

What Difference Does It Make? Assessing Outcomes From Participation in a Residential Environmental Education Program

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ABSTRACT: The authors explored the influences of 3- and 5-day residential environmental education programs at the Great Smoky Mountains Institute at Tremont (TN) on participants' connections with nature, environmental stewardship, interest in learning and discovery, and awareness of the Great Smoky Mountains National Park and biodiversity. The authors found significant positive, short-term effects on all outcomes of interest. Also, 3-month delayed posttests indicated retention of significant gains in environmental stewardship and awareness, whereas other gains faded. Longer stays and active engagement of visiting teachers in on-site instruction enhanced most outcomes. The authors discuss the influences of revisit preparation and group size on participants.

KEYWORDS: attitudes, evaluation, residential environmental education, stewardship

Residential environmental education (EE) programs offer opportunities for students to explore the environment firsthand, experience adventure-based challenges, and develop stewardship skills in active outdoor settings. Programs are typically aimed at enhancing environmental attitudes, increasing environmental knowledge and literacy, promoting citizenship

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skills, and encouraging stewardship behaviors that not only take place on site but also continue once the students return to their home communities. These intensive residential experiences also offer opportunities for personal growth by encouraging teamwork, collaboration, and the development of leadership skills, which serve participating students well in their academic and professional futures (Dettman-Easler & Pease, 1996, 1999; Kruse & Card, 2004; Smith-Sebasto & Semrau, 2004).

In the present article, we discuss the results of an evaluation system developed in partnership with and administered on site by the staff of the Great Smoky Mountains Institute at Tremont, a residential EE center in Tennessee in the Great Smoky Mountains National Park (GSMNP). We and the staff designed the system to measure the program's influences on participants' environmental awareness, attitudes, and behaviors and to use those results to improve existing programs and report on the program's benefits to interested stakeholders. We focus on short- and medium-term impacts of the program on its participants and explore factors associated with achievement of program goals.

Contributions to the Field: Literature Review

In the present article, we address aspects of EE that are not commonly reported in the literature, by focusing on issues associated with the retention of positive outcomes (attitudes, behaviors, and awareness) 3 months after the students' residential EE experiences. We also address issues related to the influences of program length, group size, previsit preparation, and the degree of visiting teachers' engagement in on-site instruction.

Although previous researchers of residential EE programs have commonly found that participation produces short-term positive results across a range of cognitive and affective outcomes (e.g., Dettman-Easler & Pease, 1996, 1999; Jordan, Hungerford, & Tomera, 1986; Knapp & Benton, 2006; Smith-Sebasto & Semrau, 2004), the incorporation of delayed follow-up measures is less common in the literature. In a recent meta-analysis of EE evaluations, Schneider and Cheslock (2003) found only five peer-reviewed evaluations of EE programs between 1991 and 2000 that investigated and reported student-based outcomes 3 months or more after programs of interest concluded. Some of those studies suggested retention of positive gains (e.g., Dettman-Easler & Pease, 1999), whereas others showed inconclusive evidence (Bogner, 1998). When investigating the influence of multiday, zoo-based EE camps on school-aged children, Kruse and Card (2004) recorded short-term increases in attitudes, knowledge, and behavior, but they recorded a consistent drop in these variables when they measured them 1 month later (although the overall increase remained positive from pretest to delayed posttest). Knapp and Benton (2006) found that students retained vivid memories of a residential EE experience 1 year after their visits, whereas the degree of knowledge retention varied. However, Knapp and Benton did not seek to gauge significant changes in students' attitudes or behaviors in follow-up interviews.

A similar lack of conclusive evidence exists regarding the influence of EE program duration. Reserachers in the field of EE have assumed that increased duration produces more positive outcomes for students, but little empirical research exists to support this claim. Although Bogner (1998) noted significant changes in student-related outcomes after 5-day—but not 1-day—EE programs, other studies have been more speculative. For example, on the basis of a qualitative study of a 5-day outdoor program for high school students in Belize ($n = 10$), Emmons (1997) speculated that the duration of the program (5 days for most) “appeared to be important in the reduction of negative perceptions of the environment, including fears. . . . A shorter EE programme may not have had the same effect” (p. 347). Powers (2004) examined whether participating in a 1-day EE program versus a 2-day EE program affected increases in students' knowledge and appreciation of natural resources; she found that “location and economic status of the school” were more influential than the duration of the program (p. 43).

Riggins (1986) assumed that smaller group sizes enhance education outcomes. The often cited

optimal class size of 15 is based on research conducted in formal education settings (Glass, Cahen, Smith, & Filby, 1982). Few researchers have explored the question of group size for outdoor and EE settings. Walsh and Golins (1976) promoted the *10-group* concept—although it is not based on empirical research—for outdoor and adventure education, theorizing that a group of 10 (or a group that ranges from 7–15) creates dynamic diversity without overwhelming individual voices. Neill (2004) refuted that belief by citing research conducted with 3,000 Outward Bound participants who showed no significant differences in long-term outcomes among group sizes ranging from 5–26. Moreover, Orams (1999) found no significant difference in the effectiveness of EE for different sizes of groups of tourists in Australia.

Smith-Sebasto and Cavern (2006) encountered somewhat ambiguous results regarding the impacts of preexperience preparation. They found that students exposed to both previsit and post-visit activities supporting a residential EE experience in New Jersey showed more positive environmental attitudes. However, previsit experiences alone had no significant effect on outcomes without the follow-up experience; the reverse was also true. In Smith-Sebasto and Cavern's literature review, which spanned nearly 30 years from 1967–2005, they reported only one other study that measured the influence of preparatory experiences on EE outcomes for students. In that study, Gutierrez de White and Jacobson (1994) found that a preexperience workshop for teachers enhanced knowledge and attitude gains for students visiting a zoo in Colombia.

Although numerous programs incorporating active engagement of teachers in EE programs have shown positive impacts on students (Rickinson, 2001), studies comparing similar programs with and without such engagement are lacking. The present study may be the first to do so.

By analyzing both short- and longer term impacts of the program and by addressing the influences of program length, group size, previsit preparation, and on-site engagement of teachers, we explore how and why EE programs fail or succeed in influencing outcomes of common interest to EE professionals.

Great Smoky Mountains Institute at Tremont

Tremont provides 3- and 5-day residential programs to school groups addressing both ecological and cultural exploration of GSMNP. More than 4,000 primarily fourth- through seventh-grade students from 14 states visit Tremont each year, with groups ranging in size from 10 students to more than 100 students. At least one teacher and a cadre of adult chaperones accompany each group.

Visiting teachers may plan their Tremont visits by selecting from more than 40 curricular options, ranging from cooperative team building to inquiry-based science and other creative or exploratory activities. The program content reflects Tremont's mission statement: "Great Smoky Mountains Institute provides in-depth experiences through educational programs designed to nurture appreciation of Great Smoky Mountains National Park, celebrate diversity, and foster stewardship" (Great Smoky Mountains Institute at Tremont, 2007).

All programs stress experiential and place-based learning by using the national park as an outdoor classroom. Teachers accompanying student groups may share teaching responsibilities with Tremont instructors, if they so desire. The Tremont staff encourages those teachers interested in this cooperative teaching experience to review lesson plans prior to their visit and to work closely with Tremont staff to implement on-site activities.

The Evaluation System

The evaluation system is grounded in theoretical underpinnings that are common in the evaluation field, but it is noteworthy in that it blends several models to ensure the development of a user-friendly and utilization-focused system that is rigorous, self-sustaining, adaptive, and methodologically appropriate

(for further detail, see Powell, Stern, & Ardoin, 2006). After a series of workshops to clarify the specific outcome goals of Tremont programs, we developed survey items that reflected those goals in close collaboration with Tremont staff and with input from GSMNP representatives. We then developed and pilot-tested survey instruments, which we subsequently revised for clarity and for reliability and construct validity.

The results that we discuss in the present article represent a subset of outcomes of interest to Tremont. We developed indexes for these outcomes and refined them through pilot-testing procedures outlined by DeVellis (2003).¹ Cronbach's alphas for each index ranged from .70 to .79. We measured items on 5-point Likert-type scales, and components of each index were weighted equally and standardized so that a maximum score for each index equals 100. Although we based the development of these measures specifically on Tremont staff's visions for the program, there are many parallels with measures commonly used by other EE researchers (e.g., Bunting & Cousins, 1983; Dunlap & Van Liere, 1978; Evans et al., 2007; Leeming, Dwyer, & Bracken, 1995; Musser & Malkus, 1994).

Connection with nature. The connection-with-nature index, which was composed of seven items, was based on four premises: (a) Students feel comfortable in the outdoors; (b) students feel that they are a part of nature, rather than separate from it; (c) students actively engage in observing their surroundings when in natural settings; and (d) students show interest in outdoor activities.

Environmental stewardship (stewardship). The stewardship index, which was composed of seven items, measured participants' attitudes toward environmental conservation and their intentions and actions regarding environmental behaviors.

Interest in learning and discovery (discovery). The discovery index, which was composed of five items, gauged students' degree of interest in learning about natural history and cultural heritage and their degree of interest in directly exploring these topics in various settings.

Knowledge and awareness of GSMNP and biological diversity (awareness). The awareness index included eight true/false/don't-know items and multiple-choice items regarding exotic species, biological diversity, and the national park.

Survey Administration

The results that we discuss in this article reflect preexperience, postexperience, and follow-up surveys that we conducted with a sample of 300 students who attended Tremont during the 2006–2007 academic year. When the visiting teachers arrived, Tremont staff asked them to select 10 students at random to participate in the evaluation. Staff reported that teachers generally selected the students who moved into their cabins most expediently and therefore were available before the other students. Although a truly random sample was not achieved, our conversations with Tremont staff who observed the selection procedures did not indicate a reason for concern about a systematic selection bias in the results that we report.

Tremont staff administered the initial preexperience surveys as soon as possible after the students' arrival at Tremont. Immediately following the week's final organized activity, the same students completed postexperience surveys designed to gauge changes in the key metrics. The students' teachers administered 3-month follow-up surveys at their schools. Teachers received explicit instructions for administering the follow-up survey while on site at Tremont and also received a reminder letter reiterating the instructions prior to administration of the follow-up survey. The teachers then mailed the completed follow-up surveys to the Tremont staff for data entry into SPSS 15.0 statistical software.

Participants who completed both the preexperience and postexperience surveys numbered 273

(from 30 school groups). Those students who responded to all three surveys were 183 (from 20 school groups). In all, 52% of the sample were female students, whereas 48% were male students; and 36% were from private schools, whereas 64% were from public schools. All respondents were in the fourth through seventh grades. Group sizes ranged from 10 to 104 students, with a mean of 57 ($SD = 22.6$). Tremont staff recorded weather conditions and other extenuating circumstances, such as a student injury or a late arrival, for each group. These factors showed no significant relations with any of the outcomes of interest in the study.

Tremont staff also administered surveys to participating teachers on their arrival at Tremont to determine the relative degree of preexperience preparation that their classes received prior to their visits. We scored response categories as follows: 0 (*no preparation*), 1 (*logistics only*), 2 (*minimal content-related preparation*), 3 (*moderate content-related preparation*), 4 (*extensive content-related preparation*), and 5 (*focus of semester up until trip*).

Results

Paired sample t tests revealed that students made significant gains in each of the outcomes of interest immediately after the programs (see Table 1). Also, 3 months after students participated in the Tremont program, statistically significant gains remained for students' stewardship and awareness scores, whereas gains diminished in students' connection with nature and interest in discovery.

Immediately after participation, students' scores on the awareness-of-GSMNP index increased 13.7%, with students retaining a large degree of this knowledge 3 months after their participation. Tables 2, 3, and 4 contain the individual survey items composing the other indexes in Table 1. In the connection-with-nature index (see Table 2), changes in students' (a) feelings of comfort in the outdoors, (b) views of humans as part of nature, and (c) preferences to visit parks or woods rather than seeing a movie or playing video games contributed most powerfully to short-term gains. However, significant longer term gains took place only with regard to students' feelings of comfort in the

TABLE 1. Paired Samples Mean Comparison of Index Scores

Preexperience vs. postexperience	Preexperience		Postexperience		t	df	p
	M	SD	M	SD			
Connection with nature	79.0	19.6	81.1	18.2	2.6	242	.01
Stewardship	69.0	18.6	80.6	17.1	10.0	250	< .01
Discovery	80.2	14.2	82.4	14.4	3.4	261	< .01
Awareness	60.7	20.3	74.4	19.9	11.8	252	< .01

Preexperience vs. 3- month follow-up	Preexperience		Follow-up		t	df	p
	M	SD	M	SD			
Connection with nature	82.0	19.1	81.9	19.1	0.1	168	.96
Stewardship	69.3	18.9	75.1	18.1	3.7	170	< .01
Discovery	80.8	14.1	79.8	15.0	1.0	175	.31
Awareness	59.8	20.0	68.4	20.7	5.3	173	< .01

TABLE 2. Connection With Nature: Paired Samples Means Comparison, by Item

Preexperience vs. postexperience	Preexperience		Postexperience		<i>t</i>	<i>df</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
I feel comfortable in the outdoors.	4.39	0.74	4.54	0.73	3.5	272	< .01
Humans are a part of nature, not separate.	4.10	0.95	4.37	0.87	5.0	269	< .01
When I'm outside, I pay close attention to different plants and animals.	3.73	1.02	3.82	0.97	1.5	260	.15
I'd rather play outside than inside.	4.03	1.02	3.99	0.97	-0.6	264	.58
I'd rather visit a national park than see a movie.	3.55	1.13	3.81	0.98	4.2	262	< .01
I'd rather play video games than explore the woods.	2.21	1.04	2.09	0.98	-2.4	265	.02
I'd rather go to a shopping mall than Great Smoky Mountains National Park.	2.11	1.22	2.03	1.11	-1.5	265	.15

Preexperience vs. 3-month follow-up	Preexperience		Follow-up		<i>t</i>	<i>df</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
I feel comfortable in the outdoors.	4.40	0.72	4.55	0.69	2.8	182	< .01
Humans are a part of nature, not separate.	4.08	0.99	4.36	0.88	3.7	181	< .01
When I'm outside, I pay close attention to different plants and animals.	3.77	1.05	3.61	0.94	-2.3	176	.02
I'd rather play outside than inside.	4.07	0.99	4.02	0.95	-0.6	179	.58
I'd rather visit a national park than see a movie.	3.62	1.15	3.73	1.03	1.3	179	.20
I'd rather play video games than explore the woods.	2.15	0.99	2.11	0.96	-0.7	178	.51
I'd rather go to a shopping mall than Great Smoky Mountains National Park.	1.91	1.17	1.97	1.12	0.9	179	.36

outdoors, views of humans as part of nature, and paying close attention to plants and animals in the outdoors, and that limitation suggested that preferences for playing in the outdoors diminished over time after students' Tremont experiences.

Intentions and behaviors were the most powerful drivers of changes in the stewardship index (see Table 3). It is noteworthy that short-term gains in the stewardship index may be somewhat exaggerated

TABLE 3. Environmental Stewardship: Paired Samples Means Comparison, by Item

Preexperience vs. postexperience	Preexperience		Postexperience		<i>t</i>	<i>df</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
I feel it's important to take good care of the environment.	4.77	0.49	4.80	0.48	1.1	269	.28
It's important to protect as wide a variety of animals and plants as we possibly can.	4.70	0.70	4.72	0.58	0.6	269	.55
I might someday like to volunteer to work in a national park.	3.24	1.03	3.39	1.03	2.7	267	< .01
I (will) turn the lights out when I leave a room.	4.01	0.91	4.37	0.79	6.8	267	< .01
I am (will be) careful not to waste food.	3.75	0.94	4.42	0.83	11.1	266	< .01
I am (will be) careful not to waste water.	3.98	0.99	4.46	0.86	7.7	263	< .01
I (will) talk to my friends and family about the environment.	3.08	1.19	3.76	1.09	9.3	266	< .01

Preexperience vs. 3-month follow-up	Preexperience		Follow-up		<i>t</i>	<i>df</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
I feel it's important to take good care of the environment.	4.77	0.52	4.76	0.51	-0.3	180	.79
It's important to protect as wide a variety of animals and plants as we possibly can.	4.70	0.70	4.66	0.62	-0.6	182	.55
I might someday like to volunteer to work in a national park.	3.27	1.00	3.30	0.99	0.4	178	.71
I turn the lights out when I leave a room.	3.94	0.97	4.22	0.85	4.1	180	< .01
I am careful not to waste food.	3.78	0.95	4.12	0.87	4.3	180	< .01
I am careful not to waste water.	3.94	1.06	4.26	0.86	4.0	178	< .01
I talk to my friends and family about the environment.	3.07	1.22	3.47	1.17	4.0	178	< .01

TABLE 4. Interest in Learning and Discovery: Paired Samples Means Comparison, by Item

Preexperience vs. postexperience	Preexperience		Postexperience		<i>t</i>	<i>df</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Interest in learning about plants, animals, and the places they live.	3.93	0.90	4.02	0.90	2.2	267	.03
Interest in learning about different cultures or other ways of life.	3.83	1.01	4.03	0.95	3.5	268	< .01
Interest in visiting national parks.	4.39	0.80	4.47	0.87	1.8	268	.07
Interest in exploring in the outdoors near my home.	4.16	1.04	4.22	0.95	1.0	264	.32
Interest in learning about the history of my hometown.	3.76	1.21	3.89	1.15	2.3	266	.03

Preexperience vs. 3-month follow-up	Preexperience		Follow-up		<i>t</i>	<i>df</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Interest in learning about plants, animals, and the places they live.	3.98	0.90	3.89	0.96	-1.4	179	.17
Interest in learning about different cultures or other ways of life.	3.83	1.01	3.86	1.00	0.3	180	.78
Interest in visiting national parks.	4.43	0.77	4.38	0.84	-1.0	180	.32
Interest in exploring in the outdoors near my home.	4.22	1.00	4.17	0.99	-0.7	178	.49
Interest in learning about the history of my hometown.	3.73	1.27	3.66	1.22	-0.8	178	.43

because preexperience surveys measured self-reported behavior, whereas the first postexperience surveys measured intentions in four of the key items composing the index.² Follow-up surveys provided a more direct comparison with preexperience scores, again asking about self-reported behaviors. The results suggest that many of the students who intended to change their environmental behaviors immediately following their experiences may have actually done so, although this inference is based on self-reporting. In contrast, survey items related to broader attitudes about environmental conservation showed no significant changes after the program.

The index of interest in learning and discovery showed incremental but significant gains in the surveys administered immediately following the program. Students reported significantly greater interest in learning about the places where they live, plants, animals, different cultures or ways of life,

and the histories of their hometowns (see Table 4). Although items associated with visiting national parks and exploring in the outdoors near students' homes showed some positive gains, those gains were not statistically significant. All significant gains dissolved in the follow-up surveys.

Influence of Program Duration, Group Size, Previsit Preparation, and On-Site Engagement of Visiting Teachers

To examine the influence of program duration and on-site engagement of teachers, we calculated changes between preexperience and postexperience scores for each outcome measure for each respondent. These changes provided the basis for gauging significant differences between subsets of the sample population (3-day participants vs. 5-day participants; active teacher engagement in on-site teaching vs. none).

We performed independent samples *t* tests to determine whether short-term and follow-up changes in each outcome were different for students who participated in 3-day programs (*n* = 206) than for those who participated in 5-day programs (*n* = 67). Students participating in 5-day programs showed significantly greater short-term gains in stewardship, interest in discovery, and awareness scores (see Table 5). When investigating the influence of duration on longer term outcomes, we found that only gains in awareness scores were significantly greater (*p* ≤ .05) for 5-day participants.

The teachers of 233 students in the evaluation sample opted to share teaching responsibilities with Tremont instructors during the on-site program, whereas the teachers of the remaining 40 students in the sample elected to have Tremont staff lead all activities. Table 6 shows differences in student outcomes for those students whose teachers were engaged in teaching at Tremont versus those whose teachers were not. The table shows average changes in outcome scores for each subsample. Comparisons between the two subsamples are limited by the small sample sizes for nonshared teaching experiences (ranging from 31–38 for immediate postexperience responses and from 17–19 for follow-up responses). Nonetheless, all short-term outcomes, with the exception of connection with nature, were significantly more positive for students whose teachers were actively engaged on site. In the long term, only awareness scores remained significantly higher for those students.

The degree of previsit preparation reported by teachers showed significant correlations (*p* < .05) with preexperience and postexperience measures of students' interest in learning and discovery (Spearman rank *r_s* = .17 for each) and their preexperience awareness scores (*r_s* = .16). Also, 6% of teachers reported no previsit preparation; 18% reported only discussions of logistics; 18% reported

TABLE 5. Comparisons of Average Percent Changes in Outcome Scores for 3- and 5-Day Programs

Outcome	3-day	5-day	<i>t</i>	<i>df</i>	<i>p</i>
Short-term % change					
Connection with nature	1.9	2.9	0.5	241	.634
Stewardship	10.2	15.5	2.0	249	.047
Discovery	1.4	4.7	2.2	260	.025
Awareness	12.2	18.0	2.2	256	.028
Longer term % change					
Connection with nature	0.4	-1.0	0.6	167	.570
Stewardship	3.9	9.9	1.8	169	.070
Discovery	-1.7	0.7	1.2	174	.220
Awareness	5.2	15.5	3.1	172	.020

TABLE 6. Comparisons of Average Changes in Outcome Scores for Shared Teaching Experiences (STE) Versus Nonshared Teaching Experiences (NTE)

Outcome	STE	NTE	<i>t</i>	<i>df</i>	<i>p</i>
Short-term change					
Connection with nature	2.6	-0.6	1.3	241	.207
Stewardship	12.3	7.0	2.0	59.3 ^a	.047
Discovery	3.0	-2.6	3.1	260	.002
Awareness	14.7	7.8	2.1	256	.035
Longer term change					
Connection with nature	0.1	-1.6	0.5	167	.640
Stewardship	6.3	2.1	0.8	169	.420
Discovery	-0.3	-6.1	1.9	174	.050
Awareness	9.8	-1.3	2.2	172	.030

^aDegrees of freedom reduced by unequal variances between the two subsamples.

minimal content-related preparation; 52% reported moderate content-related preparation; and 6% reported extensive content-related preparation. Teachers participating in on-site instruction reported significantly greater preparation than those who did not, $t(20.8) = 2.7, p = .01$.³

Statistically significant differences were also associated with group size, in that students in larger groups showed more positive outcomes on several measures. Group size was significantly correlated with both short- and longer term changes in awareness scores ($r_s = .12, p = .05$; $r_s = .22, p < .01$; respectively) and in immediate postexperience interest in learning and discovery ($r_s = .17, p = .03$).

Discussion

We found that the residential EE experience at Tremont appeared to be achieving short-term success in all of the measured outcomes. Analyses of 3-month follow-up surveys revealed that (a) increases in students' commitment to environmental stewardship and (b) their knowledge and awareness of GSMNP and biological diversity remained significant. However, increases in (a) students' interest in learning and discovery and (b) their connection with nature faded over time.

Certain activities at Tremont likely contributed to the significant changes in reported stewardship behavior and in environmental knowledge and awareness. For example, Tremont's food waste program included numerous daily competitions among tables in the cafeteria to reduce the amount of food that students discarded at the end of each meal. The program was accompanied by an original song and instructor-led discussions of the processes and energy expended to bring the meal to the table. In addition, general environmental knowledge and awareness were likely enhanced by the location of Tremont within the GSMNP. Myriad issues and challenges facing the park, many related to biodiversity conservation and invasive species, were frequently discussed during Tremont programs and explored firsthand by the students on each day of their visit.

The evaluation findings suggested that, although immersive EE experiences may achieve desired effects in the short term, long-term influences on broader attitudes may be less distinct. Follow-up programming, such as school visits by Tremont instructors or other supporting activities, may be appropriate for enhancing attitudes and reinforcing newly acquired interests. Other researchers have reached similar conclusions (e.g., Bogner, 1998; Dettman-Easler & Pease, 1999; Smith-Sebasto & Cavern, 2006).

We also found that longer stays (3- vs. 5-day) at Tremont contributed to greater influences on desired outcomes, especially with regard to short-term changes. Longer stays were associated with longer term retention of awareness and knowledge increases among participants 3 months after the program's conclusion. This finding complements the findings of other studies (e.g., Bogner, 1998; Emmons, 1997).

Although sample-size limitations prevented a more rigorous examination of the statistical significance of trends in the impacts of teacher involvement in on-site instruction, it appeared that active engagement of visiting teachers in on-site instruction also contributed to more positive outcomes. This finding may be related to the amount of preparation that teachers had incorporated into their classrooms prior to the visit, which was positively correlated with students' interest in learning and discovery and with their awareness of GSMNP and biological diversity. This finding also reflects the potential importance of legitimizing the program in the eyes of students through teacher or role-model validation of the experience. In support of this conjecture, Sivek (2002) found that 15 of 20 students interviewed in a Wisconsin high school cited their teachers as role models who most significantly influenced their environmental sensitivities.

Contrary to our expectations, students in larger groups exhibited more positive scores on awareness and on interest in learning and discovery. Although Riggins (1986) reported opposing results in the formal education environment, it is possible that the social learning environment of residential EE programs mitigates, negates, or even reverses some of the relative advantages of small-group interactions that occur in formal settings. Further research on the effects of group sizes for different types of experiences could help to clarify these findings.

Recommendations for Further Research

Similar to Smith-Sebasto and Cavern's (2006) results, our results suggest that previsit preparation and follow-up programs influence the achievement of student outcomes. Larger sample sizes could help confirm or refute these influences. Larger sample sizes could also provide insight into the effects of group size and active on-site teacher engagement on student-related outcomes and offer opportunities for researchers to explore additional questions (e.g., Which combinations of specific activities within Tremont's broad curricula produce the most positive outcomes for visiting students? Are there significant differences in the findings across grade levels?). Although we explored these themes, the small samples did not provide sufficient data to draw conclusions with confidence.

In addition, further researchers could help to directly address some of the primary weaknesses of the present study. We relied heavily on Tremont staff and visiting teachers to collect data. This reliance may have injected some nonsystematic bias such as that potentially arising from the opportunistic sampling of students who moved into their bunks most quickly. Furthermore, although teachers were given explicit instructions for administering the 3-month postvisit surveys, no structure was in place to ensure that they followed these operating procedures. Having an outside research team collect all data would enhance the external validity of these data collection processes, but resource limitations precluded this exercise across a large sample size.

Also, we included self-reported actions in the data. Future researchers could use numerous techniques to further explore the validity of these responses. We are currently addressing this shortcoming in ongoing research at Tremont by conducting follow-up surveys with teachers to triangulate, to some degree, students' self-reported actions. Additional surveys of students' parents could also help to bolster these data, although this path is not currently being pursued. Observation and individual interviews represent other potentially powerful research methods that could further document

changes in students' behavior and also uncover deeper understandings of why those changes occurred and how the Tremont experience influenced them.

As with any research that examines long-term impacts of a particular event, countless intervening factors exist that could influence the results (Babbie, 2001). Still, studies into the effects of different forms of previsit and postvisit experiences seem warranted, particularly in regard to the retention of gains made on site in outcomes of interest. The influence of the time of the school year during which students complete surveys may also warrant further attention because student morale may change over the course of normal academic cycles (Meece & Miller, 1999). Follow-up surveys at different intervals of time could also help to reveal how long it takes for certain gains to diminish. These surveys may suggest important lessons regarding how and when researchers and educators should implement effective follow-up interactions with participants.

Conclusion

We evaluated the short-term and mid-range (3-month delayed) impacts of the Tremont residential program on participating fourth- through seventh-grade students. The results reflect the general success of residential EE programs at Tremont, particularly in short-term gains for attitudes, intentions, and awareness. Although positive changes in some attitudes faded over time, significant gains in self-reported stewardship behavior, environmental knowledge, and environmental awareness remained after 3 months. In addition, 5-day programs and greater active engagement of visiting teachers on site proved more successful in effecting desired outcomes than did 3-day programs. The results suggest that longer programs, greater previsit preparation and on-site teacher involvement, and follow-up efforts may enhance the long-term outcomes of residential EE programs.

NOTES

1. We implemented the pilot study with three visiting student groups: one 5-day group and two 3-day groups. Although one of the 3-day groups did not receive a preexperience survey (to investigate the potential for testing bias), all students in each group ($N = 79$) received a postexperience survey on site, and two of the groups (one 3-day, one 5-day) completed follow-up surveys 3 months after their visits ($N = 64$). The research team directly observed students taking the pilot surveys on site and solicited feedback from respondents to identify problems associated with wording or survey administration. We developed survey items to represent each of the outcome goals identified in workshops. We removed highly correlated items (duplicate items) and items that showed little or no variation in response. We used iterative reliability analyses and item-to-total correlations to identify outlying survey items for removal to maximize Cronbach's alpha coefficients of indexes. We used principal components factor analyses to confirm the reliability and validity of these constructs.

2. We used conditional terms (those in parentheses in Table 3) on immediate postexperience surveys, but not on preexperience or 3-month follow-up surveys.

3. Unequal variances between the two subsamples reduced the degrees of freedom.

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