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The development of trust in residential environmental education programs

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Trust, a relational phenomenon that is an important building block of interpersonal relationships and within society, can also be an intermediary outcome of field-based environmental education programs. Trust creates a foundation for collaboration and decision-making, which are core to many ultimate outcomes of environmental education. Yet, understanding how trust develops among environmental education program participants is still nascent, partly because few methods exist for measuring trust in informal contexts, such as those that are common for many environmental education programs. Our study used social network analysis and qualitative data from focus groups, questionnaires, and participant observation to investigate the development of trust among residential environmental education program participants in two school groups, some of whom had initial familiarity with each other. Network data indicated differential increases in peer-to-peer trust among group members when measured at the individual level. Qualitative data from the focus groups highlighted salient dimensions of trust that were particularly relevant in this setting, including friendship, emotional and physical safety, and self-disclosure; reciprocal trust among peers and educators; and aspects of this immersive setting that fostered trust among the participants.

Keywords: trust; intermediary outcomes; residential environmental education

Introduction

Trust is touted as an essential element of society, at the core of relationships, social interactions, and everyday life (Weigert 1981; Lewis and Weigert 2012). Among other values central to decision-making in communities, trust forms a building block for cooperation and collaboration, and, in this way, it can be instrumental in affecting pro-environmental and stewardship behaviors (Stern and Coleman 2015). Seen as a relational phenomenon, trust describes taking another person's 'perspective into account when decision-making and not act[ing] in ways that violate the moral standard of the relationship' (Weber and Carter 1998, 3). Moreover, trust entails being 'vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to

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monitor or control the other party' (Mayer, Davis, and Schoorman 1995, 712). Trust comes in many forms, including based on a feeling of connectedness or shared values (affinitive), related to others' behaviors (rational), and related to past histories with trust and mistrust (dispositional) (Stern and Baird 2015). In these ways, trust evolves from the convergence of emotional affinity, rational expectations (either met or unmet), and particular social and physical contexts.

Certain settings and situations may be particularly fruitful for engendering and supporting trust and trusting relationships. Residential environmental education (EE) programs, like many educational efforts occurring in informal settings – particularly those with immersive elements – aim to foster a positive social environment and nurture skills associated with personal growth. A review of more than 200 residential EE programs found that nearly half (46%) described goals that included 'social skills,' including cooperation, teamwork, leadership, and trust (Ardoin, Biedenweg, and O'Connor 2015). Although these intra- and interpersonal skills may not be the ultimate intended outcomes of informal EE programs, they are often seen as intermediary outcomes, or critical steps along the path toward developing intended outcomes. Intended outcomes such as environmental responsibility and environmental stewardship, for example, may be influenced by a sense of self-efficacy to address environmental problems, collaborative dialog around environmental issues, and new skills for collaboration and teambuilding that may result from participation in such programs. As EE program participants move from the place-based program context to their other life realms (e.g. school, home community), many EE proponents design programs with the intention that participants may further foster these skills and enact these ideas with regard to new environmental, or other, challenges, ultimately supporting civic engagement and stewardship.

Because of this stated desire to work toward such outcomes in EE programs, our study set out to explore how trust develops among youth participants of a residential EE program. We did so as part of a larger research agenda considering critical intermediary outcomes that relate to these often-described intended outcomes, such as interest (Ardoin et al. 2014), sense of place, personal growth, and environmental identity (Ardoin, DiGiano, O'Connor, and Holthuis 2015).

This study examines the evolution of trust in residential EE programs and is guided by three main research questions:

- How, if at all, do peer-to-peer relationships change during the course of a residential EE program?
- If those relationships do change, does peer-to-peer trust increase among participants during the residential program?
- How do participants' notions of peer-to-peer and student-to-educator trust differ in these immersive, residential EE settings versus formal classroom settings?

We investigated these questions using a mixed-methods approach; we sought to develop tools for measuring trust in a field-based setting, and we also evaluated the efficacy of those tools. We adapted existing quantitative measures of childhood trust (McAllister 1980; Rotenberg et al. 2005; Betts, Rotenberg, and Trueman 2009; Flanagan and Stout 2010) to design and administer surveys related to trust among program participants before and immediately after a residential EE program. We complemented these with focus groups and open-ended items. We used social

network analysis (SNA) to explore how individual relationships changed between pre- and post-programmatic surveys.

We conducted this study in the context of the Golden Gate campus (San Francisco Bay Area, CA, USA) of NatureBridge, a nonprofit organization offering residential EE in U.S. national parks. The program is designed for school groups, mostly grades 5 through 7 (ages 10 through 12), who stay on site from 2.5 to 5 days. Although NatureBridge programs primarily focus on environmental science in field settings, many program aspects are explicitly or implicitly designed to enhance personal growth, develop interpersonal skills, and build a sense of community among participants.[1] Participants, for example, engage in teambuilding activities, cooperative group work, and shared meals, and they live in dormitories throughout the multiday session. At NatureBridge, teachers organize 'hiking groups' of 12–15 students.[2] Participants spend the bulk of their on-site time within these hiking groups; therefore, we examined how peer-to-peer trust develops and morphs within hiking groups, rather than within the class or school group as a whole.

The study of trust in environmental education

Despite the potential importance of trust as a mediator of intended EE outcomes (Ardoin, Biedenweg, and O'Connor 2015), few EE studies have explored trust as an intermediary outcome, and even fewer have systematically measured trust, particularly in informal settings. One exception is Duffin et al. (2007), who collected qualitative data to evaluate the Appalachian Mountain Club's five-day residential EE programs. Their evaluation of these programs found that trust was enhanced among peers, as well as between youth participants and their classroom teachers, who accompanied them on the trip. The evaluators also report that the heightened sense of acceptance resulting from the programs improved the community that developed among the youth and the educators.

Duffin et al. (2007) framed their instrument development and conceptualization of trust-related variables within the broader youth development literature, rather than with a specific focus on trust. This is consistent with other EE studies where trust is treated as a component of positive youth development and youth well-being (e.g. Schusler and Krasny 2010; Schusler 2013). This related area of youth development research suggests that trust, especially at the group level, can play an important role in encouraging youth to feel as if they are part of a community and also in catalyzing environmental action (Schusler and Krasny 2010; Almers 2013). In conjunction with a supportive social network, Chawla and Cushing (2007) describe how group trust can girder strategic behaviors related to environmental action. Almers (2013) argues that trusting relationships between youth and adults can be important preconditions to environmental action.

The study of trust as a broader socio-emotional outcome of experiential education is more prevalent in the related field of outdoor adventure education;[3] however, many scholars (e.g. Kellert and Derr 1998; D'Amato and Krasny 2011) have focused on personal growth and interpersonal relationships, rather than targeting trust specifically. Research in formal educational settings has examined the role of trust in creating caring school communities or positive classroom communities (e.g. Watson and Ecken 2003; Corrigan, Klein, and Isaacs 2010), or examining student trust in teachers (Bryk and Schneider 2003). In addition, research in informal education settings has emphasized the role of 'safe spaces' in fostering trust among

peers and educators, as well as concepts related to self-actualization and confidence-building (Brady 2005; Kraftl 2014).

Recently, some scholars have focused on how trust relates to broader EE-related outcomes, such as fostering civic engagement in environmental issues, catalyzing stewardship and supporting well-being. Krasny et al. (2015), for example, explore the concept of youth social capital in an EE context, piloting a survey and using generalized measures of social trust among youth. These authors describe connections among social capital (of which trust is one aspect), environmental education, and socio-ecological resilience. They posit that, while the relationships may be circular, mutual reinforcement may occur such that 'trustworthiness makes possible collective action around environmental stewardship, and engaging in environmental stewardship may further increase levels of trustworthiness' (Krasny et al. 2015, 5).

Krasny et al. (2015) advocate that environmental education scholars and practitioners should devote more attention to researching and creating the conditions for collective action to manage natural resources, complementing the traditional focus on individual-level behaviors. This conceptual shift, from individual to collective relationships and actions, complements a growing body of literature in sustainability sciences that examines how networks of individuals and groups are addressing some of the world's most challenging environmental problems (Ostrom 2010; Pattberg and Widerberg 2015). These studies, and others (e.g. Ostrom 1999), highlight the ways in which trust may be considered an enabling condition of collective action. How trust transfers (and/or scales up) from one setting (e.g. environmental education program) to another (e.g. community or larger scale) requires more attention; however, studies such as Krasny et al. (2015), Almers (2013), and Chawla and Cushing (2007), suggest that even discrete, bounded positive experiences with collaboration, trust-building, or the environment more generally can have positive 'ripple' effects to other potential arenas of environmental behavior and action. To make these connections across contexts and scales requires, as a starting point, understanding the development of trust and how it is situated within place-based groups joined with a specific purpose (in the case of our study, a multi-objective environmental education program).

SNA in environmental education

As we gain understanding of how social relationships, including trust relationships and social networks, impact learning and youth development more broadly, there is need for more robust and nuanced methodological approaches to study these relationships. SNA is one approach garnering attention in the learning sciences (e.g. Haythornthwaite 2001; Dawson 2008), as well as natural resource management (e.g. Pretty and Ward 2001; Bodin and Crona 2009; Prell, Hubacek, and Reed 2009). SNA is rooted in theoretical mathematics, specifically graph theory, but has been applied to varying fields including organizational management, physics, computer science, public health, sociology, and anthropology (Freeman 2004). In the sociology literature, social networks are defined as a 'specific set of linkages among a defined set of persons, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behavior of the persons involved' (Mitchell 1969, 2). SNA is designed to explicate these relationships between actors and uncover the social structure of relationships around a person, group, or organization. Relationships between actors in the networks are known as 'ties.' These ties between actors can be analyzed in various ways. If there are

subgroups apparent between actors – meaning that not everyone in the network is connected – then these networks are broken into 'components.' Component analysis can be used as a primary analysis to understand how dense, or well-connected, a network is. SNA can also unveil social and relationship dominance in a group. 'Centralization' describes the extent to which a network is dependent on, or dominated by, one or a few individuals. In SNA, characteristics of the network as a whole, as well as individual actors within the network, are examined, quantified, and compared (e.g. Olson 1963; Diani and McAdam 2003; Finnigan and Daly 2012). Diverse networks, for example, can increase exposure to information and ideas, thus influencing enhanced knowledge acquisition (Valente 1995; Burt 1999).

To date, however, few studies have applied SNA in EE settings. Therefore, this work builds on research in related areas, including adolescent development and friendship networks (e.g. Frank, Muller, and Mueller 2013); how these relationships develop through helping build behaviors and emotional supports (e.g. Alfassi 1998; Chu 2005; Stanton-Salazar and Spina 2005); and how interactions outside of classroom settings relate to adolescent friendship development (Schaefer et al. 2011). These topics reflect the values and goals of EE and the NatureBridge program; they are also well-suited to act as proxies in lieu of robust SNA literature in EE settings.

Research propositions

To investigate our main questions related to the evolution and meaning of trust in an immersive, field-based EE setting, we developed three propositions:

(1) Trust will increase among individuals in hiking groups over the course of the EE program

In addition to time spent together in the dormitories, at meals, during evening activities (e.g. campfires), and free time, hiking groups at NatureBridge spend seven hours a day together 'on the trail' – hiking, engaged in group learning activities in nature and in the labs, and collaborating on group challenges. Some trail activities are purposefully designed with the intent of enhancing interpersonal relationships and building trust. Students participate in a 'trust walk,' for instance, where they are responsible for leading blindfolded peers safely from one point to another. Based on these explicit programmatic teambuilding objectives, we expected that – at the end of their residential EE experience, as compared with pre-experience measures – students would report higher levels of trust, according to our survey measures and their own conceptualizations. From a social network perspective, we also expected that the relationship between network density (number and strength of ties), increased potential for reciprocity, and the development of mutual trust among group members would be positively correlated (Axelrod 1997; Pretty and Ward 2001; Janssen and Ostrom 2006; see also Diani and McAdam 2003). To test this, we used a structured survey to quantify and compare individual peer-to-peer relationships prior to, and immediately following, the NatureBridge program. We did so in conjunction with open-ended questionnaires and focus group data from participants.

(2) Group dynamics within hiking groups will change over the course of the EE program

Within hiking groups, we expected to see changes in group dynamics, as measured by individual relationships, over the course of the EE program. As mentioned above, teambuilding activities are an integral part of the NatureBridge experience, with each hiking group participating in at least one group challenge during their program. Because of the heavy programmatic focus on cooperation and collaborative action, we expected that hiking groups would transform from ensembles of small cliques, dominated by one or two actors, to a more level network and counterbalanced social dynamic.

Sociological and network theory posits that, when cliques exist within a small group dynamic, these cliques can negatively impact collaboration, overall group cohesion, and willingness to cooperate (Granovetter 1973). Within this residential EE setting, cliques may be an artifact of social dynamics occurring in a larger school setting, and they may create subdivisions among students; therefore, we conjectured that they may dissipate and be replaced with a more inclusive, cohesive group dynamic during the residential program, which is designed with a cooperative, experiential educational dynamic. Additionally, because of the time associated with forming relationships with more people, we speculated that we might see a decrease in the number of high-quality relationships and, concurrently, that we might see an increase in the overall total number of relationships, signaling a shift from clique to group preference. To test these propositions, we employed a SNA of pre- and post-programmatic survey data to quantify and compare the structure of individual relationships within hiking groups.

   (3) Peer-to-peer trust has specific meanings within a residential EE context; this meaning may be different from concepts of trust experienced among, and between, peers in a classroom setting

Social constructivist theory argues that trust is a dynamic concept, informed by the interface between individuals and their socio-cultural context (Rotter 1971; Yosano and Hayashi 2005; Glanville and Paxton 2007).With this in mind, we posit that notions of trust may vary according to different fields of interaction and contexts; it may also have different meanings within the field setting. We base this proposition on our previous observations at NatureBridge, as well as conversations with field science educators. The physical challenges of the field experience introduce elements of safety that are not necessarily present in a classroom; these elements may influence different conceptions of trust. To test this, and our other propositions, we weave together findings from participant focus groups, open-ended questionnaire items, and observations by researchers, teachers, and field science educators to understand participants' notions of trust in a residential, field-based setting.

Methods

Study site and participants

We selected our study sample by inviting schools attending NatureBridge's Golden Gate campus in fall 2012 to participate in the research. We selected two schools with classes of the same grade level (sixth grade; approximately ages 11 and 12). We attempted to maximize diversity in terms of the size of the overall group visiting NatureBridge (one small, one larger) and school type (public, private) to investigate

variables potentially affecting the development of trust in the context of the residential EE setting. School 1 was a parochial school from San Francisco, CA; all 28 sixth graders were from the same class. School 2 was a public school near Sacramento, CA; this school group had more than 40 sixth graders attending NatureBridge from three different classes. Many of the School 1 students had progressed through their school together since kindergarten; by contrast, some of the School 2 students had not met each other before arriving at NatureBridge.

Study design and data collection

We employed a mixed-methods approach to data collection and analysis. Due to the paucity of quantitative research about the development of trust in EE and informal EE settings, we drew upon previously validated survey instruments used to measure peer-to-peer trust in classroom settings (McAllister 1980; Rotenberg et al. 2005; Betts, Rotenberg, and Trueman 2009; Flanagan and Stout 2010). These studies examined different aspects of inter-personal trust among children and adolescents, including reliability, honesty, and emotional domains (Rotenberg et al. 2005; Betts, Rotenberg, and Trueman 2009); intimacy and self-disclosure (McAllister 1980); and promise and secret-keeping (Flanagan and Stout 2010). Based on these prior conceptualizations, we designed a structured survey adapted to our research questions and the data requirements for SNA. Then, we solicited feedback from NatureBridge field science educators to assess its application to the field setting.

We administered the survey to participants at their school the week prior to their NatureBridge trip and again on the NatureBridge campus at the end of the program, with the objective of assessing changes in levels of trust between participants. Both pre- and post-program surveys were administered using handheld computer tablets (iPad Minis) to minimize respondent burden and data-entry errors. The surveys took approximately 15 minutes to complete.

Because ties between individuals are foundational to SNA, we required data from each participant about every other participant in their bounded group. Therefore, we asked participants a series of questions related to each of the members of his or her hiking group, restricting our analysis of trust to within those bounded groups. This structure allowed us to examine peer-to-peer relationships that informed the general characteristics of those social networks, such as strength of ties and group structure. The questions were as follows:

(1) How well do you know [Student X]?
(2) On a scale of 1–10 (with 1 being 'not good at all' to 10 being 'best friend'), how good of a friend is [Student X]?
(3) How often does [Student X] keep promises? (*Promises*)
(4) Would you tell [Student X] something personal about yourself? (*Disclosure*)
(5) If you had a problem, would you go to [Student X] for help? (*Problem*)
(6) Do you think [Student X] trusts you? (only School 2)

The initial question filtered for peers who did not know each other prior to the residential program. This was particularly relevant for School 2, where some students had no prior interaction with other members of their hiking group, such that, if a student responded that s/he did not know one of her/his hiking group members, the survey logic was programed to skip further questions about that individual.

The second question asked students to rate their level of friendship with their peers. Recognizing that friendship is just one dimension of trust, we then asked individuals about other kinds of relationships with their hiking group members that might indicate trust, including if they would tell their peers a secret, go to them for help, or expect them to keep a promise. Each of the questions related to trust domains (questions 3 through 5) had three possible responses: Never/Not at all, Sometimes, and Always/A lot. A positive response ('sometimes' or 'always/a lot') about a peer on any of these questions 'nominated,' or moved, that peer into a different group for purposes of our analyses; this new group was what we called their trust circle/group of 'trust peers.' Based on feedback we received from School 1 students during post-program focus groups, we added a final question related to reciprocal trust to the School 2 survey (question 6).

We complemented structured surveys with focus groups and open-ended written questions. We used these data to reflect on our survey instrument and determine whether the items we asked about trust relationships were, indeed, related to the ways in which participants themselves evaluated levels of trust among peers, particularly in the residential, field-based setting. In School 1's follow-up focus group, which took place three weeks after the field-based program, we asked participants to respond both in writing and verbally to the question, 'How do you know you can trust someone?' We also discussed trust more generally by asking participants to reflect on their NatureBridge experience and describe times during the program when they trusted someone – either their peers, field science educators, or others.

As part of School 2's post-programmatic survey, we asked students to 'write about a time during the week (at NatureBridge) when you trusted someone. How did you know you could trust them?' Of the 40 students from School 2, 18 responded to this question. Further, we observed the hiking groups on site, concentrating on students' interactions with one another. We also had daily discussions with field science educators to solicit their observations regarding group dynamics and potential indicators of trust among participants.

Data analysis

We pursued data analysis with three objectives in mind. First, we were interested in investigating *whether* individual relationships related to trust might change over the course of the residential EE program, and second, *how* individual trust-related relationships might change. Third, we were interested in exploring the notion that the concept of 'trust' might differ in residential EE contexts from formal education contexts. In particular, we asked whether accepted conceptualizations of childhood trust, and accompanying instruments, were appropriate in this residential EE setting.

To this end, we analyzed the data in three ways. We conducted statistical analyses of survey data to measure changes in trust between pre-program and post-program surveys. To do so, we first calculated the percentage of overall responses that students answered in the affirmative (either 'sometimes' or 'always') for each of our questions about trust. We then conducted a paired-sample t-test to compare the percentage of affirmative responses between the pre- and post-program surveys to assess changes.

SNA metrics were used to assess the structure and strength of trust relationships among peers within hiking groups. In SNA, different characteristics of the network can be examined, quantified, and compared. Commonly studied characteristics

include number of ties, degree of network cohesion, and network centralization (Wasserman and Faust 1997). In this study, we focused on four commonly used SNA metrics: (1) cohesion, or the degree to which actors are connected directly to one another and the network; (2) network centralization, which describes the degree to which the network is dominated by one or a few nodes; (3) network density, the proportion of direct ties in a network; and (4) component analysis, the number of wholly disconnected sub-graphs within the graph.

We thematically analyzed the qualitative data collected through the focus groups and open-ended survey items, with the intention of understanding the varying dimensions of trust among participants. We coded responses for trust domains (e.g. disclosure, dependability) that we thought might be salient based on the literature and our propositions. Concurrently, we allowed space for emergent themes. In this manner, we looked for patterns in participants' notions of trust, identifying the domains of peer-to-peer trust both generally and within the context of a residential EE program. Data collected from informal interviews with field science educators were not systematically analyzed, but rather used to contextualize findings.

Results

We combined findings from statistical analysis of survey data, SNA, focus groups, and open-ended responses to better understand whether and how peer-to-peer trust develops in the context of residential EE programs. Using this mixed-methods approach, we consider these complementary strategies as lines of inquiry for testing our three propositions.

Our findings indicate positive changes overall for participants in terms of trust development between individuals as demonstrated in descriptive statistical and social network analyses, and supported by the qualitative focus group, questionnaire, and observational data. Equally interesting is the refined definition of trust that emerged from our discussions with participants as they described the different conceptualizations of 'trust' (rooted in reciprocal trust relationships with program instructors and notions of keeping safe) in residential EE versus a classroom setting. Here we present results for each of the propositions.

Trust increased among program participants

We began by exploring our first proposition to determine whether differences occurred in the levels of trust participants experienced with their peers before and after the NatureBridge program. Using paired sample t-tests and comparing pre- and post-programmatic surveys by school, we were most interested in tracking changes in peer-to-peer trust within hiking groups. For this analysis, we aggregated to the school level because: (1) the small sample size of hiking groups limited the reliability of statistical analyses, and (2) we expected differences in trust development between the two schools based on some of the distinguishing characteristics of those school environments (e.g. close-knit class in School 1 vs. combined classes from the larger School 2). (See Table 1.)

Overall, in the pre-program survey, School 1 participants demonstrated a higher percentage of affirmative responses than School 2 participants. However, we found that School 2 participants reported larger increases in affirmative responses from the pre-program to the post-program survey. School 2 participants demonstrated

Table 1.   Pre- and post-program trust relationships.

Trust question		Pre-experience (%)	Post-experience (%)	Significance
How often does [Student X] keep promises? (*promises*)	School 1 (*N*=26)	84	78	*p* = .006
	School 2 (*N*=34)	39	53	*p* = .01
Would you tell [Student X] something personal about yourself? (*disclosure*)	School 1 (*N*=26)	44	46	NS
	School 2 (*N*=34)	25	44	*p* < .001
If you had a problem, would you go to [Student X] for help? (*problem*)	School 1 (*N*=26)	58	57	NS
	School 2 (*N*=34)	32	48	*p* < .001
Do you think [Student X] trusts you? (*reciprocal trust*) (only applicable to School 2)	School 1	n/a	n/a	n/a
	School 2 (*N*=34)	36	54	*p* = .006

Table 2.   Change in number of classmates youth trusted in hiking groups.

Trust question	Direction of change	School 1 *Hiking Group* 1	School 1 *Hiking Group* 2	School 2 *Hiking Group* 1	School 2 *Hiking Group* 2	School 2 *Hiking Group* 3	Totals per tie question
Promise	Positive	6	8	7	8	5	34 (63%)
	Neutral	7	5	0	1	0	13 (24%)
	Negative	0	0	2	2	3	7 (13%)
Problem	Positive	5	10	6	8	4	33 (60%)
	Neutral	8	3	2	2	3	18 (33%)
	Negative	0	0	1	1	2	4 (7%)
Disclose	Positive	9	12	7	8	5	41 (75%)
	Neutral	4	1	2	2	2	11 (20%)
	Negative	0	0	0	1	2	3 (5%)

significant increases in the percentage of affirmative responses across all four questions. In other words, at the end of their NatureBridge program, School 2 students indicated that there were more members of their hiking group than there had been before the program who they thought would keep promises, to whom they would disclose something personal, to whom they would go for help, and who trusted them. By contrast, School 1 participants reported a significant decrease in the percentage of affirmative responses for the question, 'How often does X keep promises?,' indicating that the number of hiking group members they felt would keep a promise went down from before the program to after the program.

We analyzed whether and how the number of individual relationships (network ties) to other members of their hiking group changed between the pre- and post-tests (Table 2). This analysis differs from the prior one in that it considers how many individual students reported an increase, decrease, or no change in the number of people they nominated in their group for each of the trust domain questions (*promise*, *problem*, *disclosure*). This analysis uncovers whether the interactions while at NatureBridge were able to foster net increases of classmates that students trusted. This also neutralizes bias that may be present due to strong pre-existing friendships, and leaves open the possibility that an intensive, day-in-and-day-out experience, such as a residential one, may, at times, contribute to some deterioration in trust between participants.

As documented in Table 2, nearly all participating youth experienced a net positive increase in at least one element of trust formation within their hiking group. Nearly 66% of changes in trust within groups across all of the trust questions were positive, about 25% were neutral (neither increasing nor decreasing during the course of the programing), and only 9% resulted in a decrease in the number of people whom they thought they could trust in their group based on these three proxies for trust.

Statistical and social network analyses demonstrated slight differences between School 1 and School 2. The variation in pre-program to post-program change in participant responses between the schools may be related to several factors. School 1 is a small school in which students move from one grade level to the next with the same group of peers. Over one half (15 out of 28) of the students had begun school together in kindergarten, with just four newcomers joining the cohort in the previous school year. Given this, the majority of students had interacted with one another for several years, including participating in an immersive, multi-day field trip experience the year before. Knowing the history of this peer-to-peer interaction, it is not entirely surprising that classmates would not experience radical shifts in trust-related perceptions with one another over the course of this year's immersive field trip experience.

By contrast, School 2 participants came from a larger school, and the experience drew together multiple classes, which were combined to form three newly constituted hiking groups for their NatureBridge experience. Many of the students did not know each other prior to the program and did not necessarily interact during the regular school day, according to teachers. In fact, when asked on their pre-program survey, 'How well do you know [Student X]?,' twelve School 2 students – four from each of the three hiking groups – responded, 'I don't know that person,' regarding at least one member of their hiking group.

Qualitative data from open-ended questions, research, and field science educator observations support the notion that new relationships were developing during the course of the field-science learning experience. Several School 2 participants wrote about specific instances in which new friendships engendered trust:

> Yesterday during the hike, a person I didn't like at all helped me and showed me the path. His name is Adam.[4] He was fun when I got to know him and cool. So now I feel I can trust him with some things.

> In the dorms I trust Francis, Jordan, and Callum because they hang out with me in the dorms and be nice to me. At school, I have no one to play with and now here I am making new friends.

Table 3. Difference in number of network components pre- and post-experience.

Trust question	School 1 *Hiking Group* 1	School 1 *Hiking Group* 2	School 2 *Hiking Group* 1	School 2 *Hiking Group* 2	School 2 *Hiking Group* 3
Pre-promise	1	1	3	2	4
Post-promise	1	1	1	1	4
Difference	–	–	−2	−1	–
Pre-problem	1	3	5	2	4
Post-problem	1	2	2	1	3
Difference	–	−1	−3	−1	−1
Pre-disclose	1	2	5	3	7
Post-disclose	1	1	1	3	4
Difference	–	−1	−4	–	−3

Hiking group structures changed from a more centralized network to a more diffused and balanced group dynamic

To address our second proposition, we analyzed survey data using SNA to understand the general structure of the hiking groups. For this portion of the analysis, we treated each hiking group as a separate network and explored relationships between individuals within these networks, both before and after the program. Network centralization and network reach were originally our primary metrics of interest. The network centralization measure reports the extent to which networks are dominated by a central actor. Because of the fragmented nature of these networks, however, we were unable to calculate these measures reliably across hiking groups. Therefore, we analyzed the number of components within each hiking group prior to, and after, their NatureBridge experience (Table 3). Components within the context of SNA are sub-groups that are connected within, but disconnected between, other sub-groups within the network. Component analysis measures the number of components apparent within a network; it can measure the relative strength of the individual components based on the number of ties that exist within the sub-group in relation to those that could potentially exist if the group were maximally connected – or tie strength within the sub-group (if the ties were weighted). Since the hiking groups were relatively small in size, for the purposes of this analysis, we measured the number of components for each 'tie' question (those questions that measure *promise*, *problem*, and *disclose*) within the individual hiking groups.

In Table 3, a negative number in the 'Difference' row indicates a decrease in the number of components identified in that hiking group network. A negative number signals that the hiking group was less fragmented and more cohesive a unit than it was at the beginning of the EE program. With the exception of School 1's Hiking Group 1, every other hiking group showed signs of becoming closer, with respect to at least two of the three domains of trust (*promise*, *problem*, *disclosure*), as indicated by the survey's tie questions. The number of components remained the same in just 25% of the tie questions. More important to note, there are no instances of groups becoming increasingly fragmented with respect to the trust questions.

Notions of trust among program participants closely aligned with general domains of trust; however, the notion of 'keeping safe' and reciprocal trust relationships with adult instructors are particularly relevant in the field setting

With regard to our third proposition, we explored the domains of trust that may be relevant in residential EE settings, particularly questioning whether they may differ from notions of trust in a more traditional classroom or lab setting. Our School 1 focus group findings and the School 2 open-ended responses suggest five key dimensions of trust relevant to both general notions of trust and trust in the Nature-Bridge context. These include: friendship; ability to keep secrets; reciprocal trust (with both peers and instructors) and trustworthiness; willingness to help others (dependability); and keeping safe. School 1 focus groups also indicated that the NatureBridge context creates a safe space in which students feel comfortable enacting new roles and interacting with peers outside their normal friendship groups.

When we asked students how they knew they trusted someone, they most frequently responded that trust was related to friendship or to knowing someone well. For example, 22 of 26 School 1 participants responded that friendship was a key indicator of trust. Important aspects of friendship included the length of the relationship, desired qualities in a friend (e.g. kindness, honesty, respectfulness), and shared experiences. One participant wrote, 'You feel really close to that person and the closer you get to that person, the more trust that person gains.' Keeping secrets was another salient theme, with several participants from both schools mentioning this aspect of trust. One School 2 participant, for example, mentioned instances of their peers keeping secrets at NatureBridge:

> In the dorms this week (at NatureBridge), I trusted some people. They didn't go and tell others about what I did or what happen *(sic)* to me.

Reciprocal trust and trustworthiness were also identified as important indicators of trust. One participant wrote, '… you've known them 'till that point in time where you can tell they will trust you and you can trust them.' Willingness to help was another salient domain in participants' general notions of trust. This included 'being there,' 'when we help each other out,' and 'when you ask for help and they come and help you right away.' The idea of 'keeping safe' on hikes or during group activities was frequently mentioned in conjunction with helping. One student wrote,

> One time when me and my group went to the lighthouse, I was with Ciara, Beth, and Jamie, so when I looked over the ledge, they told me to stop because they didn't want me to fall in. So, that made me trust Beth, Jamie, and Ciara.

The aspects more unique to NatureBridge's setting and structure included mutual trust between participants and program instructors. Qualitative data indicated that participants perceived that field science educators trusted them and, therefore, allowed them freedom to hike at their own pace and explore independently. This was in contrast to what participants described as a more structured and authoritarian classroom environment. The trusting environment that this break from school norms created also allowed students to experiment with taking on new roles. One School 1 student told us, 'We could see everyone equally at NatureBridge, so everyone pitched in and everyone could be an equal leader.' In addition, another unique aspect was the trustworthiness that the Field Science Educators demonstrated to participants by keeping the participants safe. One participant wrote,

> During this one hike, we were up on this 300 [foot] steep hill and we had to do a *trust walk*. So while we were walking, we had our eyes closed, and I trusted Ben (Field Science Educator) for telling us where to go.

Discussion

This study investigated the development of peer-to-peer trust in residential EE programs. We were interested in this intermediary variable because trust is a critical mediator of many of the ultimate intended outcomes of residential EE programs, such as personal growth and interpersonal skills. Moreover, it may have effects on undertaking pro-environmental behavior – another key goal of many EE experiences (Zint 2013) – through influencing the development of social norms and sense of self-efficacy, among other important variables. Thus, we endeavored to examine the development of peer-to-peer trust in the context of an immersive field-based setting, and also to test innovative metrics for measuring changes in trust.

Our findings suggest several key messages. First, we found that immersive field settings can result in an increase in trust and change group dynamics, even in very short amounts of time. Our survey results demonstrate that there were increases among different trust domains following the program. Perhaps not surprisingly, these increases were more significant for School 2, where many peers did not know each other prior to attending this residential program. SNA findings contributed an additional perspective to the survey data, demonstrating that nearly all participants experienced a net positive increase in peer-to-peer trust. Further, the network data captured a marked decrease in sub-groups (or cliques) within hiking groups following the NatureBridge program, perhaps suggesting an increase in overall group cohesiveness.

Second, we found that trust was facilitated by freedom from school norms; thus, this setting allowed participants to take on roles different from those at school. Focus groups with the students helped contextualize the quantitative findings and better understand the conditions under which trust develops in these settings. Participants framed the program as a safe space – free from prescribed, expected, and rehearsed classroom roles. As one School 1 student put it, 'At school, we are more concentrated on education, whereas at NatureBridge we could focus on each other and other things.' Researchers and teachers observed students enacting new roles, including leadership roles, and interacting with different groups of peers than those previously observed in the classroom. We observed two male students, for example, who came to the aid of a student from a special-needs class, who was struggling both physically and emotionally to climb a steep hill. The two boys held the other student's hands, encouraging him until they reached the ridge-top together. Later, the teacher commented that one of the boys who was helping had the reputation, in class, of being 'a trouble-maker,' and that neither of those two students had previously interacted with the special-needs class.

Following what prior researchers and practitioners have suggested, our findings document that the immersive and residential experiences – which remove participants from their day-to-day routines and norms – may provide safe spaces for students to explore new roles and connections with their peers. Field science educators are critical mediators of these safe spaces, as they help facilitate and translate what may be foreign; at the same time, they support exploration. The idea of 'creating

safe spaces' – including those that support physical and psychological safety, relationships, identity formation, and skill building – has been identified as an enabling condition for positive youth development and environmental action (Schusler and Krasny 2010).

A third finding relates to the notion that some universal dimensions of trust are important in the classroom, as well as in the field-based setting, while other domains may be more distinctive for residential, field-based experiences. Our findings affirmed that dimensions of childhood trust previously identified in classroom studies or laboratory studies (e.g. McAllister 1980; Betts and Rotenberg 2009; Flanagan and Stout 2010), such as friendship, keeping secrets, and reciprocal trust, remained relevant in our study setting. However, safety and security, as well as reciprocal trust relationships with adult instructors, were particularly salient in the field-based context. This finding suggests that these may be distinct notions of trust particularly pertinent to this field-based setting. For example, while many participants discussed the importance of disclosure, reciprocity, and honesty – consistent with classroom studies of trust – they also mentioned new aspects, such as 'having my back' and the importance of shared experiences. We suggest that in a field-based setting, rich with novel experiences, disclosure may not be as important as physical and structural trust, offering safe spaces, providing opportunities to take on new roles, and ensuring safety within a group or teamwork setting. Further, we suggest that the element of physical challenge enhances participants' notions and awareness of trust. Similarly, and perhaps not surprisingly, related studies in outdoor adventure education and experiential learning have linked overcoming physical challenges with team-building (Priest 1986; Gibbons and Ebbeck 2011) – certainly an element of trust that is critical to these studies, as well.

A fourth finding relates to the role of EE instructors in demonstrating reciprocal trust; this aspect of immersive field-based settings deserves further study. Participants openly discussed the reciprocal trust they felt with NatureBridge program instructors. These relationships differed from their prior experience with classroom-based authority figures (e.g. teachers); the participants described experiencing a new degree of freedom, along with being given a sense of personal responsibility to take care of themselves. During our School 1 focus group, for example, participants commented that the field science educators showed that they trusted the students 'by not hovering over them' and letting them hike at their own pace with whomever they chose. One participant added, 'It is easier to trust someone when you know they trust you.'

Limitations of the study and future directions

As suggested in our findings, as well as the literature, trust is dynamic and relational in nature; because of this, it is difficult to characterize, particularly in short-term evaluations (Carleton-Hug and Hug 2010). Although this study is subject to challenges, it suggests methods and future directions in trust research in the EE context.

In light of an interest in innovative tools to address difficult-to-characterize concepts, this approach has certain limitations. Our small sample size presented challenges for quantitative data analysis, and certain individuals (with particularly low or high scores) may have skewed the network structure; thus, they may misrepresent the group dynamics. Further, our methods were inherently biased by their attempt to measure individual relationships and changes in trust using individual surveys and

social network metrics when, really, these may more realistically be a function of the broader social system. There may be group qualities or characteristics not adequately represented by these measurements of individual relationships. Community-level metrics are especially important in understanding how a phenomenon, such as trust, may foster group-level pro-environmental behavior, such as collective action (Krasny et al. 2015).

In this vein, our study suggests an opportunity to further develop measures and metrics reflective of, and appropriate to, this type of immersive field setting. Because of the prior reliance on laboratory and classroom-based measures and settings, the instruments currently available to address childhood trust may not be appropriate to out-of-school settings. Thus, our data and findings emphasize the importance of adapting such measures to the context, and also highlight that our initial survey items may not have been ideally matched to the NatureBridge setting. The opportunity for youth in the program to 'keep promises' or 'disclose' something personal, for example, may not have been as critical as being able to support one another in the face of physical or psychological challenges, or in an intensive team-related problem-solving exercise.

In addition, this study raises important questions regarding the appropriate time horizon for measuring trust, as well as around the permanence or additive nature of trust. We necessarily limited our study to the program's timespan, using pre- and post-programmatic surveys as bookends to consider changes over a relatively short period. Particularly in the post-program survey, participant responses may have been biased by the program's halo effect. Certainly, the participants' responses may be expected to vary should the instruments be re-administered in six months or a year.

Moreover, in this study, we did not purport to measure the impact of trust on the EE program's intended outcomes, although this would be a logical, enticing, and, indeed, exciting future research direction. As Krasny et al. (2015) reflect in their examination of social capital, there is a fundamental riddle of circular reasoning with regard to trust and desired outcomes: Is trust an outcome of EE or a variable that facilitates intended outcomes of EE? EE programs can provide a laboratory to examine how network characteristics and structures can be both explanatory variables of programs' intended outcomes or outcomes themselves (cf. Borgatti and Foster 2003).

Our findings suggest the existence of promising opportunities for exploring the differentiation of trust in settings such as these. Because trust – especially relationships between and among peers – is difficult to measure using existing instruments and conceptualizations of childhood trust, this suggests the possibility for creating new measures and metrics that better relate to such settings. One approach may be to iteratively revise our survey and SNA instruments to more closely reflect the structural elements that we learned were key in this, and similar, settings (e.g. physical challenges, notion of 'safe spaces').

Based on our experience, we also contend that a network approach to studying trust in field science education is conceptually promising. We were particularly interested in understanding when, where, how, and why network structure might affect the development of trust. Future studies could further investigate how, and under what conditions (e.g. program/participant/instructor characteristics), network characteristics affect the development of trust. Future work could develop more refined measures and metrics that facilitate examination of these trust relationships with

other outcomes such as social learning, place-based connections, and pro-environmental behaviors.

Finally, our findings suggest an opportunity to further explore relationships of trust not only among peers, but also with field science educators. These findings echo those of other studies, such as Almers (2013), who found that 'trust and faith from, and in, adults' facilitated the development of action competence related to sustainability. This included 'being allowed freedom based on personal responsibility, rather than being subject to parental control and strict demands.' When adults demonstrated trust and faith in youth, the youth, in turn, felt greater self-trust and empowered to assume responsibility and courage to act. Child-to-educator trust has been more extensively studied in the fields of formal education (e.g. Wooten and McCroskey 1996; Lee 2007) and youth development (e.g. Bird et al. 2013), but is a relatively nascent theme in residential and field-based EE. Understanding the dynamics of trust not only between and among peers, but also between participants and their field science educators, may facilitate understanding of how trust develops in these unique settings, further illuminating links between trust and intended program outcomes.

Conclusion

In her Nobel Prize acceptance speech, renowned economist and collective action theorist Elinor Ostrom (2009) stated, '[T]here's a five-letter word I'd like to repeat and repeat and repeat: Trust.' Ostrom and others have asserted the centrality of trust in tackling some of society's most complex environmental problems. To date, however, few have successfully characterized, operationalized, and assessed trust among youth, particularly in informal education settings. In particular, trust is a phenomenon that is understudied in EE. Yet, this elusive phenomenon is at the core of our being and relationships as humans, underpinning our decision-making processes, as well as the ways in which we treat each other and the planet. The goals of environmental learning and fostering stewardship, especially within the context of increasingly interconnected and interdependent environmental issues, depend on problem-solving skills related to collective action and cooperation. Thus, trust may be considered an intermediary outcome that supports broader intended outcomes of EE programs.

This study examined peer-to-peer trust within immersive EE programs and attempted to characterize how trusting relationships form, develop, and morph over a short time period. In the process, we sought to develop new tools for evaluating how trust develops among youth. We suggest that these kinds of immersive, nature-rich settings have a unique character that can enhance, support, and facilitate trusting relationships. As one study participant said, 'Nature just makes you open up more.' By better understanding when, where, how, and why these kinds of relationships develop and strengthen – especially at young, critical ages and life stages (Kellert 2002) – we can consider how to craft EE programs and experiences that nurture today's stewards and tomorrow's decision-makers. Moreover, we can design EE experiences that foster youth with strong social ties and trusting relationships, enabling them to more effectively make decisions about pressing social and environmental issues in a community context that is nurturing, supportive, and dynamic over space and time.

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Notes

1. See NatureBridge's Core Education Framework (2012): http://www.naturebridge.org/how-we-teach.
2. NatureBridge considers the optimal group size to be 12–15, based on adventure education literature (e.g. Hattie et al. 1997; McKenzie 2000), which indicates that groups of 7–15 participants may be ideal for facilitating collaborative learning and bonding. Hiking groups are led by a Field Science Educator and accompanied by classroom teachers and/or chaperones. Classroom teachers organize groups based on a number of factors, including their knowledge of peer relationships within the classroom and/or group diversity; however, we did not explicitly investigate how teachers organize these groups.
3. Outdoor adventure education differs from environmental education in that it places a heavier emphasis on the inter- and intrapersonal relationships among participants and less emphasis on the environmental content and context, as well as resulting (pro)environmental behaviors (D'Amato and Krasny 2011).
4. All names are pseudonyms.

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