Using digital photography and journaling in evaluation of field-based environmental education programs

Nicole M. Ardoin, Graduate School of Education and Woods Institute for the Environment, Stanford University*
Maria DiGiano, Independent Researcher
Jennifer Bundy, Graduate School of Education, Stanford University
Stephanie Chang, Graduate School of Education, Stanford University
Nicole Holthuis, Independent Researcher
Kathleen O’Connor, Graduate School of Education, Stanford University

*Corresponding author: nmardoin@stanford.edu; 650.721.2231


ABSTRACT

Interest, curiosity and engagement are critical intermediary outcomes in environmental education programs, many of which ultimately work toward enhancing participants' environmental attitudes, knowledge, skills, and behaviors. Methods to measure the construct of “interest” in the context of environmental education have the potential to enhance program evaluation practices yet remain underdeveloped. Therefore, we investigated how situational interest was triggered among participants in an environmental education camp and tested two participant-driven tools for exploring interest within this setting: digital photography and journaling. Findings suggest that several key domains of interest may be revealed by using photography and journaling concurrently and/or independently as evaluation tools. We discuss potential benefits and challenges of their use for evaluating environmental education programs.

Highlights
• Interest is a key intermediary outcome in environmental education (EE) programs, yet tracking tools are underdeveloped.
• This study piloted participant-driven tools to assess interest as an intermediary outcome of EE in informal settings.
• Findings demonstrated an array of triggers of situational interest, including non-human animals and social interactions.
• Embedded tools are promising for evaluating interest, yet challenges remain to implementation, replication, and validity.
Introduction

In the field of environmental education, the desired outcomes and impacts of programs in formal and informal settings are often some form of environmentally related knowledge, attitudes, values, skills, and behaviors (Ardoin, Biedenweg, & O’Connor, in press). This, perhaps, is not surprising, as many programs are developed based on an understanding of environmental education derived from the classic Tbilisi Declaration definition—authored by 265 representatives from 66 member states—which emphasizes these five goals as key to environmental education (UNESCO, 1977). The Tbilisi Declaration also emphasizes social, economic, and political aspects of environmental education in urban as well as rural areas, in addition to individual, as well as collective, action (UNESCO, 1977).

Yet environmental education programs are often short in duration, ranging from one hour to one day to, perhaps, one week, thus necessitating measurement of intermediary outcomes (Heimlich, 2010). The lofty goals and ideals of environmental education can be challenging to achieve in such a short period of time with diverse audiences in a wide range of settings, and with educators whose training, knowledge, and experience in the areas comprising environmental education may range from cursory to deep. Thus, expectations for outcomes from environmental education programs must be realistically adapted to reflect the actual programs under consideration, and intermediary outcomes become critically important when developing evaluation models. Intermediary outcomes can function as bridging indicators that link direct program outputs to short-, medium-, and longer-term outcomes. They also can serve as signals to program planners and evaluators that, while participants may not fully achieve the desired outcomes by the end of a short program, the participants may be headed toward deepened environmental knowledge or environmentally responsible behavior, among other goals aligned with the program’s design, logic, and theory of change.

However, intermediary outcomes, particularly those that focus on affective rather than cognitive aspects of the program, are challenging to characterize, capture, and assess, and, therefore, are often not measured (Ardoin, et al., in press). The first step is to consider which intermediary outcomes might be meaningful or important to track, particularly recognizing that the participants are not homogeneous and bring a range of interests, backgrounds, experiences, and expectations. Subsequent steps involve operationalizing a process for tracking intermediary outcomes, including being sensitive to preexisting differences among participants and recognizing contextual factors that may be influential. Research and practice in fields closely related to environmental education, such as informal science education, offer guidance in both of these areas. Prior studies suggest, for example, that interest, curiosity, and engagement are critical intermediary outcomes in sparking longer-term engagement in areas such as science and environment (Barron, 2006; Hidi & Renninger, 2006; Renninger, 2009; Renninger & Hidi, 2011; Krapp & Prenzel, 2011). Moreover, interest and engagement have also been linked
with an overall positive affect toward learning, thus building on research in intrinsic motivation among learners, suggesting that elements such as contextualization, personalization, and choice are critical in sparking and maintaining interest in learning activities (Cordova & Lepper, 1996; Dweck, 1986; Patall, Cooper, & Robinson, 2008). Similarly, many years of research have indicated that pro-environmental behavior is heavily influenced by positive affect, including evaluations of how pleasant it will be to perform a behavior, how effective the behavior will be, and how others will view the behavior (Ardoin, Heimlich, Braus, & Merrick, 2013; Bandura, 1977; Heimlich & Ardoin, 2008). Therefore, better measures of affective responses to learning experiences, including those with a component of environmental or stewardship behavior—and, in particular, being able to better characterize the development of interest—may be essential to opening up the “black box” of the environmental education experience.

This study focused on an outdoor environmental education experience to better understand triggers of interest in vivo—in the field, during the course of the program. We conducted an exploratory study to investigate how youth participating in a weeklong environmental education summer camp in a national park made meaning of their experiences. In particular, we explored how certain aspects of the experience sparked, or further supported, interest in the environment and natural world. Summer camp participants journaled and took photographs, which we then analyzed qualitatively using an inductive coding scheme to explore situational interest. Although we expected that elements of the natural environment (especially those that were novel to participants) would trigger interest, we found that social interactions were also important. In addition to investigating what triggered interest, our parallel methodological objective was to consider how these participant-driven tools captured aspects of the program and the overall experience that piqued students’ interest. We selected these tools with the belief that, by their participant-driven, embedded, reflective nature, digital photography and journaling might be effective evaluation tools that would provide nuanced indicators of the development of interest in field-based environmental education settings.

**Review of Interest-Related Literature**

Situational interest, in contrast with personal interest, is spontaneous, transitory, and environmentally activated (Hidi & Anderson, 1992; Krapp, Renninger, & Hidi, 1992). As each individual experiences stimuli differently based on his or her prior knowledge, expectations, and experiences, situational interest is also highly individualized. Researchers have identified possible sources of situational interest, including novelty, choice, physical activity, social involvement, hands-on activities, discrepancy, food, modeling, games and puzzles, content, biophilia, fantasy, humor, narrative, meaning, involvement, group work, and computers, among others (Bergin, 1999; Mitchell, 1993; Palmer, 2009). Of these, some situational interest sources common to multiple studies include novelty, challenge, and social interaction (Paris, 1997).
Regardless of the trigger, empirical studies over the last 30 years show that situational interest and learning are overwhelmingly positively correlated (Schraw, Flowerday, & Lehman, 2001). These studies suggest that interest plays an important role in what, how, and how well people learn (Renninger, Hidi, & Krapp, 1992), as well as the level of engagement during the learning process (Flowerday, Schraw, & Stevens, 2004). Much of the early research in interest dealt with reading comprehension in text-based studies. That work—as well as subsequent studies—suggested that, if students are interested in what they are reading, they do better on recall measures (Alexander, Jetton, & Kulikowich, 1995; Alexander, Kulikowich & Schulze, 1994; Alexander & Murphy, 1998). Subsequent research has branched out to explore the impact of interest on perseverance, time on task, focus, willingness to return to the subject matter at a later point, and other elements suggesting that the internal motivation encouraged through a focus on interest can also have positive links with enhancing cognitive effects of the learning process (Krapp & Prenzel, 2011; Patall, et al., 2008; Renninger & Hidi, 2011; Schiefele, Krapp, & Winteler, 1992).

More recently, researchers have focused on the role of interest in informal learning settings, which are “often characterized by people’s excitement, interest, and motivation to engage in activities that promote learning about the natural and physical world” (Bell, Lewenstein, Shouse, & Feder, 2009, p. 58). Barron (2006), whose research agenda has carefully considered informal contexts, identifies the ways in which interest can be triggered and developed across different, but interrelated, contexts of a learning ecology, such as informal education programs, classrooms, museums, playgrounds, and kitchens, among others. Azevedo (2011) examines the role of science-related interests in long-term engagements in a hobby, such as model rocketry. Both Barron (2006) and Azevedo (2011), in their widely ranging contexts and contents, emphasize the importance of interests as an avenue toward learning-related outcomes.

As the study of interest among youth has broadened, differing theoretical and conceptual frameworks have emerged. Hidi and Renninger (2006), for example, have conceptualized interest “as a psychological state or as a predisposition that emerges from, and is sustained through, interaction” (p. 119). They develop a model that includes four phases of interest development: triggered situational interest; maintained situational interest; emerging (less-developed) individual interest; and well-developed individual interest. The phases are thought to be sequential and are characterized by varying amounts of affect, knowledge, and value. Extending on some of these notions, Barron (2006) applies a “learning ecology” model of interest in which she looks across a set of contexts, each of which provides opportunities for learning. Barron describes these contexts as “comprised of a unique configuration of activities, material resources, relationships, and the interactions that emerge from them” (p. 195), each being interdependent with the others. Azevedo’s (2011) descriptive framework explores the interplay among preferences and conditions of practice to reveal “a more fine-grained structure and phenomenology of interest-based persistence” (p. 178).
In each of these frameworks and models—many of which are interrelated—situational interest is considered to be a catalyst or spark, something that is “activated” and then nurtured through subsequent experiences. Fortunately for educators, many of the factors that may evoke interest are, to some degree, under the control of teachers and program developers (Schraw & Lehman, 2001). Thus, by identifying specific elements of environmental and educational programs and interventions that contribute to participant interest, educators can focus on, emulate, and enhance those aspects, striving to create a more engaging, stimulating, and potentially meaningful learning experience (Paris, Yambor & Packard, 1998; Tobias, 1994).

In this way, methods that help better conceptualize, understand, and measure interest in the context of environmental education have the potential to enhance program planning, implementation, and evaluation. Yet, to date, reliable and valid instruments for assessing situational interest—particularly in field-based environmental education programs, which include myriad interacting variables from weather to program content, and from instructor variability to participant interactions—remain underdeveloped (Ardoin, et al., in press). In studies of informal learning, interest is often inferred on the basis of behavior displayed (Ballantyne & Packer, 2008; Bell, et al., 2009); that is, participants who appear engaged are presumed to be interested. Other studies rely heavily on surveys or interviews in which students are asked to self-rate their level of interest in, or feelings about, particular aspects of a text or lesson (Chawla, 1998; Palmer, 2009; Schiefele, 2009; Tai, Liu, Maltese, & Fan, 2007). These types of measures assume that ratings of interest, often conducted post-hoc, correspond with the experience of situational interest. Often lacking are direct, immediate measures of situational interest, or even measures that have the opportunity to be more relevant to, and aligned with, the meaning-making as it occurs in the flow of the experience itself.

For this reason, researchers and evaluators have sought alternative methods to more accurately, reliably, and creatively, identify triggers of situational interest. Visual methods, such as drawing and photography, have recently grown in popularity as an improved means of qualitative research that allows researchers to gain deeper insight into participant thoughts (Clark-Ibañez, 2004; Knoblauch, Baer, Laurier, Petschke, & Schnettler, 2008; Schwartz, 1989), engage study participants more actively (Jenkins, Woodward, & Winter, 2008; Smith & Woodward, 1999), and appeal to a wider range of senses through visual imagery, instead of focusing solely on written or audio material (Gotschi, Delve, & Frayer, 2009; Lehman-Frisch, Authier, & Dufaux, 2012; Pullman & Robson, 2007; Radley & Taylor, 2003; Smith & Woodward, 1999).

More specifically, participant photography is a visual method that allows research subjects to drive the research experience, empowering them to document and reflect on both the cognitive and affective aspects of their experience that they find most interesting and desire to record. Photographs taken by study participants display the
unique perspective of the participant, showing what he or she deems to be important or significant without the influence of, or with a lesser influence from, outside expectations (Allen, 2011; Reeve & Bell, 2009). Thus, the captured media represents a subjective point of view, while also providing empirical value that may be useful for evaluation purposes.

In addition, photography appeals to emotions and visual senses in a way that reading, writing, and talking may not (Radley & Taylor, 2003), with the resulting photographs providing an alternate manner in which to express ideas and feelings (Cappello, 2005) or elicit participants’ sense-of-place values (Beckley, Stedman, Wallace, & Ambard, 2007). The media itself aligns well with the visual experiences participants have as they examine and react to their designed or natural surroundings and environment (Loeffler, 2004; Pullman & Robson, 2007). Each photo reveals something about what participants find interesting—taken en masse, the resulting photographs can also show an evolution of ideas or feelings (Rockwell, Albrecht, Nugent, & Kunz, 2011).

Participant photography as a research method is often combined with interviews, journaling, and photo captioning, providing opportunities for deeper understanding of the participants’ perspective and intention behind the images. As Bignante (2010) argues, “the snapshot must be considered not a point of arrival but of departure in exploring informants’ understandings and perceptions” (p. 11). Thus, a pivotal aspect of this approach is not only about studying the images, but also analyzing how informants respond to them, attributing social and personal meanings and values (Ruby, 1995).

Student journals, in association with photographs, can provide such an avenue. Environmental and experiential educators have long encouraged or required students to keep journals to promote student reflection, personal growth, and critical thinking during the course of a single or multi-day educational experience (Bennion & Olsen, 2002; Dyment & O’Connell 2003; Priest & Gass, 1997). These journals can be leveraged to provide a research and evaluation tool to assess a variety of environmental education outcomes (Thomson, Hoffman, & Staniforth, 2003). By asking participants to write and share their reflections in a journal, researchers have obtained insight into participants’ perceptions, interests, social interactions, and changes and gains in cognition (James & Bixler, 2008; Leinhardt, Tittle, & Knuston, 2002). Thus, by triangulating photos, journal entries, and photo captions, our study attempted to gain deeper understanding of what sparks participants’ interest during immersive environmental education experiences and how that can be best captured.

**Target Audience, Research Procedures, and Methods**

We implemented this study in an environmental education summer day camp on the Pacific Coast of the United States. The week-long program primarily targets youth from the San Francisco Bay Area (“the Bay Area”) and includes a variety of field-based experiences, such as hiking, teambuilding activities, and science-focused lab work,
centered on environmental themes. The camp participants are youth between the ages of 5 and 15 who are registered by parents or caregivers. Some of the youth attending may have self-selected to participate because of prior interest in environmentally or science-related topics, whereas others attend because of the camp’s location, time frame, and other logistically related aspects.

Within this context, in summer 2012, we conducted pilot studies of two evaluation tools for directly and immediately measuring participants’ situational interest: digital photography and reflective journaling. We worked with three groups of campers between the ages of 10 and 14. The groups had between 8 and 12 campers each, for a total sample size of 28 participants across the three pilot studies. Each pilot test included one day of observation by researchers, followed by one day of participant-elicited data collection in conjunction with participant observation.

During data collection, we randomly divided participants into two sets. Each set had between two and five participants, depending on the total number of participants in the three pilot groups. For each of the three pilots, Set 1 participants were given digital cameras and asked to document what interested them using a variety of prompts (see Table 1 for prompts). After approximately three hours, Set 1 participants were asked to select their “top five” photos, and write captions to describe each photo. At this time, Set 2 participants were asked to write about their experiences, using the same prompts. For the remaining three hours of the camp day, we repeated the test with Set 2 using digital cameras and Set 1 journaling. In this way, all participants used both tools (photography and journaling) to document what interested them throughout the course of the day. We used a variety of prompts to explore how the prompting language altered whether and how participants documented their experiences. In our first pilot, we used the prompt, “Document what interests you,” allowing the broadest possible interpretation of “interest” for participants. Based on researcher observations and concerns that the lack of specificity may lead to confusion among participants, we opted to test more focused prompts in the two subsequent pilots. These included asking participants to document what aspects of their experience they would like to remember or share with others, as well as prompts regarding desired future actions, such as what they would like to learn more about, based on their experience.
Table 1: Prompts used for digital photography and journaling exercises for the three pilot studies.

<table>
<thead>
<tr>
<th>Pilot</th>
<th>Prompts</th>
<th>Participant Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot 1</td>
<td>1. Take pictures of anything that interest you. Then you will choose your top 3 to 5 photos and write a caption for each photo.</td>
<td>N=10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ages 10-12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Camp theme: Teambuilding</td>
</tr>
<tr>
<td>Pilot 2</td>
<td>1. Create a postcard for yourself 5 years from now. What interesting things about Coastal Camp would you want to remember?</td>
<td>N=8</td>
</tr>
<tr>
<td></td>
<td>2. Write about, or take photos of, the top 3 to 5 things that you would like to learn more about.</td>
<td>Ages 12-14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Camp theme: EcoQuest</td>
</tr>
<tr>
<td>Pilot 3</td>
<td>1. What are the top 3 to 5 things that you want to remember from this morning?</td>
<td>N=10</td>
</tr>
<tr>
<td></td>
<td>2. What are 3 to 5 things from this afternoon that you would like to learn more about?</td>
<td>Ages: 10-12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Camp theme: Call of the Wild</td>
</tr>
</tbody>
</table>

Across the three pilot studies, we collected 97 photos, 88 photo captions, and 25 journal entries. Data were grouped into two categories for coding and analysis: (1) photos and their accompanying captions, and (2) journal entries. We then developed a preliminary coding scheme, based on our observations in the field, as well as categories of interest derived from the literature. These included natural and human-made objects, social interactions, programmatic-related themes, and affective responses, such as novelty. Three researchers independently coded data from the first pilot test, compared coding, and discussed codes that lacked clarity or consensus to finalize the coding scheme. Next, two of the three researchers simultaneously coded (and, in the case of the first pilot, recoded) the data for all three pilot tests. Initially, the average level of agreement for coding between these two coders was 51%. Because of the relatively low levels of consensus, a third researcher then reviewed all coding and, following discussions with the initial two coders, resolved coding discrepancies where appropriate.

Journal entries, photos, and their accompanying captions were coded for both content (e.g., landscapes, non-human animals, and people) and the language used to describe content, including positive connections to nature, engagement, or reference to past experiences. In addition, we coded captions and journal entries for statement complexity, ranging from simple statements of fact or opinion to more complex statements that were reflective or included references to future engagement, questioning, or action. We allowed data to be coded into multiple sub-categories within the general categories of participant references and statement complexity, acknowledging that photos, captions, and journal entries could embody multiple representations and meanings, as noted in
other research employing photography (Beckley, et al., 2007; Stedman, Beckley, Wallace, & Ambard, 2004).

Finally, although the study was primarily intended to be qualitative, we employed basic quantitative analyses to describe how categories of interest were differentially represented in our dataset. We report percent representation based on the participant-generated data (i.e., number of photos and photo captions, or journal entries coded to each category divided by the total number of photos or journal entries) for each of our interest domains in the findings section (see Table 2). However, our small sample size prevented testing whether such differences were statistically significant.

In the following section, we qualitatively and quantitatively compared photos and photo captions, along with journal content. We emphasize that the nature of this pilot study, in addition to the variability of each group, limits the generalizability of our findings; yet, the findings may present interesting insights, particularly for evaluation methods, but also into elements that trigger interest among environmental education program participants.

**Findings**
The aim of this exploratory study was to investigate triggers of situational interest within a field-based environmental education program, as well as how participants described, related to, or made meaning of their experience in that program. We found that participants captured a range of content across photographs, photo captions, and journal entries. (Tables 2-5 present the findings from our analysis of photographs and journals, describing the percentage of photos—including captions—and journal entries that fit our main categories of interest. Figure 1 presents four examples of participant-elicited photos and their captions.)
Thematically, an area of interest that rose to the top among both journals and photos was non-human animals (Table 2). Over 43% of photos and photo captions, and 48% of journal entries, contained references to non-human animals (see Figure 1a for example). By contrast, landscape features were prevalent among journals, and to a lesser extent, among photos and photo captions (see Figure 1b for example). Many of these journal entries referenced experiences on the beach, a prominent landscape feature of at the summer camp’s location in the Marin Headlands. For example, one participant wrote, “The beach was fun because it was so cool how the rocky sand were (sic) colored.”

Figure 1: Examples of participant-elicited photos and photo captions
1a: “I picked this one because it is so cool that mountain lions live here.”
1b: “(I choose this photo) because of how cool the fog looks rolling over the hills.”
1c: “This is an image of an activity we did here at the beach.”
1d: “fun, me and friend.”
Social interactions, which included references to other participants, the field-science instructor, or group activities, were found in almost 20% of the photographs and over 30% of journal entries. Photographs often captured fellow participants and focused on friendships that developed during the course of the program (see Figure 1d). Other examples included posed photos of participants arm in arm, with captions such as, “I chose this picture because I am grateful for the great friends we meet and have here;” and “It’s the only [photograph] of me and the friends I’ve made at camp.” In contrast, the journal entries that referenced social interactions focused on participant experiences in group activities that centered on teamwork and collaboration. One participant wrote, “Something that was interesting was the Mussel Game [a team-building challenge] because it was cool to collaborate and figure out what to do.” Another participant wrote about this specific activity as well: “When we played the Mussel Hustle and the other challenges, I think we all grew a lot as a team.”

We coded participant-elicited data as either “program-related” or “non-program related.” Program-related data points refer to experiences that were instructor-led and part of the overall program structure, such as teambuilding challenges, lessons, and activities. Non-program-related data points refer to experiences outside the bounds of the program structure. We found that photos captured more non-program-related aspects of the participant experience, with a smaller percentage of photos representing content directly related to program activities (see Figure 1c and Table 3). These photos captured participants’ unstructured or spontaneous observations of the natural world (see Figure 1b), as well as their relationships with their peers (see Figure 1d). By contrast, journal entries focused more heavily on program content, reporting on what participants had done or what activities they liked best. For example, when given the prompt, “What would you like to remember?” one participant wrote:

“I would want to remember my time observing plankton in the lagoon. I would like to learn more about the necropsy and what they do with the information they find as well...”

<table>
<thead>
<tr>
<th>Content</th>
<th>Photos</th>
<th>Journals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants</td>
<td>11.3%</td>
<td>0%</td>
</tr>
<tr>
<td>Non-Human Animals</td>
<td>43.3%</td>
<td>48%</td>
</tr>
<tr>
<td>Landscape</td>
<td>18.6%</td>
<td>32%</td>
</tr>
<tr>
<td>Human-made Structures</td>
<td>14.4%</td>
<td>8%</td>
</tr>
<tr>
<td>Social Interactions</td>
<td>17.5%</td>
<td>36%</td>
</tr>
</tbody>
</table>

Table 2: Results from analysis of 97 photos, 88 photo captions, and 25 journal entries presented by content categories.
as more about what they do to help the animals at the MMC [Marine Mammal Center].”

Table 3: Results presented by programmatic focus.

<table>
<thead>
<tr>
<th>Programmatic Focus</th>
<th>Photos</th>
<th>Journals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program-related</td>
<td>42.3%</td>
<td>84%</td>
</tr>
<tr>
<td>Non-program Related</td>
<td>57.7%</td>
<td>16%</td>
</tr>
</tbody>
</table>

We also considered the language participants used in writing their photo captions and journals entries, using two categorizations referred to in Tables 4 and 5 as “Participant References” and “Statement Complexity.” By coding Participant References, we explored the kinds of abstract references used to describe their observation or experience, such as positive connection to nature, affective responses, and references to past experiences. As shown in Table 4, the majority of photo captions (66%) and journal entries (52%) included participants’ affective responses. This category included references to generally liking something, or to things that sparked their interest or curiosity. The word “cool” was often used in such references (see, for example, Figures 1a and 1b). To a lesser extent, participants described their experiences in relation to a positive connection with nature. Only one participant related his experiences at the environmental education program with past experiences in nature. In a photo caption of a plant, he wrote, “Looked like cactus, like desert in Mill Valley, desert in Marin.”

Table 4: Results presented by participant references.

<table>
<thead>
<tr>
<th>Participant References</th>
<th>Photos</th>
<th>Journals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Connection to Nature</td>
<td>28.9%</td>
<td>24%</td>
</tr>
<tr>
<td>Affective Response (e.g., engagement, novelty)</td>
<td>66.0%</td>
<td>52%</td>
</tr>
<tr>
<td>Connection to Past Experience</td>
<td>4.1%</td>
<td>4%</td>
</tr>
</tbody>
</table>
Statement complexity was an additional metric to explore participant meaning-making in photo captions and journal entries. We coded data along a continuum, from simple descriptive statements to comparative or reflective statements, and, finally, to more complex statements predicting future actions or behavior. The vast majority of statements in photo captions and journal entries were descriptive; 84.5% and 100%, respectively (Table 5). A much smaller percentage went beyond descriptive to explain in-depth the significance of the photo selected (16.5%) or provide more expression in their journal entries (40%). The following caption accompanied a close-up shot of pebbles and exemplifies a reflective statement: “(H)ow many rocks when you look closely...wonder if you look closely if there’s something cool or valuable.”

Table 5: Results presented by statement complexity.

<table>
<thead>
<tr>
<th>Statement Complexity</th>
<th>Photos</th>
<th>Journals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive</td>
<td>84.5%</td>
<td>100%</td>
</tr>
<tr>
<td>Comparative or Reflective</td>
<td>16.5%</td>
<td>40%</td>
</tr>
<tr>
<td>Predictive</td>
<td>14.4%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Similarly, and perhaps somewhat surprisingly given the intended emphasis in the camp program on environmental behaviors and links back to the home setting, few participants used the photo captions (14.3%) or journal entries (16%) to predict or express future actions or behaviors triggered by their informal learning experience. One example where a participant did express this kind of desire was with regard to a photograph of the nearby Marine Mammal Center, which participants visited as part of the camp, and the accompanying caption read, “I like [this picture] because it makes me think and wanna (sic) tell people to be more thoughtful about the ocean.” Of a scenic photograph, a participant wrote, “I like this picture because the landscape is pretty and I want to learn more about it because I want to know if Native Americans lived there.”

In addition to the analyses of participant-elicited data, researchers also observed participants during a regular camp day, and while participants used cameras. We noted a range of behaviors indicating situational interest in participants’ verbal language (e.g., exclamations and excited talk), body language, and prolonged engagement. Although some participants took photos during periods of sustained situational interest, we found that often, when participants appeared most interested, they did not take photos. During an activity where participants examined plankton under microscopes, for example, we observed high levels of engagement, with students actively developing curiosity questions, independently seeking out answers from the various resources at their disposal, and discussing the activity with their peers. One participant even commented, “This is funner (sic) than school!” Yet, few participants took photos during the process.
Whether this may be attributed to the physical limitations of the activity or evidence of the state of “flow” (Csikszentmihalyi, 1990) is difficult to ascertain. More rigorous observation protocols, perhaps in conjunction with interviews, may allow a deeper exploration of this particular aspect of the relationship between engagement and photo taking.

DISCUSSION

Our findings generated several important themes for further discussion. First, we examine what we learned about catalysts of situational interest through this exploratory study. Second, we discuss the methodological aspects, reflecting on the use of two different approaches to exploring interest, as well as the prompts employed. As part of our discussion comparing the use of journaling with digital photography, we consider some implications of the use of technology to mediate and understand experiences in nature and the tensions inherent in this approach. Third, we explore some limitations of the study.

Capturing what sparks participant interest

Through the use of embedded, in vivo participant-elicited data from photography and journals, we were able to capture and better understand some of the triggers of situational interest in an environmental education program within a field-based setting. Salient triggers of interest included non-human animals, interactions with peers, and unstructured observations of nature, as well as an emphasis on both program- and non-program-related activities. These findings emphasize the social aspect of learning, while also suggesting that interest may be triggered within spaces, relationships, and activities that are inherent in any educational experience, especially those that occur in an informal setting.

Environmental education programs can facilitate these triggers of interest by allowing for self-directed learning and observations, and also by creating opportunities for peer-to-peer interactions. Studies have shown that, in formal learning contexts, peer-to-peer interaction is positively related to learning (Bianchini, 1997; Holthuis, Lotan, Saltzman, Mastrandrea, & Wild, in review) in formal learning contexts. Within informal learning contexts, such as those common in environmental education, we suggest that these are also promising paths to triggering situational interest, and thus, possibly longer-term positive engagement with the environment and related issues surrounding human-environment interactions.

Reflecting on embedded assessment tools

Our methodological approach to capturing participants’ interest in the moment, rather than through the exclusive use of pre-/post-surveys or activity-based evaluations,
provides insight into how participants make meaning of their experiences in informal learning settings, such as environmental education programs. We endeavored to focus on research and evaluation techniques that could become embedded aspects of the camp experience. Therefore, the photography and journaling exercises reflect the opportunities and constraints afforded by embedded evaluation tools. The benefit is that these methods—particularly the photographs—offer an in-the-moment, or, at least, an in-the-field, understanding of interest development; the journals, while slightly removed from the day itself, do still occur in the camp setting and offer a situated learning opportunity for reflective and retrospective vision. These nuances become obvious when considering what is differentially captured among the methods.

Findings demonstrated that participant-elicited photography yielded more distinct representations of situational interest than did the journal entries. Journal entries contained a higher proportion of references to programmatic activities than photos and photo captions, which focused more on participants’ spontaneous observations of the natural world outside of program activities and on peer-to-peer relationships. These variations suggest some underlying differences in the way that participants responded to the two types of media expression. One possible explanation is that the act of writing in a journal might place the participants—children, in the case of this camp program—in the mindset of doing school-like activities, which are often quite different from those done in informal science or environmental education settings. Thus, when asked to write and reflect as part of the embedded assessment, even if well integrated into the program as part of the activity, participants may feel that they are being asked to perform in a way similar to a school setting. The lack of affective words and statements in the journal entries—in contrast to photo captions—provides further evidence that something different is being expressed in journals.

In addition, programmatic aspects may have been more salient in journals due to physical and programmatic limitations on taking photos. When participants were engaged in program activities, for example, they were not necessarily able to take photographs because of logistical constraints. At other times, the field science educator actively discouraged or disallowed use of the cameras during certain program activities, as was the case in the first pilot test. When reflecting on the day while writing a journal entry, however, those same barriers and constraints did not exist.

Although journaling may have been considered by some participants as an act akin to “doing school,” photography presented its own set of considerations. Recent research from diverse fields, such as anthropology and visual studies, has shown that the nature of photography itself is changing, especially among youth (van Dijck, 2008). The use of digital photography to document experiences is second nature to many youth, and thus, provides an additional and accessible tool for embedded assessments. Photography is increasingly focused on expressing identity and (re)presenting one’s experience to others, rather than capturing memory (van Dijck, 2008). The performance aspects of
photography suggest both an opportunity and a challenge to researchers. We are faced with the challenge of distinguishing what may be performative, such as the ways in which participants seek to create or act out an identity for researchers or their peers, from what may be an authentic display of interest. Then, as researchers, we must decide how to treat these aspects in similar or differential ways.

Reactivity—or when participants change their behavior due to the awareness of being studied—is a persistent challenge to validity in ethnographic research. Participant observation may reduce problems of reactivity, and in the case of photography, using other data points, such as captions or interviews, to probe the meaning behind photos can help clarify what the researcher thinks they are measuring and participants’ representations (Bernard, 2002; LeCompte & Goetz, 1982).

Prior studies have demonstrated that photo elicitation can enrich research and evaluation by providing visual prompts for reflection to help confirm or challenge researchers’ observations (Rockwell, et al., 2011; Stedman, et al., 2004). Yet, the use of photography in informal educational settings, and especially within environmental education programs, may be contentious due to the perceived barrier posed by bringing technology into field-based settings. In discussions with field science educators in this camp setting, some suggested that cameras may inhibit participants from directly experiencing the natural world. In addition, we did indeed observe that, when participants became deeply engaged in an activity, many did not stop to take pictures. This observation supported the educators’ concern that for some participants, cameras—and other similar digital devices—may present obstacles to authentic experiences.

A burgeoning body of literature examining youth and their relationship to technology demonstrates divergent viewpoints, some supporting, and others refuting, the notion that technology is a barrier to the types of deep experiences in nature that are often characteristic of environmental education programs. On the one hand, authors such as Louv (2005) suggest that the increasing use of gadgets and technology by youth contributes to less time spent outdoors, and what he terms “nature-deficit” disorder. Additionally, scholars such as Turkle (2011) argue that technology increasingly mediates our experiences in the world and with each other, ultimately leading to a greater sense of disconnection.

On the other hand, researchers such as Hsi (2007) call today’s youth “digital kids” who fluidly use technology and multimedia to express their identity and produce cultural knowledge through digital artifacts. Similarly, findings from the large-scale Digital Youth Project demonstrate that various forms of media play important roles in communication and identity construction for youth (Ito, Horst, Bittanti, Boyd, Herr-Stephenson, Lange, Pascoe, & Robinson, 2008). Ito et al. discuss the role of personal photos in particular: “That personal photos about one’s life are readily available in social contexts means that
visual media become more deeply embedded in the everyday communication of young people” (2008, pg. 26).

Although we observed some participants setting cameras aside when deeply engaged, we also observed that, for others, the art of taking photographs increased their interest at particular moments. One participant, for example, wrote as a caption for her photo: “I love taking pictures of flowers because I can edit them in cool ways and can make cool effects.” Due to increased digital fluency among youth, photography may promote interest and engagement by providing a tool to view something differently, share the experience with someone else, and simply enhance the youths’ aesthetic appreciation of the natural world. Photography, mediated through the digital device and shared through the techno-networks, may also provide some of these youth with the impetus to slow down and take notice of otherwise fleeting moments or ephemeral natural events.

**Limitations of pilot study**

Because this was exploratory research, we see many opportunities for replication with larger samples, more controlled settings, and more consistent prompts. We consider here three challenges to scaling up these embedded tools for rigorously evaluating interest. The first is that, while *in vivo* tools may capture the spark of interest or situational interest, they may not measure or predict the development of longer-term interest; yet, some studies have suggested that this sustained interest is more important in developing meaningful engagement with issues, topics, and subjects (Barron, 2006; Renninger, 2009; Renninger & Hidi 2011). Further, Renninger (2009) cautions that we cannot place too much stock in positive affective responses as indicating more developed phases of interest. Learners may need additional support, tools, and opportunities to transform situational interest to more developed phases of interest, including scaffolding to deepen learner connections to content, formulate curiosity questions and learning goals, and develop “a sense of possibility about their involvement” in a topic (Renninger, 2009, p. 107). A research approach that incorporates the use of embedded assessment tools, in conjunction with follow-up research and tracking of additional scaffolding, could better evaluate if, when, and how sparks of interest are transformed into longer-term maintained interest.

A second challenge in replicating this study is that, as we found, the ways in which the evaluation activities—either photo-elicitation or journaling—are framed makes a difference. The prompts used in both photo-elicitation and journaling exercises shaped participant responses. The language used in prompts, such as references to “learning” or “remembering,” seemed to influence how participants reported programmatic activities (in the case of learning) or shareable memories (in the case of remembering). The open-ended prompts, such as “take photos” or “write about anything that interests you,” helped to elicit the ways in which participants constructed meaning from their experiences and captured catalysts of interest. Future research would benefit from a
careful exploration of the role of language, prompts, and framing in shaping participant responses. A wealth of research suggests that the language used—and the expectations set by that language—can have a significant effect on how participants perceive the exercise and what they choose to record as a result (Semin, 2000; Semin & De Poot, 1997; Walton & Banaji, 2004).

Third, we undertook this exploratory study with a small, selected sample in a camp setting. This field setting—even more so than many other learning settings—included variations in the learners’ experience, making it challenging to control, and account for, potential differences among experiences. Perhaps one of the aspects that varied the most was the range of participant experiences related to the instructors’ diverse backgrounds. The instructors’ academic preparation, as well as number of years of teaching experience both in and outside of classroom settings, varied, as did their prior training in pedagogical techniques for outdoor settings. The instructors engaged participants in slightly different activities, and encouraged and supported different group dynamics and characteristics, thus influencing different learning outcomes in terms of the development of participant interest. Researchers observed differences in the amount of time instructors allowed for the activities. Some encouraged participants to take photographs during each activity, while others asked participants to refrain from taking photographs until the end of the day. Certainly, these influences from instructors impacted this study’s results.

To replicate these findings—and to use these instruments effectively as evaluation tools—would require instructors to receive clear instructions for conducting the journaling and photography exercises and consistency in the use of the instruments to ensure continuity across instructors and field-based experiences. In addition, a balance should be achieved between capturing rich ethnographic elements of participant-elicited data and the need for rigorous and consistent evaluation methods that allow for replication and some level of standardization among researchers and evaluators. As such, multi-researcher coding provides one way of codifying ethnographic data for evaluation. However, researchers and evaluators also run the risk of oversimplifying participants’ observations and superimposing the researchers’ own interpretation of potentially ambiguous material, such as the images portrayed in the participant-elicited photographs (Williams & Patterson, 2007). Therefore, we emphasize that photography as a stand-alone evaluation tool may not effectively capture what sparks participants’ interest; participants’ photo captions or accompanying participant interviews can help contextualize this data-collection method.

CONCLUSION

What sparks learners’ interest has been a rich topic of inquiry for over a century. More systematic study in recent years has advanced not only the conceptualization of interest,
but also revealed ways in which research findings can enhance learning in both formal and informal settings. Although the application of interest research in environmental education is still nascent, this is a promising avenue for understanding the ways in which environmental education programs can trigger interest in the environment, environmental learning, and environmental behavior. In an effort to capitalize on the potential of interest research in the field of environmental education, this study explored what sparks participants’ interest in the context of an environmental day camp. In addition, we also had the objective of exploring the use of participant-elicited photography and reflective journaling as evaluation tools to track interest in immersive, in vivo settings.

Our findings, both in terms of content and methods, have broader implications for environmental education. Through the lens and voices of participants, we deepened our understanding of which aspects of the environmental education experience spark interest in such a way to potentially lead to a powerful, memorable environmental learning experience. We found that while programmatic aspects triggered participant interest, so did interactions with peers, as well as observations and experiences occurring outside of the program structure. Environmental education programs, such as the one we observed, are often characterized by flexible program structures, shaped by instructor experiences and participants’ own learning objectives. The inherent variability and flexibility of such programs provide opportunities to catalyze and enhance participant interest by making learning personally significant, which is cited as a critical dimension in the development of interest (Krapp, 2003). This could be achieved, for example, by creating spaces for self-directed and/or peer-to-peer learning, as well as by making program themes and lessons relevant to the participants’ home environments.

This same variability within environmental education programs is a challenge to researchers and evaluators seeking to systematically track the development of interest and other intermediary outcomes. In this pilot study, we tested two participant-driven, embedded evaluation tools to address the emergence of situational interest. Evidence from this exploratory study suggests that mixed in vivo approaches have the potential to elucidate triggers of interest; however, longitudinal studies are necessary to track whether and how sparked situational interest develops into more advanced stages of interest that could lead to longer-term engagement with environmental learning, as well as change in environmental behavior. Continued exploration of these questions is central, not only to the study of interest in the context of environmental education, but also to the field of interest more broadly (Renninger & Hidi, 2011). As such, future research building on this exploratory study has the potential to contribute to this expanding body of knowledge, enhancing environmental education program outcomes that could, in turn, increase the ability of such programs to spark further interest and learning about the environment.
REFERENCES


NOTE: This is a pre-press version. Final version available online through the journal *Studies in Educational Evaluation*, doi.org/10.1016/j.stueduc.2013.09.009.


NOTE: This is a pre-press version. Final version available online through the journal *Studies in Educational Evaluation, doi.org/10.1016/j.stueduc.2013.09.009.*


NOTE: This is a pre-press version. Final version available online through the journal *Studies in Educational Evaluation,* doi.org/10.1016/j.stueduc.2013.09.009.