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Will they leave what they find? The efficacy of a Leave No Trace education program for youth

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ABSTRACT

The authors explored the influences of a youth-focused Leave No Trace educational program on participants' attitudes, behaviors, and nature connectedness. The study employed an experimental, equivalent control-group design and included survey and direct observation measures. Pretest and posttest surveys provided self-report measures of attitudes and nature connectedness, while direct observations examined participants' behavior toward keeping or leaving objects found in nature. Participants who received the PEAK educational program reported positive attitude changes above and beyond participants who did not receive the program, and left found objects more often than those in the control group.

Introduction

Decreased outdoor and nature-based activity is negatively related to mental and physical well-being among youth (Louv, 2008). Less is known about the relationship youth have to environmental stewardship and environmentally responsible behavior. Researchers have recently begun to explore this relationship. For example, in a study spanning 1976–2005, Wray-Lake, Flanagan, and Osgood (2010) found that taking personal responsibility for the environment and conservation behavior has declined in adolescents. They argue there has been a decline in knowledge regarding the scarcity of natural resources stemming from a rise in consumerism and materialism in the United States, and suggest this decline in knowledge has led to a decreased concern for the environment among youth (Wray-Lake et al., 2010).

Today's youth will inevitably become national and global leaders with responsibility for environmental stewardship and sustainability, and trends among young people can serve as a barometer for social change (Wray-Lake et al., 2010). Significant

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life experiences in the childhood years have powerful influence to inform attitudes, values, and behaviors throughout life, especially those related to issues of the environment (Chawla, 1998). And these early experiences in nature have been shown to be strong predictors of future environmental stewardship (Chawla & Cushing, 2007). Adolescents' reduced time spent outdoors and environmental concern call for educational and programmatic interventions to promote environmental consciousness among this rising generation (Wray-Lake et al., 2010). Environmental education interventions are one way to develop greater environmental consciousness and outdoor activity among youth.

Youth and environmental education

In her review, Davis (2009) identified three areas of inquiry regarding youth and environmental education (EE) research: (a) youth's relationships with nature (education *in* the environment), (b) youth's understandings of environmental topics (education *about* the environment), and (c) youth and environmental behaviors (education *for* the environment). Generally, literature around education *in* and *about* the environment suggests that young people who participate in EE programs develop a greater connection to nature and an increased knowledge of the environment and natural processes (e.g., Barratt Hacking, Barratt, & Scott, 2007; Wells & Lekies, 2006). Davis (2009) suggested studies involving youth and education *for* the environment are still needed. Where such studies do exist, researchers have typically utilized self-report measures of behavior, or behavioral intent, as surrogates for actual behavior (e.g., participation in home recycling programs). Studies utilizing actual behavioral observations are practically non-existent in the EE literature (Camargo & Shavelson, 2009).

While getting children outside and experiencing natural environments is a critical step in fostering environmental stewardship, research shows that increased use of natural and recreational areas increases the probability of negative impacts on the environment (Marion, Leung, Eagleston, & Burroughs, 2016). Thus, it is essential that children not only be provided opportunities to engage in EE programs, but also taught basic minimum-impact outdoor skills necessary for the long-term health of the natural environment.

Leave No trace: Promoting educational awareness in kids

Recognizing the need for youth education in minimum-impact outdoor skills, The Leave No Trace Center for Outdoor Ethics developed the Promoting Environmental Awareness in Kids (PEAK) program to teach children about the environment and how to recreate responsibly in the out-of-doors. However, little is known as to the effectiveness of the PEAK program. One study measured the effect of the PEAK program on children's knowledge of Leave No Trace principles following participation in a one-day program (see Miller, Shellman, Hill, Ramsing, & Lawhon, 2014). The authors noted a significant increase in knowledge scores between pretest

and posttest; however, knowledge does not necessarily translate to behavior change (Hungerford & Volk, 1990; Hwang, Kim, & Jeng, 2000; Manning, 2003; Petty, McMichael, & Brannon, 1992), and this is particularly true of Leave No Trace-related behaviors (Vagias & Powell, 2010). Therefore, more research needs to be conducted to understand the effect of PEAK on attitudes and behavior.

Previous research has established that attitudes influence behaviors (Ajzen, 2001; Fishbein & Manfredo, 1992; Ham & Krumpe, 1996; Heberlein, 2012). Accordingly, Leave No Trace behavior is influenced in part by attitudes toward specific Leave No Trace guidelines and recommended practices. Understanding the influence of PEAK education on attitudes related to Leave No Trace is essential for the development of educational programs that foster positive attitude and behavior change. Thus, the purpose of this study was to measure the influence of a PEAK educational program on the attitudes and behaviors of youth participants using an experimental, equivalent control-group design that included survey and direct observation measures.

Methods

Site and sample

The research was conducted in Pennsylvania, USA, at an outdoor school (ODS) program for fifth and sixth grade students. ODS is a four-day, three-night residential environmental education program that uses nature-based experiential learning techniques to teach about the interrelatedness of humans and the natural environment. Participants consisted of primarily fifth grade students from participating schools in three counties surrounding the ODS location.

Data for this study were collected during the six-week spring 2016 ODS season, from March 29 to May 13, 2016. Students spend four days at ODS (Tuesday morning through Friday). A typical day involves a combination of outdoor lessons, free time activities, cabin time, meals and campfire activities. For the outdoor lessons students are randomly assigned to "learning groups" of 10 to 12 students. While much of the ODS curriculum is built around environmental and nature-based themes and topics there is currently no explicit discussion of Leave No Trace or other similar outdoor ethics concepts, thus creating a baseline control condition.

All spring 2016 ODS students (N = 360) were eligible for participation. Upon Institutional Review Board (IRB) approval, a letter describing the study and a parental consent form were included with the ODS registration forms. Parental consent was provided for 357 children (99%).

Educational intervention

The intervention was a single 30-minute educational module from the Leave No Trace PEAK program titled "Unlocking the Past" focused on the Leave What You Find Principle (LWYF). LWYF teaches the importance of leaving artifacts and other natural objects behind for future visitors to enjoy. It stresses leaving places in their natural state so as to preserve the ecological, cultural, and historical value of the

place. This principle was selected because: (1) the prescribed behavior is observable at the individual level (e.g., whether someone removes a fossil from a rock outcrop), and (2) it involves the highest level of ethically grounded decision-making compared to the other principles.

Students were randomly assigned to learning groups, and learning groups were randomly assigned to treatment or control conditions. Learning groups selected to receive the treatment participated in the PEAK educational module on the first day (Tuesday) of ODS during a three-hour nature walk that includes a combination of games, teambuilding activities, and educational components. Learning groups assigned to control conditions participated in the same nature walk program without the PEAK module.

Survey instrument

Pretest and posttest surveys measured attitudes toward the LWYF Principle. Respondents indicated the extent to which they agreed or disagreed with a series of behavior-related statements regarding the appropriateness of keeping things found in nature (e.g., *It is wrong to collect fossils*). Responses used a five-point Likert Scale ranging from one ("strongly disagree") to five ("strongly agree"). Thus, respondents who agreed that keeping objects they find in nature was acceptable would have attitudes less aligned with the LWYF Principle.

Posttest survey items, presentation order, and design were identical to pretest surveys, with the addition of two items examining nature connectedness as related to found objects. Taking home natural objects found during an outdoor experience is often cited as a reminder of the event, like a souvenir (Ward & Roggenbuck, 2003; Taff, Newman, Vagias, & Lawhon, 2014). To explore this concept, we asked respondents to evaluate: (1) the importance they attributed to keeping found objects, and (2) the extent to which keeping a natural object might foster connections with nature. These items were not included on the presurvey to avoid biasing participant behaviors during the observation phase of data collection (Schwarz, 1999). Pretest surveys were administered on the first day of ODS. Posttest surveys were administered on the last day of ODS. After removing incomplete and unmatched surveys, 346 matched-pair surveys were collected ($n_{control} = 153$; $n_{treatment} = 193$).

Field experiment and behavior observation

The behavior of interest was whether students decided to keep a unique object they discovered during an ODS activity. To examine this behavior, researchers devised a field experiment that created opportunities for students to find arrowheads, fossils, or pyrite in a seemingly natural and authentic context. These three objects are known to occur in the geographical region, and are considered collector's items. Therefore, the discovery of one of these objects would create a novel nature-based experience requiring students to navigate a moral/ethical dilemma of what to do with the found object.

The field experiment and behavior observations were conducted during the second and third days (i.e., not on the nature walk day) of ODS. During an interactive lesson at one of three previously identified sites, students engaged in digging and sifting through soil layers and taking note of what they found to better understand soil. Researchers prepared the sites in advance by burying the objects of interest within a dig plot. Objects were buried to be easily found during the activity, while also appearing to be naturally occurring. Each dig site consisted of three individual 14-inch dig plots, spaced approximately 8–10 feet apart. One object was buried within each dig plot. For consistency, plot one always contained an arrowhead, and plots two and three the fossil and piece of pyrite, respectively. Learning groups of 10–12 students were randomly assigned to one of the three dig sites, and then groups of three to four students were randomly assigned to dig plots. Two researchers worked independently at each dig site, noting the type and number of objects found and kept.

A total of 48 learning groups participated under control conditions and 54 learning groups participated in the educational treatment. An initial variable of interest during the observations was whether or not the preburied object of interest was found during the activity. For objects that were discovered, we then recorded whether the object was kept or left at the dig site. Objects were evenly distributed across conditions and groups.

Results

Attitudes toward leave what you find behaviors

Overall, results of paired samples *t*-tests suggest the treatment group held attitudes more in line with the LWYF Principle than did the control group (Table 1). That is, while the data indicate positive shifts in attitudes from pretest to posttest for both groups, those in the treatment group showed a tendency to report posttest scores in greater agreement with LWYF than those in the control group. For some behaviors both groups reported significant changes in attitudes to better align with LWYF. For example, attitudes toward picking flowers in nature (Item 1) significantly improved in both groups, with both becoming less supportive of the behavior at the time of posttest. The same is true for Item 6 regarding collecting rocks.

Alternatively, significant changes in attitudes toward the keeping of arrowheads (Item 7) were less in line with the LWYF Principle for both the control and treatment groups, indicating participants became more supportive of the behavior from pretest to posttest. The changes for the control group participants were greater than those in the treatment: a mean change of 0.45 and 0.23, respectively. Comparisons of mean posttest scores indicated that those in the treatment group ($M = 2.56$, $SD = 1.353$) had a greater tendency to evaluate this behavior as negative, while the mean score for the control group ($M = 3.07$, $SD = 1.461$) is just above the midpoint on the scale indicating more favorable attitudes toward keeping arrowheads.

Table 1. Comparison of attitude measures by treatment group: paired and independent samples *t*-tests.

		Control		Treatment	
When visiting nature …		Pre	Post	Pre	Post
1. It is OK to pick flowers.	Mean	2.73	2.16***	2.69	2.08***
	N	146	146	191	191
	SD	1.288	1.083	1.229	1.041
2. It is wrong to pick up natural objects even if you put them back where you found them.[2]	Mean	3.08	2.67**	3.06	2.90
	N	146	146	188	188
	SD	1.329	1.249	1.311	1.259
3. It is OK to collect live animals.	Mean	1.40	1.44	1.56	1.53
	N	141	141	189	189
	SD	0.845	0.848	0.975	0.948
4. It is wrong to collect fossils.	Mean	2.94	2.93	3.10	3.21
	N	147	147	184	184
	SD	1.366	1.398	1.376	1.324
5. It is OK to collect insects.	Mean	2.27	2.00*	2.15	2.08
	N	143	143	183	183
	SD	1.296	1.120	1.244	1.213
6. It is wrong to collect rocks.	Mean	2.57	2.85*	2.55	2.82*
	N	139	139	181	181
	SD	1.302	1.251	1.222	1.248
7. It is OK to keep arrowheads.[2]	Mean	2.62	3.07***	2.33	2.56*
	N	138	138	174	174
	SD	1.363	1.461	1.391	1.353
8. It is OK to collect animal bones or antlers.	Mean	2.37	2.18	2.07	2.02
	N	130	130	176	176
	SD	1.342	1.309	1.318	1.209
9. It is best to look but don't touch the things you find	Mean	3.76	3.58	3.90	3.75
	N	139	139	175	175
	SD	1.172	1.285	1.216	1.223
10. It is OK to pick up things as long as you leave them where you found them.	Mean	3.46	3.45	3.34	3.65**
	N	145	145	192	192
	SD	1.236	1.252	1.268	1.231
11. It is important to leave nature as you find it so others may enjoy it.	Mean	4.23	4.27	4.35	4.33
	N	146	146	189	189
	SD	1.127	1.039	0.954	0.984
12. Bringing a natural object home from nature is important to me.[1, 2]	Mean		2.85		2.20
	N		151		191
	SD		1.269		1.148
13. I feel more connected to nature if I bring a natural object I find home with me (such as a rock, feather, or shell).[1, 2]	Mean		3.05		2.73
	N		152		190
	SD		1.385		1.348

Note. asterisks indicate statistically significant differences between pretest and posttest scores based on paired samples *t*-tests, where $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

[1]These items were only included in the posttest survey instrument.

[2]Indicates statistically significant difference in mean posttest scores ($p < 0.05$) between control and treatment groups based on independent samples *t*-tests.

When examining attitudes toward more general LWYF behaviors (Table 1), the control and treatment groups reported a high level of agreement with item 11 at both pretest and posttest. Results from Item 10 indicate that treatment group participants reported significant attitudinal shifts, becoming more likely to agree with the statement. Those in the control reported no changes in attitude toward this behavior.

Overall, while not all item comparisons revealed significant differences, general trends in the data suggest that those who participated in the treatment left the

ODS program with more positive attitudes toward LWYF than did those in the control.

Nature connectedness

Items 12 and 13 addressed nature connectedness (Table 1). Results indicate significant differences between control and treatment groups on both items. Participants in the treatment group were significantly less likely to agree with item 12 ($M = 2.20$, $SD = 1.148$) than control participants ($M = 2.85$, $SD = 1.269$), and item 13 ($M = 2.73$, $SD = 1.348$; and $M = 3.05$, $SD = 1.385$), respectively, indicating greater alignment with LWYF. These results suggest participating in the LWYF educational program led participants to associate less importance with keeping natural objects as a way to feel more connected to nature.

Behavioral observations

Rate of object discovery

The control group found the object 41 times out of 48 discovery opportunities (85%) (Table 2). Pyrite had the greatest likelihood of being found (94%), followed by arrowheads (88%) and fossils (75%). Treatment groups found 40 objects out of 54 opportunities (74%). Pyrite was found 100% of the time, followed by fossils (72%) and arrowheads (50%). Thus, differences in LWYF behaviors were based upon a similar number of objects found (e.g., $n_{control} = 41$; $n_{treatment} = 40$).

Rate of object removal

Participants in control groups removed 29 of 41 found objects (71%) (Table 2). Arrowheads were most likely to be kept (86%), followed by pyrite (67%) and fossils (58%). Participants in treatment groups removed 24 of 40 found objects at a rate of 11% less (60%). Arrowheads were most likely to be kept (78%), followed by pyrite (67%) and fossils (39%).

Table 2. Relationship between objects of interest and number of objects found and kept.

		Condition					
		Control			Treatment		
Object		Total N	Found	Kept	Total N	Found	Kept
Arrowhead	N	16	14	12	18	9	7
	% within arrowhead		87.5%	85.7%		50.0%	77.8%
	% within condition		34.1%	41.4%		22.5%	29.2%
Fossil	N	16	12	7	18	13	5
	% within fossil		75.0%	58.3%		72.2%	38.5%
	% within condition		29.3%	24.1%		32.5%	20.8%
Pyrite	N	16	15	10	18	18	12
	% within pyrite		93.8%	66.7%		100.0%	66.7%
	% within condition		36.6%	34.5%		45.0%	50.0%
Total	N	48	41	29	54	40	24
	% within object		85.4%	70.7%		74.1%	60.0%
	% within condition		100.0%	100.0%		100.0%	100.0%

Discussion and implications

Youth are spending less time outdoors—a trend linked to decreased environmental concern, knowledge, and stewardship. Scholars have called for effective educational interventions to promote environmental consciousness in youth (see Louv, 2008; The Outdoor Foundation, 2010; Wray-Lake et al., 2010). The present research responded to this call by investigating the influence and efficacy of a Leave No Trace educational program on the attitudes and behaviors of youth participants.

While both control and treatment groups reported attitudes generally in line with LWYF at pretest, treatment group participants reported attitudes in greater alignment with LWYF after the intervention. Individuals with positive attitudes toward a behavior are more likely to then perform that behavior (Ajzen, 1991, 2011). Therefore, the positive attitudes reported by participants from the treatment group suggest they may subsequently behave in a manner more consistent with the LWYF Principle. However, self-report attitudinal measures are not always accurate and must be interpreted with caution (Camargo & Shavelson, 2009).

The behavioral data reported in this study address that limitation. Supporting the attitude–behavior thesis, we found that treatment group participants removed objects found in nature 11% less frequently (60% removal rate) than control groups (71% removal rate). While we expected lower removal rates overall, the novelty of finding an arrowhead, fossil, or pyrite is different than finding common objects such as acorns or wildflowers. Therefore, the uniqueness of the find might explain the relatively high object removal rate. Overall, however, treatment group participants left objects in place at a higher rate than did the control group participants. In practice, the implications of these findings are substantial considering an estimated 14 million youth participate in camps such as this annually (American Camp Association, 2013).

Even though objects were kept more often than not, the majority of participants across both groups indicated that taking home an object they find in nature was not an important part of the experience. LWYF program participants, however, were significantly more likely to evaluate the behavior as unimportant, and the majority disagreed further that bringing natural objects home helped them feel connected to nature. Despite some critiques of the Leave No Trace program suggesting that it discourages human interactions with the natural world, where one should not pick up or interact with things they find (e.g., Simon & Alagona, 2009), these results provide evidence to the contrary.

The fact that significant differences in attitudes and behavior were present after only a 30-minute program that broadly covered the LWYF concept, it stands to reason that a more intensive (e.g., longer, more elaborate) outdoor ethics curriculum might have even greater positive influence on outdoor behaviors. Further research is needed to better understand the extent to which outdoor ethics education might influence environmentally responsible recreation behaviors in youth.

The results of this research are intended to provide guidance for the development of future Leave No Trace programs for youth. They also provide further support

for the value and importance of outdoor and environmental education programs for youth. Though limited research of this kind has been conducted, most of which has been hypothetical and attitudinal rather than behavioral and experimental, there have been no such studies of this kind related to youth and Leave No Trace to date. As such, this study provides a unique addition to the scientific and professional literature on parks and protected areas, and the limited body of literature on alternative management practices for reducing outdoor recreation-related impacts in parks and protected areas. Additionally, the study helps to fill a gap in the youth environmental education literature concerned with the effectiveness of programs designed to educate *for* the environment. Future research should consider focusing on additional environmental behaviors, which may include skill-based behaviors stemming from the Leave No Trace principles (e.g., "Dispose of Waste Properly"). Future research should also attempt to reevaluate attitudes longitudinally, to determine the salience of attitude change, and potentially behavior, over time.

At a time when outdoor activity and environmental concern among youth is trending downward, it is essential that we continue our efforts, through both research and practice, to get children outside and interacting with the natural environment. Today's youth will be the leaders of tomorrow, responsible for the health of the natural environment. This research supports the notion that Leave No Trace education for youth can make a positive impact on attitudes and behaviors *for* the environment.

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