



# The impact of direct and indirect experiences on the development of environmental knowledge, attitudes, and behavior

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## ABSTRACT

This study employed a mixed-methods design to examine the relationship between nature experience type (e.g., direct and indirect) and learning outcomes (e.g., environmental knowledge, attitudes, and behavior) associated with an environmental education, international immersion program for adolescents. Longitudinal data from 108 participant and 49 comparison group members were analyzed to test the study's hypotheses. Additionally, qualitative data were analyzed using grounded theory methodology to assess participants' perceptions of these processes. The findings indicate that environmental knowledge increased more than environmental attitudes during the indirect portion of the program (i.e., preparatory program) whereas the direct portion (i.e., international workshop) produced similar levels of knowledge and attitude growth. Further, while attitudes were more strongly associated with behavior during the indirect component of the program, the strength of the relationships between attitudes and behavior, and knowledge and behavior were similar during the direct portion of the experience. A synthesis of the findings suggests that the program's direct experiences catalyzed environmental knowledge into a stronger motivating force than it had been during the indirect experiences. The qualitative findings also provide insights into the characteristics of direct experiences. These findings offer important insights for both theory and practice related to the use of direct and indirect nature experiences to develop environmental knowledge, attitude, and behaviors.

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## 1. Introduction

Does reading a book about the Peruvian Rain Forest, an indirect nature experience, have the same impact on an individual as a more direct experience such as actually traveling to and spending time in that same location? While this may initially seem like a simple question, undertaking research that both describes and accounts for differences between outcomes associated with these experiences is more complicated. Answers to this question have relevance for a variety of fields from entertainment to education. Those interested in providing individuals experiences designed to produce certain end results should be interested in understanding the relationship between experience type (indirect vs direct) and outcomes.

### 1.1. Direct vs indirect nature experiences

The relative impact of direct vs indirect experiences has already received some scholarly attention; for example, an established body of literature addresses the complexities and characteristics of

direct (i.e., experiential) experiences (see Warren, Mitten, & Loeffler, 2008). However, additional empirically validated studies are still needed. For example, in the environmental education (EE) field, researchers and practitioners have debated the relationship between experience type (i.e., indirect vs direct) and learning outcomes. In other words, what type of learning outcomes are indirect vs direct experiences most likely to produce? For example, while many EE programs take place in classroom settings and involve primarily lecture-based learning, some programs incorporate or rely solely on natural settings and experiential learning.

Studies comparing programs with traditional (e.g., classrooms) vs non-traditional (e.g., wilderness) settings have produced incongruous conclusions. In some cases, research findings suggest that outdoor contexts positively impact ecological attitudes and behavior (Dettmann-Easler & Pease, 1999; Dresner & Gill, 1994). However, in a review of EE studies that looked at either traditional (e.g., classroom based) or non-traditional (e.g., workshops, nature camps, and field studies) program contexts, results indicated that classroom based programs were most effective (Zelezny, 1999).

Kellert's (2002) model of the impact of different types of nature experiences (e.g., direct, indirect and vicarious) on various modes of learning (e.g., cognitive, affective and evaluative) is useful for

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addressing issues regarding context and learning outcomes. The theoretical and empirical work of Fazio, Zanna and Millar (e.g., Fazio & Zanna, 1978, 1981; Millar & Millar, 1996) also provides insights into the influence of direct and indirect experiences on attitude development and behavior. For example, their findings suggest that indirect experiences lead to more cognitively based attitudes while direct experiences produce more affectively based attitudes (Millar & Millar, 1996).

Such a model is also pertinent for inquiries regarding the relationship between environmental knowledge, attitudes, and behavior. While EE practitioners agree that the promotion of pro-environmental behavior is their primary aim (Mangas & Martinez, 1997), they disagree regarding the most effective methods to promote this outcome. Part of the issue revolves around whether EE programs should promote affective (i.e., attitudes and values) or cognitive (i.e., knowledge) learning. Supporters of the cognitive approach argue that most environmental educators overemphasize affective learning and call for a renewed effort to increase program participants' environmental knowledge (Ballantyne & Packer, 1996). Proponents of affective learning make the opposite claim, suggesting that cognitive learning has taken precedence over the development of pro-environmental attitudes in EE programs (Pomerantz, 1990–1991; Pooley & O'Connor, 2000).

To further complicate the issue, research findings regarding the causal influence of environmental attitudes and knowledge on behavior have been mixed (Bogner, 1998; Hanna, 1995; Orams, 1994, 1997). Part of the problem may be that many EE studies measure attitudes and knowledge but do not measure behavior (Leeming, Dwyer, & Porter, 1993), thus hindering attempts to understand potential antecedents of actual performance. In order for EE programs to more effectively influence the development of pro-environmental behaviors among participants, a clearer understanding of the relationships between environmental knowledge, attitudes, and most importantly, behavior is needed.

Since the targeted outcome of most EE programs is improved pro-environmental behavior, the current study also incorporates the theory of planned behavior (TPB; Ajzen, 1985, 1991) to clarify the processes linking knowledge and attitude to behavior. The TPB suggests that an individual's intention to engage in a particular behavior is the best predictor of actual behavior. Furthermore, behavioral intentions are influenced by an individual's knowledge about and attitudes towards the behavior in question. Societal norms as well as perceptions of behavioral constraints also impact these intentions.

### 1.2. Purpose

Given this background, the purpose of the study was to investigate the relationship between experience type (indirect vs direct) and learning outcomes (knowledge, attitudes, and behavior). Both quantitative and qualitative data were collected, to examine the influence of indirect and direct experiences on environmental knowledge, attitudes, and behavior for a sample of middle and high school aged participants participating in a multi-stage (e.g., preparatory program and international workshop) environmental education, international immersion program.

## 2. Literature review

The following sections highlight important literature related to the relationship between experience type and learning outcomes. The literature review is primarily delimited to EE research in order to reflect the study's context.

### 2.1. Environmental knowledge, attitude and behavior

Research findings suggest that the link from environmental knowledge and attitudes to pro-environmental behavior is somewhat tenuous (Kaiser & Gutscher, 2003). Multiple reasons account for this disconnect, but conducting theoretically sound research with accurate conceptualizations of key constructs may be part of the solution (Kaiser, Wolfing, & Fuhrer, 1999). Additionally, the application of an appropriate theoretical framework may also aid inquiry in this area. For example findings from EE studies employing the TPB model suggest that environmental knowledge and attitudes both hold predictive power in terms of pro-environmental behavior (Kaiser & Fuhrer, 2003; Kaiser et al., 1999).

The theory of planned behavior (TPB) presents an empirically validated model of the predictors that lead to behavior (Ajzen, 1985; Ajzen & Madden, 1986). TPB suggests that a particular behavior is best predicted by an individual's intention to engage in that behavior. Intention is in turn influenced by the individual's attitude towards the behavior, perceived control they have over actually engaging in the behavior (i.e., perceived behavioral control), and the social norms associated with the behavior (e.g., support or lack thereof from key individuals). This framework presents an effective approach to understanding the processes whereby individuals contemplate and then actually implement certain behaviors.

### 2.2. EE experience types

In order to understand the impact of EE programs on pro-environmental behavior, a clear understanding of the program experience itself is essential. EE encompasses a wide spectrum of programs that employ a variety of curricula, philosophies, learning experiences and settings. For example, a review of 700 different EE curricula used in the United States reported varying levels of emphasis on knowledge attainment, attitude development, and behavior adoption (Pomerantz, 1990–1991). The variety of EE programs and practices does not necessarily hamper the generalizability of research findings from specific programs, especially if the influences of different types of general program components (e.g., activities, settings, etc.) are considered. For example, the impact of program settings (i.e., indoor vs outdoor) has already received some research attention. Results from a meta-analysis comparing the effectiveness of classroom vs non-traditional settings (e.g., nature camps and field studies) suggest that classroom based programs more effectively influenced behavior (Zelezny, 1999). The applicability of these findings is tenuous, however, as a result of lack of uniformity within and between the comparison groups. Both of the indoor and outdoor setting ranged widely in age, including elementary, middle school, and college students as well as older adults. Additionally, the non-traditional category consisted of programs with a variety of different settings as opposed to a specific shared setting.

Another study examined the impact of classroom instruction and direct experiences on a group of 9–13 year old students involved in a bat education program (Kals & Ittner, 2003). Students were divided into three groups: one that received classroom instruction; one that took part in classroom instructions and direct outdoor experiences; and a control group. Findings indicated that while both treatment groups experienced positive environmental identity growth, no major differences existed between them. In another study, positive results regarding outdoor contexts were found in a comparison of students involved in a residential environmental education program that involved direct exposure to nature vs students enrolled in classroom based programs (Dettmann-Easler & Pease, 1999). Students in the residential program developed significantly more positive wildlife attitudes

than the classroom students. While these research efforts represent preliminary attempts to understand the impact of context on EE program outcomes, the dearth of applicable studies and contradictory findings make it difficult to answer questions regarding the influence of settings on outcomes.

Although the lack of empirical evidence hampers efforts to understand the influence of settings on EE program outcomes, two theoretical perspectives may assist research efforts in this area. The first addresses the developmental impact of direct, indirect, and vicarious nature experiences on children and young adolescents (Kellert, 2002). The second body of work suggests that direct and indirect experiences exert unique influences on affective and cognitive based attitudes (Fazio & Zanna, 1978, 1981; Millar & Millar, 1996). The synthesis of these frameworks provides a theory-based approach to understanding the influence of indoor and outdoor settings on EE program outcomes.

Kellert (2002) proposes a framework linking direct, indirect, and vicarious nature experiences to cognitive, affective, and evaluative modes of learning. Direct experiences involve contact with natural green spaces and wildlife free from human development. Indirect nature experiences usually occur at man-made nature sites (e.g., zoos, nature centers, etc.), while vicarious experiences involve classroom instruction, books and other media about nature. Kellert suggests that each of these experiences exert different influences on cognitive (i.e., intellectual), affective (i.e., emotional), and evaluative (i.e., moral) development. In the current study, the category of indirect experiences will encompass both indirect and vicarious experiences and affective and evaluative learning will be combined into attitudinal learning.

Although Kellert's model has not been directly tested, research findings support the developmental importance contact with nature holds for children and adolescents (Louv, 2008). Direct and indirect contact with nature have been linked to improved cognitive functioning (Wells, 2000), increased self-discipline (Taylor, Kuo, & Sullivan, 2002), and reductions in symptoms associated with ADHD (Taylor & Kuo, 2009). While studies involving both direct and indirect nature experiences have produced positive results, questions still remain regarding how different types of contact with nature impact psychological functioning. For example, findings from a study examining the influence of different views of nature (e.g., window, plasma screen, and no window) from an office setting on participants' stress levels suggest that those individuals who could view nature through a window exhibited greater stress reduction than individuals who viewed the same nature scene through a plasma screen and the no window group (Kahn et al., 2008). Results show that even slight differences in the type of nature exposure produces different outcomes and that direct nature contact appears most beneficial. This finding is troubling considering that children today appear to have increasingly less direct contact with nature (Louv, 2005).

Some insights regarding the different impacts of direct and indirect nature experiences can be extrapolated from research examining the influence of experiences on attitude development (Fazio & Zanna, 1978, 1981; Millar & Millar, 1996). Findings from a series of experiments on the impact of direct and indirect experiences on attitude-behavior consistency, led Fazio and Zanna to conclude that direct experiences produce attitudes that are more likely to lead to behavior than attitudes developed as a result of indirect experiences. Research stemming from these findings suggests that direct experiences lead to affective based attitudes while indirect experiences lead to cognitive based attitudes (Millar & Millar). These findings also suggest that affective based attitudes more accurately predict intrinsically motivated behavior whereas cognitive based attitudes are more closely associated with extrinsically motivated behavior.

With regards to the current study, these findings suggest that indirect EE experiences should lead to cognitively based attitudes that promote extrinsically motivated behavior, whereas direct EE experiences should produce affectively based attitudes that encourage intrinsic behaviors. Research focusing on the relationship between different experiences and learning outcomes will add to the existing literature as well as provide EE practitioners with important insights regarding how best to develop programs that promote pro-environmental behavior. In addition to understanding the influence of direct and indirect experiences, focus also needs to be given to the processes whereby knowledge and attitudes lead to actual behaviors.

### 3. Hypotheses and research questions

Based upon the reviewed literature, the following hypotheses were tested ( $p < .05$ ) using data gathered from participants in an environmental education, international immersion program:

1. Participants will experience significantly greater growth on the knowledge, attitude, and behavior measures than the comparison group from baseline to follow-up data collection periods.
2. The preparatory component (indirect nature experience) will produce greater knowledge growth than the field workshop (direct nature experience) for the participants.
3. The field workshop (direct nature experience) will produce greater attitude growth than the preparatory component (indirect nature experience) for the participants.
4. For both the preparatory and field workshop program components, attitudes will be significantly stronger predictors of behavior than knowledge, within a TPB framework.

The following qualitative research questions complemented the information gleaned from the quantitative investigation:

1. How do participants perceive the differing impacts of the indirect and direct program components on their overall experience?
2. Do participants perceive the program as having an impact on their environmental knowledge, attitudes, and pro-environmental behavior?

### 4. Methods

#### 4.1. Mixed-method design

This study employed a quasi-experimental, concurrent nested mixed-method design (Hanson, Creswell, Clark, Petska, & Creswell, 2005) to address the hypotheses and research questions. This quasi-experimental design used a non-equivalent comparison group (Babbie, 2005) which helps promote some degree of external validity despite the lack of random assignment to participant and comparison groups. The mixed-method design involves the simultaneous collection and analysis of both quantitative and qualitative data. In the case of this study emphasis was given to the quantitative data and hypotheses and the qualitative data were used to gain additional insights.

#### 4.2. Program description

The program studied was sponsored by Global Explorers (GEx), a non-profit organization that provides international immersion experiences for middle school and high school students and teachers. Program offerings focus on four core disciplines (science,

culture, leadership and service) with the overall goal of helping students develop into responsible global citizens (Global Explorers, 2008). Each offering has three stages: a preparatory program, an international field workshop, and a post-trip service project. During the preparatory program youth participate in 9–12 sessions, ranging in length from approximately one to 3 h, specific to each groups' travel destination. The length of the preparatory program varied between groups as some implemented multiple sessions over a few weeks whereas other groups implemented one session every couple of weeks. GEx does not require a specific preparatory program implementation schedule for any of its groups. Many of the groups also participate in additional fundraising and other preparatory activities.

The international field workshop lasts between 7 and 14 days. Each group consists of students, teachers, and optional adult chaperones and travels independently from other GEx groups. All aspects of the international field workshop are arranged and supervised by GEx staff. In addition to local guides, GEx provides each group with a volunteer field scientist as well as a GEx staff member. During this portion of the program students and teachers take part in a variety of cultural, scientific, and service activities led by GEx staff and local, contracted guide services. Locations included Peru, Costa Rica, and Tanzania. Upon returning from the field workshop, participants design and implement a service project directed either towards the needs of their own community or the international community they visited.

#### 4.3. Population

GEx promotes their programs to middle and high school teachers across the United States. Data for this study were collected from seven different groups of participants from schools who traveled with GEx during 2008. For this purpose of this study, each participating teacher was also asked by the researchers to recruit students to participate in the comparison group (Babbie, 2005). Consent forms were collected from all teachers and parents who had children involved in the study. Assent was obtained from participating students.

All groups ( $N = 10$ ) participating in a standard GEx program during 2008 were invited to take part in the program evaluation. Of the 215 youth who participated in a GEx program during 2008, 108 from seven different groups agreed to take part in the evaluation. Three groups declined involvement due to perceived logistical difficulties and or lack of interest from teachers and participants. Therefore, students in these three groups did not necessarily self-select out of the study but rather they were never given the chance to participate based upon their teachers' decisions. While this does not rule out the presence of a self-selection bias in the sample, it does put the onus for the non-participation of these three groups primarily on the teachers not the students. It should also be noted that 90% of the students, in the seven groups whose teachers agreed to take part in the study, completed at least one questionnaire.

Teachers from these seven groups were asked to recruit students from their school to serve in a non-equivalent comparison group (Babbie, 2005) but only three of the seven teachers complied with this request. The only specific recommendations given to teachers regarding the recruitment of this group was to select students in the same grade(s) as participating students and to recruit roughly twice the number of comparisons and participants in their schools. Beyond these directions the researchers refrained from providing further specific directions in order to avoid tampering with the makeup of the comparison group. Since teachers were not the end users of the evaluation findings, the authors did not feel that the teachers would be unduly motivated to select a biased group of comparison students.

The participant group ( $n = 108$ ) consisted of 51 females and 57 males while 29 females and 20 males served as comparisons ( $n = 49$ ). At the beginning of the study, participating and comparison students had mean ages of 14.5 ( $SD = 1.65$ ) and 13.6 ( $SD = .89$ ) respectively. Eighty-two percent of the participants and 90% of the comparisons were White.

One-way ANOVAs and chi-square tests were conducted to investigate the possibility of group age, gender, and ethnicity differences as well as baseline equivalence on all outcome measures. The only significant difference between the groups was age ( $F(1, 150) = 11.7$ ;  $p = .001$ ) and environmental knowledge ( $F(1, 150) = 12.41$ ;  $p = .001$ ) with the participants reporting higher means for both variables. The difference in environmental knowledge scores at baseline may suggest some degree of self-selection into the program.

#### 4.4. Quantitative methodology

##### 4.4.1. Data collection

Several different procedures were employed to collect questionnaire data from participant and comparison group members. While groups followed the same general program pattern (i.e., preparatory program, international workshop, and service project), each group operated based upon a unique calendar. For example, some groups traveled in April while others traveled in August. Preparatory programs also started at different times and lasted different lengths of time. In order to infuse some regularity in the data collection process, despite calendaring differences between groups, the decision was made to collect data from each group at the same periods in the program cycle rather than a uniform dates or time periods. At the completion of the preparatory program (i.e., indirect nature experience; T2), program participants completed a questionnaire containing both traditional and retrospective pre-test items. The traditional items addressed issues related to socialization processes within the preparatory program. The retrospective pre-test items assessed pre (T1) and post preparatory program (T2) levels of self-reported program outcome variables (i.e., environmental knowledge, attitude, and behavior). Students in the comparison group also completed the retrospective pre-test items during approximately the same time frame.

Retrospective pre-tests were employed due to both logistical limitations, which did not allow for data collection before all groups began their participation, and to guard against self-report bias. Retrospective pre-tests occurred at the conclusion of the preparatory program and required respondents to indicate their current perception of the degree to which they possessed a specific trait, attitude, or attribute previous to their participation in the preparatory program (Sibthorp, Paisley, Gookin, & Ward, 2007). The retrospective wording for this study was "at the beginning of the school year, how would you have responded to this statement [referring to the statement associated with that particular item]?" Use of this approach guarded against response-shift bias which occurs between pre and posttests when individuals' internal scale of measurement changes as a result of an experience (Pratt, McGuigan, & Katzev, 2000; Sibthorp et al., 2007). For example, a youth participant might rate themselves high on a pre-test skills inventory as a result of inaccurate perceptions of the difficulty of tasks they will be required to complete. After completing the tasks, even though the individual gained a greater degree of competence from their experience, they might rate themselves lower on the posttest than the pre-test due to a more accurate perception of task difficulty.

In order to provide information regarding the unique impact of the international workshop (i.e., direct nature experience; T3), participants completed all items from the T2 questionnaire at the

conclusion of this program component. A final round of data collection occurred during the fall of 2008 (T4) to follow-up with both the program and comparison groups. T4 data collection was planned to occur after all groups had completed their post-trip service projects. Thus, time between post-travel and follow-up data collection periods ranged from three to seven months. Due to logistical difficulties associated with collecting data from the comparison group during the summer, data were only gathered from the comparisons at T1, T2, and T4.

Table 1 contains a breakdown of the responses collected at each of four data collection periods. While the number of questionnaires collected across the first three data collection occasions remained static, attrition (19 comparisons and 33 participants) occurred at T4 despite extensive efforts to maintain a high response rates.

An attrition analysis was conducted in order to identify potential differences between those individuals with and without complete data. One-way ANOVAs were utilized to test for differences between these groups on applicable study variables and demographics. These analyses revealed no significant differences between those with and without complete data within both the participant and comparison groups. The assumption that the data are missing at random rather than due to some underlying reason or self-selection characteristic was supported by these findings. This finding, along with the low rate of missing data (<5%) from individuals who completed at least a portion of the survey at each time wave, provided justification for imputing some of the missing data. Imputation was conducted using the LISREL 8.8 multiple imputation procedure to address missing values at each time wave for individuals who completed a questionnaire. Data were not imputed if no response was collected from an individual for a particular wave of data collection.

#### 4.4.2. Quantitative measures

The current study employed three subscales from the Children's Environmental Attitude and Knowledge Scale (CHEAKS, Leeming & Dwyer, 1995) to measure environmental attitudes, behavior intentions, and behavior. The CHEAKS subscales each contained 12 items which measured self-reported levels of environmental affect, verbal commitment, and actual commitment. For the purposes of this study's operationalization of TPB constructs, the affect items were used to measure attitude (EA), the verbal commitment items measured behavior intentions (EBI), and the actual commitment items measured behavior (EB). The attitude subscale contains such statements as "I get angry about the damage pollution does to the environment" and "I am frightened to think people don't care about the environment". Statements like "I would not be willing to save energy by using less air conditioning" and "To save water, I would be willing to turn off the water while I wash my hands" are examples from the behavioral intention subscale. Items from the environmental behavior subscale included statements such as "I have asked my family to recycle some of the things that we use" and "I do not let a water faucet run when it is not necessary."

Previous work employing the attitude subscale suggests acceptable levels of reliability (Leeming & Dwyer, 1995). Cronbach's alpha for data collected from a sample of 4th to 7th grade students was .89. Two administrations, over an eight-month period, of the

attitude subscale produced a correlation coefficient of .70, suggesting acceptable levels of test-retest reliability. Weak correlations between the attitude and knowledge subscales across both administrations ( $r = .125$  to  $r = .127$ ) lend support to the convergent and discriminate validity of these subscales. The authors also established contrasted-group validity for the scale by having teachers identify high and low environmentally conscious students and comparisons of these groups' scores revealed significant and expected differences.

Perceived behavioral control (PBC) and social norm (SN) items were adapted from scales employed in a previous TPB study (Courneya, Bobick, & Schinke, 1999). Three items measured PBC (e.g., "For me to practice pro-environmental behavior is easy") and two items measured SN (e.g., "My parents are supportive of me practicing pro-environmental behavior"). These scales have produced adequate levels of reliability in previous research (.81 for PBC and .82 for SN; Courneya et al.). A 5 item scale (e.g., "I can explain what the term ecology means") to measure environmental knowledge (EK) was developed by the authors through a review GEx curriculum and was evaluated for content validity by GEx administrators. All items employed in this study were assessed using a 5-point Likert response format (1 = very untrue to 5 = very true). All scales produced adequate levels of internal consistency (see Table 2).

#### 4.4.3. Analysis procedure

To test H1, repeated measures ANOVAs were conducted to compare intervention and comparison group scores on the EK, EA, and EB measures across T1, T2, and T4. Repeated measures ANOVAs were also used to compare participant EK and EA development between the preparatory and international field workshop portions of the program (H2 and H3). Finally, a combination of zero-order correlation comparisons and hierarchical regressions were used to assess and compare the strength of regression coefficients of EK and EA on EB (H4).

### 4.5. Qualitative methodology

#### 4.5.1. Data collection

Working with GEx administrators, one of the participating groups was invited to serve as a case study for the qualitative portion of the evaluation. This group was selected due to the number of student participants ( $N = 46$ ), teacher support for the project, and the fact the group was traveling to Peru, which allowed GEx administrators to obtain interview and observation data pertaining to their most popular travel destination. Qualitative data collection involved focus groups and dyadic interviews with members of this group (Table 3) as well as responses, from all participant group members, to a variety of open ended items on the T2, T3, and T4 questionnaires.

Focus groups and dyadic interviews were conducted with youth participants and their parents during three three-day site visits conducted by the principle investigator (PI). The first two site visits

**Table 1**  
Participant and comparison group quantitative data collection overview.

Group	Baseline retrospective surveys (T1)	Post-preparatory program surveys (T2)	Post-international workshop surveys (T3)	Follow-up surveys (T4)
Participants	106	106	108	75
Comparisons	49	49	–	30

**Table 2**  
Reliability coefficients for all measures.

Scale	Alpha coefficients		
	(T1)	(T2)	(T4)
Environmental knowledge	.78	.83	.77
Environmental attitude	.85	.85	.84
Pro-environmental behavioral intentions	.76	.76	.77
Pro-environmental behavior	.75	.71	.65
Perceived behavioral control	.72	.75	.83
Social norms	.78	.79	.70

occurred during the preparatory portion of the program (one during the middle and one towards the end), and a post-travel visit took place during the fall. During each site multiple student focus groups (i.e., four to six participants) and one large parent focus group (i.e., eight to twelve parents) were conducted. Focus groups allowed participants to share thoughts about their experiences in the program and to respond to a variety of questions designed to facilitate discussion regarding the study's research questions. The PI also observed various activities associated with the program (e.g., after school meetings). The third site visit occurred during the fall of 2008. This visit allowed the PI to interview the same groups of individuals regarding their overall assessment of the program as well as their perceptions of the long term impact of their experiences.

The PI also traveled with the case study group during the two week international field workshop in Peru in order to conduct further program observations and interviews. The first week was spent at guest lodges in the Peruvian Amazon basin and the second week took place in southern Peru hiking the Inca Trail to Machu Picchu. The entire group participated in the Amazon portion of the trip while approximately half of the group stayed for the Inca Trail. Interviews and focus groups were conducted with all participants, parents, teachers, and GEx staff members. The PI also conducted participant observations and took field notes regarding all aspects of the program. These notes were transcribed and incorporated into the analysis.

#### 4.5.2. Analysis procedures

All interviews were recorded and transcribed. The analysis process was guided by grounded theory methodology as outlined by Strauss and Corbin (1998a) and the study's research questions. This process included reading of pertinent portions of the transcripts in order to identify repeated words, phrases and themes. This open coding process enabled the development of themes that were grounded in the data themselves (Strauss & Corbin, 1998b). Commonalities between categories allowed for the development of more abstract categories under which related sub-categories were grouped; this process is referred to as axial coding (Strauss & Corbin, 1998b). Axial coding occurred concurrently with open coding. Once fairly developed categories emerged, the researchers moved to selective coding, whereby a core category was identified and the focus of the analysis shifted to connecting other categories to this core category in order to begin the development of a grounded theory (Strauss & Corbin, 1998b).

Memo writing occurred throughout the data collection and analysis processes including code notes, theory notes and operational notes (Strauss & Corbin, 1998a). Code notes refer to memos regarding any aspects of the coding process (e.g., why certain quotes were assigned to a particular code). Theory notes deal with issues regarding conceptual relationships, whereas operational notes deal with logistical aspects of the study.

The final step of the analysis process involved the integration of themes and relationships between these themes into a coherent response to the study's research questions. Throughout the analysis process, codes, analyses and the emerging theory were reviewed by

co-PI's as well as the participants themselves to insure that all analyses remained true to the raw data and lived experience of the respondents (Strauss & Corbin). The ability to discuss emerging themes with participants while in the field provided the PI with additional guidance regarding the qualitative inquiry and allowed for a more flexible and organic approach to the collection of the qualitative data. This study employed four validation strategies (Creswell, 2007): extensive time spent in the field with the subjects, the use of multiple forms of data (e.g., interviews with parents, teachers, GEx staff and youth, field notes, and open ended survey questions), member checking, and peer review.

#### 4.5.3. Researcher's relationship to the data

As noted, the PI spent a significant amount of time with members of the case study group, during which time efforts were made to be a passive observer of the program as opposed to an active participant. The focus was on building rapport with participants in order to develop relationships that would foster the open sharing of information. The PI had previous experience as a director of programs for youth and taking on the role of observer represented a new experience, one that required a conscious effort not to take a more participatory place in the program. However, it must be acknowledged that the PI's presence in the field invariably impacted the youths' experience. For example, without the interviews and focus groups many of the youth would not have had a comparable opportunity to discuss and debrief their experiences.

#### 4.6. Integration of qualitative and quantitative analyses

The analysis of qualitative and quantitative data in this study occurred jointly and informed each other (Caracelli & Greene, 1993). However, emphasis in this study was given to the quantitative findings with the qualitative data used in a supporting role.

### 5. Findings

#### 5.1. Quantitative findings

##### 5.1.1. Descriptive findings and gender differences

As previously mentioned, no significant differences between the two groups, aside from the participant group having a higher mean age than the comparisons, were found on any of the demographic or baseline variables. A full presentation of the descriptive statistics for all relevant variables is provided in Table 4. Gender differences on the study variables within the comparison and participant groups were analyzed using one-way ANOVAs. Participating boys reported higher levels of EK at T1 ( $F(1, 101) = 10.49, p = .002$ ), PC at T1 ( $F(1, 101) = 5.15, p = .03$ ), and EK at T4 ( $F(1, 74) = 6.69, p = .01$ ). Participating girls reported higher levels of EBI at T2 ( $F(1, 101) = 6.45, p = .01$ ), SN at T2 ( $F(1, 101) = 4.27, p = .04$ ), EBI at T3 ( $F(1, 101) = 7.47, p = .01$ ), EB at T3 ( $F(1, 105) = 4.01, p = .048$ ), and EBI at T4 ( $F(1, 74) = 4.42, p = .04$ ). Females in the comparison group reported higher levels at T1 of EA ( $F(1, 47) = 7.13, p = .01$ ), EBI ( $F(1, 47) = 6.48, p = .01$ ) and SN ( $F(1, 47) = 6.63, p = .01$ ) and at T2 of EA ( $F(1, 47) = 9.97, p = .003$ ), EBI ( $F(1, 47) = 7.54, p = .01$ ) and SN ( $F(1, 47) = 10.16, p = .003$ ).

##### 5.1.2. Hypothesis 1

Results from repeated measures ANOVAs comparing participant and comparison EK, EA, and EB scores across T1, T2, and T4 (T3 was not used in the analysis due to the lack of comparison data from this collection period) partially supported the hypothesis that the participant group would experience significant growth in these areas in relationship to the comparison group. The main effects for

**Table 3**  
Qualitative data collection overview: number of case study interviews/focus groups.

	Preparatory program	International workshop	Follow-up	Total
Participants	10	23	11	44
Parents	2	5	1	8
Group sponsors	3	1	1	5
GEx staff	—	2	—	2

**Table 4**  
Participant and comparison descriptive statistics.

Measure	Group	T1		T2		T3		T4	
		M	SD	M	SD	M	SD	M	SD
Environmental knowledge	Comparison	1.73	.70	2.53	.96	–	–	2.84	1.01
	Participant	2.25	.92	3.90	.81	4.19	.77	4.42	.68
Environmental attitudes	Comparison	3.19	.79	3.57	.81	–	–	3.68	.78
	Participant	3.21	.80	3.77	.69	3.97	.64	3.94	.65
Pro-environmental behavioral intentions	Comparison	3.10	.71	3.49	.76	–	–	3.66	.59
	Participant	3.11	.67	3.68	.60	3.82	.64	3.89	.60
Pro-environmental behavior	Comparison	2.80	.67	3.07	.77	–	–	3.26	.74
	Participant	2.90	.80	3.31	.68	3.49	.64	3.64	.65
Perceived behavioral control	Comparison	2.90	1.06	3.31	1.13	–	–	3.32	1.09
	Participant	3.09	1.02	3.77	.84	4.04	.88	3.97	.82
Social norms	Comparison	3.53	1.39	3.68	1.36	–	–	3.63	1.14
	Participant	3.48	1.25	3.79	1.11	4.04	.97	4.12	1.03

these analyses were time of testing (i.e., T1, T2, and T3), measure (i.e., EK, EA, and EB), and group (i.e., participant or comparison).

The first analysis included all main effects of time, measure, and group. Mauchly's test indicated that the sphericity assumption had been violated for the main effect of measure ( $\chi^2(2) = 9.16, p = .01$ ) and the interaction effect of time of testing  $\times$  measure ( $\chi^2(9) = 60, p < .001$ ). Accordingly, Huynh–Feldt estimates of sphericity were used to correct the degrees of freedom ( $\epsilon = .98$  for the main effect of measure and  $.84$  for the interaction effect of time of testing  $\times$  measure). Results from the analysis revealed all main and interaction effects to be significant (see Table 5). The significant time of testing  $\times$  measure  $\times$  group interaction effect ( $F(3,38, 350.98) = 6.94, p < .001, \text{partial } \eta^2 = .06$ ) is of particular interest for this hypothesis as it indicates significant growth difference existed across time between the participant and comparison group on all measures. Additional repeated measures ANOVAs for each subscale (i.e., EK, EA, and EB) provide further program impact insights.

For EK there was a significant main effect of time of testing ( $F(2, 208) = 150.38, p < .001, \text{partial } \eta^2 = .59$ ) as well as a significant interaction effect (see Fig. 1) for time of testing  $\times$  group (i.e., participant or comparison;  $F(2, 208) = 16.38, p < .001, \text{partial } \eta^2 = .14$ ) indicating participants experienced significant EK growth in relationship to the comparisons. There was also a significant effect of group indicating that participants reported higher EK scores across all time periods than the comparisons ( $F(1, 104) = 85.81, p < .001, \text{partial } \eta^2 = .45$ ). For EA there was a significant main effect of time of testing ( $F(2, 208) = 42.73, p < .001, \text{partial } \eta^2 = .29$ ) and an interaction (see Fig. 2) effect that approached significance for time of testing  $\times$  group ( $F(2, 208) = 2.75, p = .07, \text{partial } \eta^2 = .03$ ). For EB Mauchly's test indicated that the sphericity assumption had been violated for the main effect of time ( $\chi^2(2) = 24.22, p < .001$ ). Accordingly, Huynh–Feldt

estimates of sphericity were used to correct the degrees of freedom ( $\epsilon = .85$ ). Results revealed a significant main effect for time of testing ( $F(1.69, 176.07) = 42.976, p < .001, \text{partial } \eta^2 = .29$ ) and an interaction effect (see Fig. 3) approaching significance for time of testing  $\times$  group ( $F(1.69, 176.07) = 2.68, p < .08, \text{partial } \eta^2 = .03$ ). In summary, it appears the program had the greatest impact on EK and a weaker affect on EA and EB growth.

### 5.1.3. Hypotheses 2 and 3

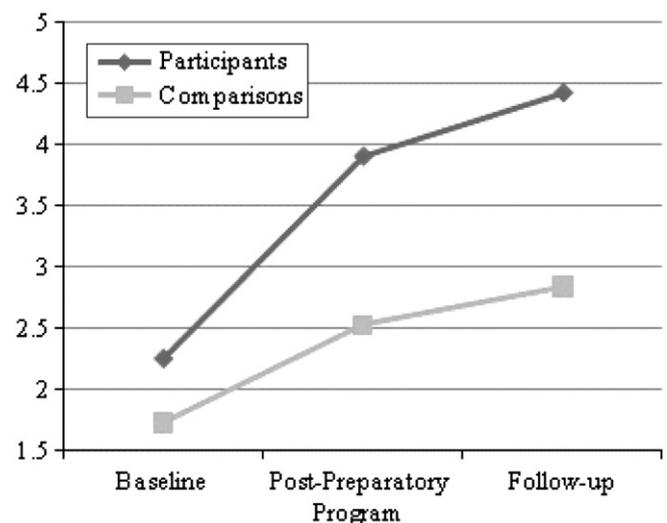
To test the differences between EK and EA growth patterns across the preparatory and international workshop portions of the program a repeated measures ANOVA with two within-subject factors (i.e., Time = T1, T2, and T3; Benefit = EK and EA) was run on the participant data. There was a significant main effect for time ( $F(2, 202) = 291.93, p < .001, \text{partial } \eta^2 = .74$ ) as well as a significant linear trend ( $F(1, 101) = 424.67, p < .001, \text{partial } \eta^2 = .81$ ). There was also a significant main effect for benefit ( $F(1, 101) = 10.97, p = .001, \text{partial } \eta^2 = .10$ ) with higher overall EA ( $M = 3.67$ ) than EK ( $M = 3.45$ ) scores which is primarily due to low EK scores at T1. The interaction effect between time and benefit was also significant ( $F(2, 202) = 119.19, p < .001, \text{partial } \eta^2 = .54$ ) which indicates that the development of EK and EA differed across time periods (see Fig. 4).

In order to address whether the preparatory and international workshop portions of the program produced different degrees of

**Table 5**  
Summary of environmental knowledge, attitude and behavior repeated measures ANOVA.

	SS	df	F	p-Value	Partial $\eta^2$
Time	141.24	2	130.43	<.001	.56
Time $\times$ group	12.12	2	11.20	<.001	.10
Error (time)	112.62	208	–	–	–
Measure	53.22	1.89 <sup>a</sup>	38.07	<.001	.27
Measure $\times$ group	46.37	1.89 <sup>a</sup>	33.17	<.001	.24
Error (measure)	145.39	191.70 <sup>a</sup>	–	–	–
Time $\times$ measure	35.44	3.38 <sup>a</sup>	46.46	<.001	.31
Time $\times$ measure $\times$ group	5.29	3.38 <sup>a</sup>	6.94	<.001	.06
Error (time $\times$ measure)	79.32	350.98 <sup>a</sup>	–	–	–

<sup>a</sup> degrees of freedom were corrected using Huynh–Feldt estimates of sphericity.

**Fig. 1.** Environmental knowledge time  $\times$  group interaction.

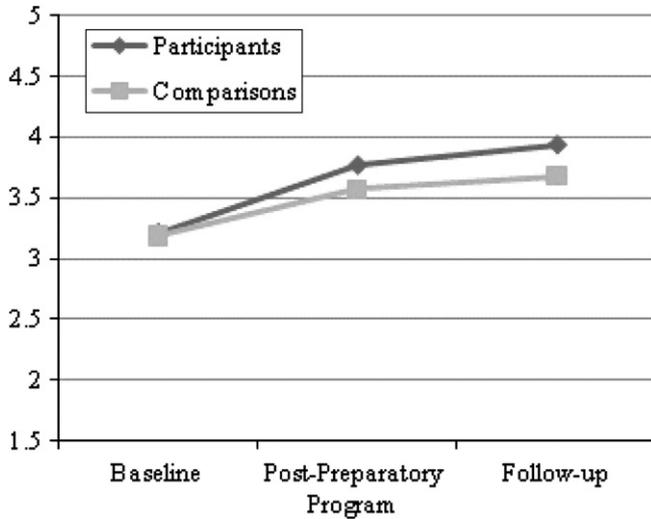


Fig. 2. Environmental attitudes time x group interaction.

EK and EA growth Cohen's D effect sizes (Cohen, 1988) were calculated for each outcome variable during each program component (preparatory program EK  $d = 1.97$  and EA  $d = .76$ ; international workshop EK  $d = .43$  and EA  $d = .32$ ). Results indicated that greater EK than EA gains were experienced in both the preparatory and international workshop program components, though the difference was greatest in terms of growth during the preparatory program. Thus H2 but not H3 was supported by the findings from these analyses.

5.1.4. Hypothesis 4

The results from two separate analyses indicate partial support for the hypothesis that EA would be more strongly related to EB than EK within each program component. The first, involved reviewing and comparing the zero-order correlations between variables of interest (see Table 6) from the preparatory program (T2) and the international workshop (T3). All correlations were significant at the .01 level. To assess the hypotheses that  $r_{EK,EB} < r_{EA,EB}$  at T2 and  $r_{EK,EB} < r_{EA,EB}$  at T3, a test for differences between dependent correlations was conducted using procedures outlined by Dawson and Trapp (2004). Results from these tests

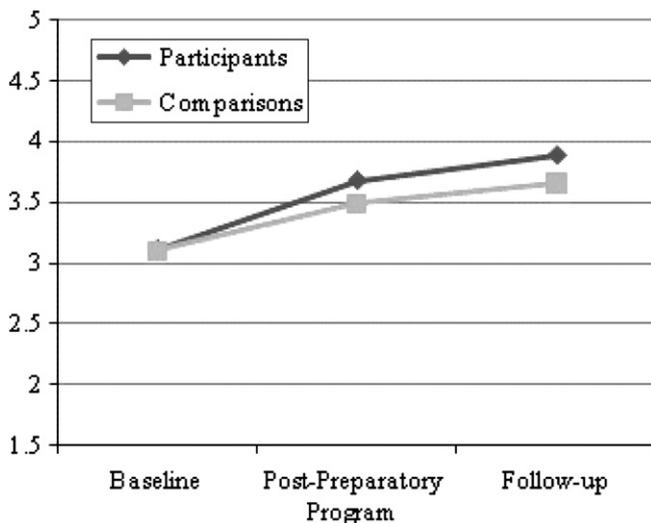


Fig. 3. Environmental behavior time x group interaction.

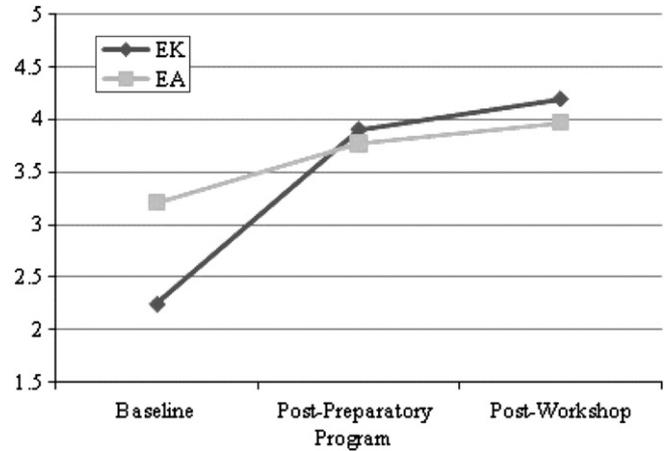


Fig. 4. Time x benefit interaction.

indicate that EA had a significantly stronger correlation ( $t = 2.01$ ,  $p = .02$ ) with EB than did EK at T2, whereas no significant difference ( $t = .10$ ,  $p = .46$ ) existed between  $r_{EK,EB}$  and  $r_{EA,EB}$  at T3.

As noted in the literature review, the authors were also interested in examining the relationship between EK, EA, and EB from a theory of planned behavior perspective. Following an analysis strategy drawn from the TPB literature (Courneya et al., 1999), separate hierarchical regression analyses (HRA) were run for both T2 and T3. The sequence and content of each regression block were based upon the TPB framework. For both time periods EB was regressed upon pro-environmental behavior intentions (EBI; Block 1), perceived behavior control (PBC) and social norms (SN; Block 2), and EA and EK (Block 3).

Results from the T2 HRA (see Table 7) indicated that Block 1 (EBI) accounted for 18% of the variance in EB, Block 2's (PC and SN) contribution was non-significant, and that Block 3 (EK and EA) explained an additional 7% of the variance. In the final equation only two of the five predictors, SN ( $\beta = .24$ ,  $p = .02$ ) and EA ( $\beta = .32$ ,  $p = .01$ ), proved significant. Results from the T3 HRA (see Table 8) indicated that Block 1 (EBI) accounted for 23% of the variance in EB, Block 2 (PC and SN) contributed 7% more explained variance, and that Block 3 (EK and EA) explained an additional 16% of the variance. All blocks were significant at the .05 level. In the final equation three of the five predictors, SN ( $\beta = .19$ ,  $p = .04$ ), EA ( $\beta = .25$ ,  $p = .01$ ), and EK ( $\beta = .34$ ,  $p < .001$ ), proved significant. These findings suggest that while EA was a stronger predictor of EB than EK in terms of the growth participants reported during the preparatory portion of the program, both EA and EK had equally strong and significant relations with EB as a result of the international workshop.

5.2. Qualitative findings

The qualitative research questions focused on understanding the role of indirect and direct experiences during participants' GEX experiences and how these influenced environmental knowledge,

Table 6  
Zero-order correlations between program outcomes ( $n = 103$ ).

	Preparatory program			International workshop		
	1	2	3	1	2	3
1. Environmental knowledge	–	.51	.29	–	.34	.52
2. Environmental attitudes		–	.47		–	.52
3. Pro-environmental behavior			–			–

**Table 7**

Hierarchical regression results for the prediction of environmental behavior at T2 ( $n = 107$ ).

Step/Predictor	$R^2$	$\Delta R^2$	$\Delta F$	$B$	$SE$	$\beta$
1 Pro-environmental behavior intentions	.18	.18	22.58**	.12	.14	.11
2 Perceived behavioral control	.22	.04	2.24	-.02	.08	-.03
Social norms				.15	.06	.24*
3 Environmental attitudes	.29	.07	4.95**	.32	.12	.32**
Environmental knowledge				.06	.09	.07

Note. Significant values and unstandardized and standardized regression coefficients reflect the results of the final regression equation. \* $p < .05$ . \*\* $p < .01$ .

attitude, and behavior outcomes. As the analysis of qualitative material proceeded it became clear that participants made clear distinctions between the indirect and direct portions of the program and associated different outcomes with each experience type. Analysis of the qualitative data suggests that a link existed between the direct experiences associated with the international workshop and environmental attitudes and behavior. Additionally, it appears that participants perceived the Inca Trail portion of the program to be a more direct experience than the Amazon portion. This finding suggests that a continuum may exist in the magnitude of the direct experience.

### 5.2.1. Direct vs indirect experiences

The program participants drew a conscious division between the indirect experience they were having in the preparatory program and the direct experience they were anticipating having during the international workshop. For example, one student said:

I've always liked hands-on things like in science we do labs and stuff like that. And it [international workshop] will be just...one big lab in science. When you go out, instead of watching it on a movie or seeing it in a text book, you're there and you're learning about it.

Some youth anticipated that the direct nature of the international workshop would also have a greater affective impact than the indirect preparatory experience:

I feel like you really care about it [the rain forest] more, because if you are just reading about it in class you are just like, this is just another thing you learned about but if you are...there you are in it and it really makes you see.

The international workshop appears to have validated participants' assumption that this portion of the program would be a significant direct experience. Participants reported a number of reasons why the travel portion of the program was such a powerful experience. For some it was the full sensory experience, as described by the following participant: "seeing it firsthand... you know just like hits you. Like all your senses, you smell different things; you see frogs and different insects and birds constantly." The fact that a direct experience was far superior to watching something on TV was a common sentiment. For example: "this [being in the rain forest] feels more real. Because when you look at

**Table 8**

Hierarchical regression results for the prediction of environmental behavior at T3 ( $n = 102$ ).

Step/Predictor	$R^2$	$\Delta R^2$	$\Delta F$	$B$	$SE$	$\beta$
1 Pro-environmental behavior intentions	.23	.23	31.80**	.14	.09	.14
2 Perceived behavioral control	.30	.07	5.09**	.01	.07	.02
Social norms				.12	.06	.19*
3 Environmental attitudes	.46	.16	14.77**	.26	.09	.25**
Environmental knowledge				.28	.07	.34**

Note. Significant values and unstandardized and standardized regression coefficients reflect the results of the final regression equation. \* $p < .05$ . \*\* $p < .01$ .

something on TV it is many many miles away but when you are there, you can actually breathe the atmosphere and live the picture."

### 5.2.2. Influence of experience type on learning outcomes

While participants and parents commented on the knowledge gained by participants, it appears that most of these comments dealt with the preparatory program rather than the international workshop. When asked what was gained from the preparatory program most youth shared what they had learned rather than how attitudes or behavior had been impacted:

- I learned that...in rain forests...it's not as nutritional as I used to think it was.
- I learned that there's a little parasite that will get inside your bloodstream and mate inside your organs and then make you poop out eggs.

In contrast, once the international workshop began the majority of the comments dealing with program impacts focused on the development of environmental attitudes and behavior. For some students just knowing about the rain forest was not enough to actually impact their attitude and behavior, for that a more direct experience was needed. The following comment was shared by a student during the Amazon portion of the international workshop:

I knew about [the rain forest]. I was not really interested in it. I was not really you know save the environment and stuff like [that]. I knew...what would happen but now ...I don't want all this to go away, this is beautiful.

The direct experience appears to have acted as a catalyst, converting preexisting knowledge into action. This process is apparent from the comment from a participant who experienced a heightened interest in biology as a result of the international workshop:

I did not have much interest, I liked animals and stuff like plants and animals but I did not have much interest in biology. Coming here [the rain forest] how diverse it is and how unbelievably...cool these plants are...I have got like this brand new. I would love [to] just stay here and learn about the bugs and the dirt.

The open-ended responses on the post-travel questionnaires also support the attitudinal and behavioral impacts of the international workshop:

- I can do a lot to help the environment, even more than I thought.
- I learned how important the environment is and how there is so much work to be done. It is definitely very important to get people involved and keep all these amazing things around.

In summary, the qualitative data suggest that the preparatory program was seen as more indirect experience that helped students learn about culture, science, etc., whereas the international workshop was a direct experience that impacted participants environmental attitudes and behavior.

### 5.2.3. Amazon vs Inca Trail

Approximately half of the participants from the Amazon experience also spent an additional week in Southern Peru hiking the Inca Trail to Machu Picchu. The opportunity to participate in two very different direct experiences provided participants the opportunity to compare and contrast their experiences during each

portion of the program. While participants spoke very highly of both experiences, the general consensus emerged that the Inca Trail was the more enjoyable and direct experience of the two. While a number of reasons were given for the Inca Trail preference, such as opportunities for physical challenge and a more enjoyable climate, perceived freedom appeared the most influential. Some of the participants felt that they were afforded more independence and freedom while on the Inca trail as opposed to the Amazon. These feelings impacted not only participants satisfaction related to these program components but also the degree to which they saw each experience as direct.

Some students felt that even though they had spent a week in the heart of the Amazon rain forest that the experience had been somewhat constrained. In reflecting upon his time in the rain forest one participant shared the following insight, "I thought we would go into the jungle more in the rainforest, it was really contained." Others expressed disappointment at not seeing as wide of variety of animals as they had hoped to see in the rain forest:

YOUTH: The main forest is definitely not how I pictured it.

PI: How is it different?

YOUTH: I really thought that there would be an animal...every ten feet, like some giant mammals.

After a series of focus groups where comparisons between the Amazon and Inca Trail were discussed the PI made the following field notes:

In the Amazon most of the interaction with nature was indirect (e.g., don't touch the plants, wear full jungle attire, stay on the path, etc.). Although we were in the middle of the Amazon most of the programming precluded us from directly interacting with the nature around us. One of the boys mentioned he wished they had been allowed more time to actually be in the rain forest, and I agree. We went on some 30 min hikes but what type of impact would [a] 3 h hike have had on the group? I realize that there are safety concerns but it seems more direct contact would be good.

These thoughts highlight the importance of activity planning because the place itself had the potential to be a direct experience, but due in part to programming design it was not necessarily seen that way by some of the participants.

When asked to explain the reason why they saw the Inca Trail as a more direct experience than the Amazon many of the participants focused on the different degrees of perceived freedom between the two experiences. The youth felt they were afforded more freedom along the Inca Trail as they were in the Amazon. For example one youth made the following comparison:

Yeah like in the rain forest it really kind of, you don't go off the trail at all but then for some reason the Inca trail...gives you the sense of...independence even though you are still [on] the trail but you are...hiking up the mountain it is pretty cool.

Some felt that they Amazon experience was too structured and that this hampered their ability to have a direct experience while in the rain forest. The following conversation exemplifies this perspective:

PI: OK let me make sure I am understanding this right, so...the rain forest was cool but it felt pretty structured like stay on the path and don't touch things.

YOUTH: I just think there was a lot more than we could have seen.

YOUTH: If we have had a little more freedom.

PI: Whereas this, you feel like you have a little bit more freedom to explore.

YOUTH: Yeah you don't have [assigned] groups; you can just walk with whoever and in your own pace.

YOUTH: You can go ahead of some people.

YOUTH: And you can just top and like look [at] whatever you want.

PI: Ok, without...somebody saying ok now we have to go do this or that.

YOUTH: Yeah the rain forest was really like [one] thing after another.

YOUTH: Here is it just like hike.

YOUTH: Tad and I were...with a couple of people and my mom again and we took...3 h to get down a trail that was supposed to be an hour and half. But it was nice, it was really nice because we got to see everything and take it in and look closely at details. We finished like an hour and half behind everyone but at the rain forest if we did that we would be dead.

Another participant provided the following explanation of why he preferred the Inca Trail over the Amazon component of the trip even though both experiences were enjoyable:

Just because I felt more independent because we are on our own a little more and...it was a challenge. Whereas in the rain forest...there were like strict things you had to do at certain times.

#### 5.2.4. Proposed direct experience continuum

While both the Amazon and Inca Trail experiences were viewed as direct experiences that positively impacted many participants' environmental attitudes and behaviors, the Inca Trail experience was preferred by many of the youth because it afforded a greater sense of perceived freedom. For example, even though a week spent in the Amazon may on the surface seem like a very direct nature experience, some participants did not feel they were given the opportunity to freely interact with the rain forest and thus classified this portion of the program as less direct than the Inca Trail. In the recreation literature, perceived freedom, or the perception of volitional action, is conceptualized as necessary for individuals to experience leisure (Kelly & Freysinger, 2000). Accordingly, it makes sense that perceived freedom appears to moderate individuals' perception of the quality of a direct experience.

## 6. Discussion

Both the quantitative and qualitative data provide increased understanding of the relationship between learning experiences and outcomes. Findings also build upon and offer insights regarding previous empirical (Fazio & Zanna, 1978, 1981) and theoretical (Kellert, 2002) work in this area. The following sections include sequential quantitative and qualitative discussions followed by a synthesis of the study's findings.

### 6.1. Quantitative discussion

Findings from this study provided partial support for the study's hypotheses. In terms of outcome differences between the participant and comparison group, the program had a significant impact on EK, EA, and EB. In terms of the type of growth participants experienced across the programs' two components, results indicated that greater environmental knowledge ( $d = 1.97$ ) than attitude ( $d = .76$ ) growth occurred during the preparatory program and that growth attributed to the international workshop for both outcomes was fairly similar ( $d = .43$  for EK and  $d = .32$  for EA). The drop off in growth during the international workshop may be due to a ceiling effect. In other words, the potential for increased growth

during the international workshop was limited by growth which had already occurred. The use of retrospective pre-tests and the varying time spans between questionnaire administrations may also have influenced the observed growth patterns. Finally, correlation coefficient comparisons and HRA's suggest that EA had a stronger effect on EB during the preparatory program whereas both EK and EA had equally strong relations to EB during the international workshop.

Trying to understand the reasons why individuals behave in certain ways requires exploring and attempting to understand multiple levels of intricate relationships. For example, the connections between knowledge, attitudes and behavior must be teased apart. Additionally, it is important, especially for practitioners, to understand the ways in which various contexts and experiences impact these outcomes in order to more effectively develop programs. While theoretical work has already occurred on both of these levels (see Ajzen, 1985; Fazio & Zanna, 1978, 1981), additional questions remain regarding the impact that different contexts and experiences have on the developmental antecedents of behavior. This study's findings provide some insight into this issue and highlights additional questions that deserve further attention.

It is interesting to note the different dynamics in terms of EK, EA and EB in the preparatory and international workshop portions of the program. While growth and relational strength between these variables operated as hypothesized during the preparatory or indirect program component (greater EK growth than EA and EA more strongly related to EB), results indicated a different dynamic occurred during the direct experience portion of the program (i.e., international workshop). As a result of this program component, individuals experienced fairly similar levels of growth on both EK and EA and both of these variables also had comparable connections to EB. This finding runs contrary to Fazio and Zanna's (1978, 1981) statements that direct experiences lead to stronger attitudinal than cognitive development.

The consecutive nature of the program's components deserves consideration when attempting to explain the study's results. Youth first participated in the preparatory program (i.e., indirect experience) which prepared them for the subsequent international workshop (i.e., direct experience). Participants gained EK during the preparatory portion of the program but had few opportunities (based upon case study program observations) to actually apply their newfound knowledge in this portion of the program due to the indirect nature of the experience. Therefore, the international workshop provided students their first real opportunity to directly apply the knowledge accumulated during preparation for travel. For example, students had to draw upon their understanding of rain forest ecology, acquired during the preparatory program, to fully engage in the activities that took place in the Amazonian Rain Forest. In other words, the sequencing of the program, an indirect followed by a direct experience, may have created a context that highlighted the importance of EK across all program components.

This conclusion suggests that the international workshop may have provided participants more direct opportunities for the application of EK than EA. It may also be that EA came to play a more important role in participants' lives and had a greater impact on EB once they exited the program and faced opportunities and decisions in which their attitudes towards the environment and pro-environmental behavior could play a greater role. This assumption appears to be born out in a post-hoc HRA utilizing participants' follow-up data. Results from this analysis, which was conducted with the same design as those conducted at T2 and T3, indicate that EA is a significant predictor ( $\beta = .30, p = .02$ ) of EB at T4 while EK is not significantly ( $\beta = .18, p = .09$ ) related to EB (for full results see Table 9).

**Table 9**

Hierarchical regression results for the prediction of environmental behavior at T4 ( $n = 75$ ).

Step/Predictor	$R^2$	$\Delta R^2$	$\Delta F$	B	SE	$\beta$
1 Pro-environmental behavior intentions	.23	.23	21.73**	.22	.12	.20
2 Perceived behavioral control	.28	.06	2.77	.11	.09	.14
Social norms				.01	.07	.01
3 Environmental attitudes	.39	.11	6.37**	.30	.12	.30*
Environmental knowledge				.18	.10	.18

Note. Significant values and unstandardized and standardized regression coefficients reflect the results of the final regression equation. \* $p < .05$ . \*\* $p < .01$ .

The fluctuating degree to which EB is influenced by EK and EA across the program's components as well as post-program suggests that a deeper understanding of the characteristics and qualities of indirect and direct experiences is needed in order to more fully understand their separate and combined impact on the development of knowledge, attitudes, and behavior. While the GEX program provided participants with a very direct experience in the form of the international workshop, the experience appears to have been structured in such a way that was more conducive to the development and application of knowledge than attitudes. Direct experiences may be more favorable for attitude development, as suggested by Fazio and Zanna (1978, 1981), but this appears to be contingent upon how they are structured. The qualitative findings from this study provide some insights regarding the characteristics of experience types; in other words, what makes an experience direct or indirect. Such information may prove useful to practitioners in their efforts to design both direct and indirect experiences which can effectively promote targeted knowledge, attitude, and behavior outcomes.

## 6.2. Qualitative discussion

The qualitative portion of this study provided additional insights into the relationship between experience type and learning outcomes. The findings support previous research related to the impact of indirect and direct experiences on learning outcomes (see Fazio & Zanna, 1978, 1981; Kellert, 2002). Additionally, results from the qualitative analysis also highlight several factors that may moderate youths' perceptions of the degree to which an experience is direct or indirect. For example, participants more frequently mentioned gaining knowledge during the preparatory program whereas environmental attitude and behavior growth were associated with the international workshop. Thus the indirect experience led to growth in knowledge while the direct experience produced attitude and behavior development.

In addition to these findings, the study offered insights regarding a potential key component of direct nature experiences. The qualitative data suggested that merely exposing youth to natural settings does not automatically guarantee they will perceive the experience as direct contact with nature. For example, participants in this program had the opportunity to spend a week in one of the most ecologically diverse natural environments in the world and some still came away from the experience with the feeling that they did not receive adequate opportunities to directly interact with the rain forest. In contrast, while on the Inca Trail portion of the program participants felt they had more opportunities to autonomously engage with nature which led some to classify this experience as more satisfying and more connected to the natural environment. The perceived level of freedom afforded the youth to interact with nature in these different contexts appears to have moderated the perceived "directness" of their experience. This finding appears to tap into a growing sentiment that overscheduled youth desire more opportunities for

unstructured play (Kapasi & Gleave, 2009) and that natural settings may be an efficacious context for these activities to occur (Nilsson et al., 2009; Taylor & Kuo, 2006).

### 6.3. Synthesis of the findings

Several insights emerge from a synthesis of the study's quantitative and qualitative findings. First, the indirect experience portion of the program (i.e., preparatory program) led to growth in EK; this claim is supported by both the quantitative and qualitative findings. Second, direct experiences appear slightly more complex in terms of their relationship to learning outcomes. For example, analyses indicated that while EK, in the context of a TPB model, was not a significant predictor of EB during the preparatory program or follow-up period, EK was a significant, positive predictor of EB during the international workshop. In other words, the relationship between EK and EB, in the context of a direct experience (i.e., the international workshop), became activated.

The suggestion was made earlier that this transformation may occur through direct experience providing opportunities for the application of already acquired knowledge which catalyzes EK into something more powerful than mere facts and figures. In other words, while participants gained EK during the indirect experience, it may not have impacted EB because they did not receive sufficient opportunities for the application of this knowledge. In contrast, the DE provided multiple, intense opportunities for participants to apply what they had learned during the preparatory program about science and culture. The qualitative data bears out the viability of this explanation, for example, the following quote from one of the youth participants highlights this transformative process:

I think, you know, before we learned about the rain forest and stuff, I knew about the rain forest and all the environmental stuff, I knew about it but I did not really like you know do anything about it. But now you know after I have seen it...like that now with us being here it is making like care more and do more to save the environment.

It can be inferred from this statement that the individual's EK remained dormant until the direct experience at which time it transformed into something powerful enough to influence attitudes and future behavior.

Additionally, the qualitative findings suggest that experiences are perceived to be direct in part due to the degree to which individuals are afforded freedom and autonomy during the experience. As noted in the qualitative findings section, this insight came to light during discussions with participants regarding the differences between the Amazon and Inca Trail portions of the international workshop. Youth felt that they were afforded more freedom and therefore more opportunities to interact with their environs along the Inca Trail. In summary, the quantitative and qualitative findings present an interesting picture of the relationships between experience type and learning outcomes. These findings highlight the complexity of this relationship and that further research is needed to more fully understand the unique characteristics and impacts of direct experiences.

### 6.4. Theoretical implications

The study's findings have implications for theoretical frameworks associated with indirect and direct experiences. While previous research proposes connections between cognitive learning and indirect experiences and affective learning and direct experiences (Millar & Millar, 1996), the results from this study suggest that those relationships may be more complex. For example, the direct experience of the GEx program produced

similar cognitive and affective growth. Additionally, the direct experience appears to have catalyzed participants' environmental knowledge into a more powerful motivating force than it had been during the indirect portion of their involvement. It may be that direct experiences promote affective growth through the metamorphosis of cognitive learning. To test this idea future research should investigate and compare the interaction of cognitive and affective learning within direct and indirect experiences. This interaction, based upon the study's qualitative findings, may be moderated by the degree to which an individual perceives the experience as direct.

### 6.5. Programmatic implications

The data indicate that GEx programs impacted participants in terms of the outcomes addressed in this study. Although analyses revealed that EK was the only outcome variable on which the participants significantly differed from the comparisons across time, differences on EA and EB measures were approaching significance and the spread between the two groups appeared to be increasing over time. The varying degree of outcome impacts suggests that EK is a more proximal outcome for EE programs while EA and EB development, while still targetable program goals, may be more distal. The study's results suggest that practitioners can influence EB through both EK and EA development and that indirect and direct experiences can both be structured to facilitate the connection of these constructs to EB. For example, although attitudes have theoretically stronger links to behavior, this study's findings suggest that knowledge may also influence behavior when opportunities for its direct application are provided.

Additionally, the results of this study provide support for an argument against the assumption that merely placing youth in contact with natural spaces constitutes a direct experience with nature. If youth do not perceive an experience as direct then they are also not as likely to be impacted as would be expected from a direct experience. The qualitative results from this study highlight the importance of perceived freedom in direct experiences. When youth are placed in a natural environment and also provided the freedom to interact with their surroundings the likelihood of their perceiving the experience as direct appears to increase. This is an important point for practitioners to consider when designing programs, especially those with experiential components. Of course such allowances of freedom must be balanced with safety concerns and the need for structured, intentional programming.

### 6.6. Limitations

Before discussing limitations, it bears reiterating the study's strengths such as the use of a mixed-methods, quasi-experimental design and longitudinal data as a counterbalance to the following methodological weaknesses. However, there were several limitations to the study. Although a quasi-experimental design was employed to improve the internal validity of the findings, the lack of random selection of participants and randomization of youth between participant and comparison groups adversely affects the internal and external validity (i.e., generalizability) of the study's findings. Additionally, the study's sample size, although fairly large for an evaluation of a program of this type, was small and most likely suffered from a certain degree of self-selection bias. Although the authors attempted to implement procedures to secure a larger sample size, difficulties in recruiting both participant and comparison participants hampered these efforts.

Variability in program implementation as well as differences in terms of data collection time periods and the sequencing of program components across the groups was also a limitation in

terms of the potential uniformity of participants' experiences. The use of self-report data also leads to a variety of potential limitations, such as response bias, especially when working with adolescents. To address this concern, efforts were made to clearly communicate the importance of responding truthfully to all questions and that responses would be kept confidential and only be seen by the researchers.

Finally, the use of retrospective procedures to secure baseline data could be viewed as a limitation because it requires respondents to gauge past levels of knowledge, attitudes, and behaviors rather than actually collecting data at the end of the time period in question. A healthy debate exists regarding the pros and cons of retrospective pretests. For example, some researchers suggest that retrospective pretests artificially inflate treatment effects as a result of respondents purposely deflating pre-test scores as a way of validating perceived growth (Taylor, Russ-Eft, & Taylor, 2009). In direct response to this study, Hawkins (2009) argues that while this argument bears merit, the authors fail to acknowledge the biases associated with traditional pre-tests (i.e., socially desirability and situational determinants) that may also inflate pre-tests scores thus deflating measured treatment effects. Moore and Tananis (2009), discussing the findings from a study that support the ability of retrospective pre-tests to negate response-shift bias, note that both methods (i.e., traditional and retrospective pre-tests) have inherent strengths and biases. They further suggest that researchers would be better served to apply the most appropriate procedure based upon the types of questions being asked and the contexts where the research occurs. For this study, logistical constraints and the need to guard against response-shift bias were deemed justifiable grounds to employ retrospective pretests.

## 7. Conclusion

This study represents a unique and important contribution to the EE literature in terms of its use of longitudinal data related to EK, EA, and EB as well as key TPB constructs. The findings presented in this article provide important insights regarding the role of EK and EA in the development of EB and the role of indirect and direct experiences in this process. These insights also highlight additional related research areas that deserve further investigation.

Although behavior modification and or development remain the primary goals of many programs and interventions, a clear understanding of how to best achieve these ends is still developing. Within the realm of EE programs the debate focuses on the role and efficacy of environmental knowledge and attitude development when the ultimate goal is the promotion of pro-environmental behavior. This study provides insight into this issue by proposing that the issue is more complex than which antecedent is more important knowledge or attitudes but rather that practitioners also need to consider the role of experience type. It appears that a combination of both indirect and direct experiences that provide opportunities for both the attainment and application of environmental knowledge and attitudes, coupled with the promotion of perceived freedom, is an effective method of promoting pro-environmental behavior.

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## Appendix. Supplementary data

The supplementary data associated with this article can be found in the on-line version at doi:10.1016/j.jenvp.2010.03.007.

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