [14–16].

Interaction with nature has shown to be a sustainable and practical method for promoting health as well as better physical, emotional, and mental well-being for youth [10,12,16]. Increased time spent outdoors in nature has been observed to be positively associated with increased physical activity, which in turn reduces health risks associated with inactive lifestyles [17]. Physical activities while being in contact with nature, such as hiking and canoeing, have been associated with greater physical and mental health benefits than traditional forms of exercise [18,19]. Increased time spent outdoors has also been associated with decreased levels of obesity through increased physical activity [19–21]. It has also been proposed that nature contact may aid learning and improve social connections [22]. Because adults often facilitate youth's leisure activities through school and family activities [23], nature contact may improve social connectedness and support at school and at home with family.

When given access to outdoor environmental opportunities, African American and Hispanic youth are able to improve their eco-awareness and environmental knowledge [4]. Thus, it is reasonable to hypothesize that the benefits associated with environmental education may be strengthened by time spent in nature [24]. There is a paucity of studies on the relationships between environmental education and health outcomes in minority youth, including physical, social, and psychological well-being. Here, we present the results of a pilot study designed to evaluate the impact of a nature contact and environmental education program on the well-being of urban minority youth in St. Louis, MO, USA.

2. Methods

2.1. Environmental Education Intervention

An environmental sustainability educational program was developed to expose low-income minority students in St. Louis, Missouri to environmental issues and activities. During the 2017–2018 academic year, the program was administered to students of three elementary schools in the St. Louis Public School (SLPS) District, the largest urban public-school district in the St. Louis metropolitan region. At each of the three schools, more than 95% of students were eligible for free meals through the National School Lunch Program and the School Breakfast Program. The majority of participants in the program were African American (89%) and Hispanic (8%).

The educational program ran continuously throughout the school year and incorporated three key elements: (1) a weekly STEM-based environmental classroom activity, (2) a monthly nature-based outdoor activity, and (3) academic year-round mentoring by local university students. Each week, the university student mentors visited the classroom and taught a hands-on, environmental lesson developed to match the students' classroom STEM curricula. Table 1 provides an overview of program topics and activities. Weekly topics included ecosystems, geology, agriculture, gardening, sustainability, global warming, and climate change. Four monthly nature-based outdoor outings were created to augment the weekly programming. These nature-based outings included trips to local farms, hiking in state parks, rock climbing, and canoe trips down the Mississippi River. These outdoor adventures not only reinforced classroom learning and provided context for earlier classroom activities, but they also enabled the students to further develop relationships with their classmates and university student mentors, learn outdoor skills, develop leadership skills, develop environmental and conservation awareness, and ultimately change their perception of science and the environment around them.

Table 1. Program topics and activities.

Fall Semester 2017		Spring Semester 2018
Week	Weekly Curriculum Topics	
1	Introductions & tent set up	Fall Topics Review
2	Leave No Trace Principals	Introduction to Climatology
3	Reduce, Reuse, Recycle	Winter & Hibernation
4	Introduction to Pollution	Introduction to Climate Change
5	Pollution Review & Trash Cleanup	Spring Weather & Plants
6	Habitats and Ecosystems	Birds & Migration
7	Food Web	Pollination & Seeds
8	Water cycle	Agriculture & Affects
9	Rivers & Geomorphology	Climate Change Review & Non/Renewable Energy
10	Geomorphology & Geology	Environmental Current Events
11	Earth History	Your Environmental Impact
12	Cartography	Year Topic Review
13	Fall review and conclusion	Graduation
Month	Monthly nature-based activities	
1	Canoe Trip	Science Museum
2	Cave Tour & Riverside Hike	Bird Sanctuary & Hike in Local State Park
3	Overnight Camping Trip	Urban Farm Tour
4	Indoor Rock Climbing	Overnight Camping Trip

2.2. Study Design and Participants

A pre-test, post-test study design was undertaken to evaluate health-related quality of life during the environmental education intervention. This design was used because random assignment of students was not possible, as the intervention was administered to students within intact class groups. A 28-item, self-administered questionnaire was administered to youth participants before the commencement of the program (pre-intervention) and after the completion of the program (post-intervention). The questionnaire collected information about age, gender, past environmental science and outdoor activity experiences prior to entering the program, general attitudes towards science, and environmental sustainability awareness. The questionnaire also included validated items about health-related quality of life (HRQoL) [25–27]. The questions evaluated HRQoL in five domains: physical activity, emotional functioning, school functioning, social functioning, and family support. Responses to these questions were assessed using 5-point Likert-type scales ranging from 1 to 5, with lower scores indicating better HRQoL.

A total of 53 SLPS students participated in this pilot study. Data were collected from January 2018 to May 2018 (Spring semester 2018), and the mean time between pre- and post- intervention survey administration was 13 weeks. The Institutional Review Board at Washington University in St. Louis deemed the study exempt from review, as youth questionnaire data were de-identified prior to analysis.

2.3. Statistical Analysis

HRQoL items were reverse-scored and transformed to a 0–100 linear scale (1 = 100, 2 = 75, 3 = 50, 4 = 25, 5 = 0), so that higher scores indicate better HRQoL. An overall score was determined by summing the scores of all five domains. Mean and median scores were determined for each of the five domains and the overall score. For each domain and the overall score, the Wilcoxon signed-rank test was used to determine whether there was a significant change in scores from pre-intervention to post-intervention. All tests were two-sided, and a *p*-value of less than 0.05 was considered to indicate a statistically significant difference. All statistical analyses were conducted using SAS version 9.4 (SAS Institute Inc., Chicago, IL, USA).

3. Results

3.1. Participant Characteristics

A total 53 students, ranging from 10 to 14 years old, participated in the program during the study period. Approximately 96% of the population were racial/ethnic minorities, and 60% of the study population were female. All participants completed the pre-intervention questionnaire; however, seven participants did not complete the post-intervention questionnaire (Table 2).

Table 2. Characteristics of the study population (n = 53).

Characteristic	n	%
Race/Ethnicity		
African American	47	88.7
Hispanic	4	7.5
White	2	3.8
Gender		
Female	32	61.5
Male	21	38.5
Age (years)		
10	10	18.9
11	26	49.0
12	14	26.4
13	1	1.9
14	2	3.8
Completed post-intervention questionnaire	46	86.8

Figure 1 presents the environmental science and outdoor activity experiences in the past year prior to the pre-intervention questionnaire. Before the environmental education intervention, approximately 49% of the students had not visited a zoo, 32% had not visited a science museum, 20% had not visited a park, 45% had not visited a garden in the past year, and 66% of the students had not met a scientist.

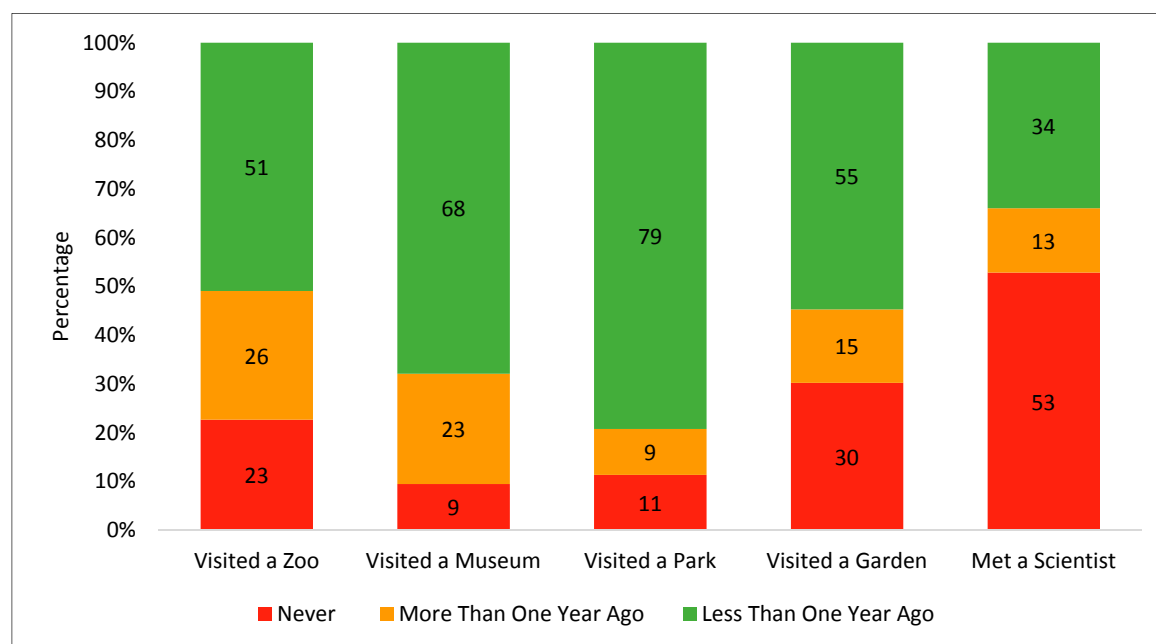


Figure 1. Environmental experiences prior to the education intervention (n = 53).

Student responses to Likert-scale statements about science and environmental sustainability awareness are presented in Table 3. Most students had a high awareness and personal connection to

local science and sustainability issues before the intervention. For example, the proportion of students who had positive (strongly agree or agree) responses to these statements ranged from 65% to 80%. The prevalence of positive responses was higher after the intervention; however, these increases were only significant for the “Science is important in my daily life” statement (Table 3).

Table 3. Science and environmental sustainability awareness at pre- and post-intervention (n=46).

Statement	Pre-Intervention		Post-Intervention		p-Value ^b
	Strongly Agree/Agree (%)	Mean ^a (SD)	Strongly Agree/Agree (%)	Mean ^a (SD)	
Scientists are active in the community.	67.4	3.9 (1.2)	84.8	4.0 (0.9)	0.67
Scientists are trying to solve problems that are important to me.	65.2	3.8 (1.3)	84.8	4.1 (0.8)	0.18
Science is important in my daily life.	67.4	3.5 (1.2)	84.8	4.0 (0.9)	0.03
Sustainability is important in my daily life.	71.7	3.9 (1.3)	93.5	4.2 (0.6)	0.27
Science is important for the problems in our world	80.4	4.0 (1.1)	90	4.1 (0.9)	0.46

^a Responses based on 5-point Likert scale (1 = strongly disagree, 5 = strongly agree. ^b p-values were derived from the Wilcoxon signed-rank test. Bold type indicates statistical significance at $p < 0.05$.

3.2. Health-Related Quality of Life

Table 4 presents the overall and domain-specific health-related quality of life scores at pre-intervention and post-intervention. Physical activity scores at pre-intervention were not statistically different from physical activity scores at post-intervention. Mean and median scores at pre-intervention and post-intervention were also not statistically different for the emotional functioning, school functioning, and social functioning domains (all $p > 0.10$). However, the family support scores at post-intervention were significantly higher than family support scores at pre-intervention ($p < 0.001$). For the Overall HRQoL score, both the mean and median score was significantly higher at post-intervention than at pre-intervention ($p < 0.01$). These results did not differ by gender, age, race, or school site.

Table 4. Health-related quality of life scores at pre- and post-intervention (n = 46).

Domain	Pre-Intervention		Post-Intervention		p-Value *
	Mean (SD)	Median	Mean (SD)	Median	
Physical Activity	73.6 (35.2)	100.0	74.4 (31.0)	75.0	0.83
Emotional Functioning	63.2 (32.7)	75.0	69.0 (31.2)	75.0	0.36
School Functioning	72.2 (26.7)	75.0	78.2 (28.7)	75.0	0.10
Social Functioning	58.0 (32.1)	75.0	65.8 (35.5)	75.0	0.18
Family Support	24.5 (30.4)	50.0	53.2 (37.9)	75.0	<0.001
Total Overall Score	292.5 (77.8)	300.0	340.7 (81.8)	350.0	<0.01

* p-values were derived from the Wilcoxon signed-rank test. Bold type indicates statistical significance at $p < 0.05$.

4. Discussion

In this pilot study of urban, minority youth, we evaluated health-related quality of life before and after the implementation of an environmental sustainability education program with a nature contact component. We observed that overall health-related quality of life scores were significantly higher after participation in the program. We also observed higher post-intervention scores in the family support health-related quality of life domain. Although we observed post-intervention increases in mean scores for the physical activity, emotional functioning, school functioning, and social functioning domains, these increases were not significant.

Overall HRQoL scores increased after the environmental education intervention. A growing body of research has shown that environmental education increases nature contact as well as environmental awareness, environmental knowledge, and environmental affinity [1–4]. One study conducted on youths’ environmental orientation found that after an environmental education intervention, more than

three-quarters of the youth claimed the program changed the way they felt about nature and increased their desire to go outside [4]. Furthermore, there is a substantial body of evidence supporting strong associations between nature contact, physical activity, and improved physical and mental health [17,20,27]. One prior study found that youth with easy access to park facilities were less likely to be overweight than youth without accessible park facilities [27]. Another study of 10- to 12-year-old youth found that increased time spent outdoors resulted in an increase in physical activity and a decrease in the prevalence of overweight youth [17]. Additional studies have observed associations between increased nature contact and improved mental health for youth [14–16].

In our study, we found that family support scores increased after the environmental education intervention. The mentorship and interactive learning components of the intervention may have exceptionally engaged the students, leading them to share what they learned with their family. The nature-based experiences of youth are often facilitated by or involve an adult's presence [23]. It is possible that students' positive experiences during the program may have encouraged family members to replicate some of the nature-based activities with them, thus increasing family support. We were unable to evaluate whether these factors were associated with the improvement in family support scores because we did not collect data on family-based activities. Future evaluations will incorporate data collection on family dynamics and collective behaviors to provide insight regarding the relationships between these factors and family support.

Our study is not without limitations. First, because this was a pilot study, the sample size was small and subject to Type II error (failing to detect a difference when one exists). Although we did not observe significant changes in four of the five HRQoL subscales, our study may have been underpowered to detect significant differences. Second, due to students moving and changing schools, approximately 13 percent of the study population was lost to follow up during the 13-week study period. Our study population comprised urban public-school students from St. Louis, Missouri, and study results may not be representative of students in other communities. Lastly, a limitation of the pre-test, post-test design is that it is possible that youth experiences over time could have confounded the results of this study. Participants may have reported better quality of life outcomes because they grew older and experienced physical, cognitive, and emotional development. We did not include a control group in this pilot study, nor did we collect information on potential events or stressors that may have influenced students' responses to HRQoL survey items.

As this study is a first step in promoting equity in environmental education, nature contact, and health-related quality of life, future research should include a larger, more geographically diverse sample of youth. Additionally, a control group of students who did not participate in the environmental education program would allow for evaluation of the extent to which environmental education and nature contact influences youth quality of life. Our future work will build on these results by evaluating outcomes across three or more time points throughout the academic school year and including more detailed measures of family-based activities. Further, qualitative studies of the youth participants, the university student mentors, school teachers, and parents will allow us to assess multiple perspectives.

5. Conclusions

Results of our pilot study demonstrate that minority youth who participated in an environmental education and nature contact program reported improved levels of overall health-related quality of life and family support. Access to the natural environment through classroom and field-based environmental education may promote health-related quality of life. Larger, prospective studies are planned to investigate initial findings further.

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