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Getting to know nature: evaluating the effects of the Get to Know Program on children's connectedness with nature

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People in industrialized countries may be losing their connection with nature. The Get to Know Program (Get to Know) is a multi-faceted program aimed at encouraging direct connection with nature through a variety of activities (observations of wildlife, hiking, creative arts, and special events), specifically among youth. Three studies assessed the effects of three Get to Know program activities on youth's implicit connectedness with nature (measured using a computer based game). Participants were youth recruited from southern California schools or youth organizations. Participation in the Get to Know Program's Creative Arts Contest was associated with increased implicit connectedness with nature. However, participation in the Get to Know Natural Treasure Adventure and Virtual Hike did not have an effect on connectedness with nature. Implications of these findings are important for agencies seeking to find effective tools for outreach focused on connecting participants with nature.

Keywords: connectedness with nature; implicit association test; environmental program

As a result of the many technological advances over the last 100 years, people in industrialized countries may be losing their sense of connection with nature (Louv 2005). One major reason for this disconnect may be dramatic changes in the experiences of children, including less time spent in nature, less knowledge about local plants and animals, increased urban and suburban lifestyles, overreliance on cars, and an existence supported by technology and human-built features (Campen 2012; House of Commons 2010; Olza and MacDonnell 2010; Rideout, Foehr, and Roberts 2010). In fact, a large national study of more than 2000 American youth ages 8–18 revealed that youth spent approximately seven hours a day, seven days a week consuming media as opposed to spending time outside (Rideout, Foehr, and Roberts 2010). This is an increase of over ninety minutes per day of media consumption compared to findings from a similar study in 1999. In addition, a recent survey of American youth concluded that while there is a general sentiment that being outdoors

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is enjoyable, youth do not spend as much time in nature as they spend participating in indoor activities (Nature Conservancy 2011). Lack of time spent in nature may stem from insufficient opportunities to spend time in outdoor environments for reasons such as: insufficient time; lack of supervision, transportation, money to travel to nature sites; unsafe neighborhoods; or, having too few parks close to home.

The notion that people may be losing their sense of connection with nature is of interest to researchers and practitioners concerned with environmental change and degradation. Some authors have proposed that direct personal experience in nature leads to first-hand knowledge of environmental issues (Barrett 2006) and a land ethic (Leopold 2004) which are necessary to increase environmental caring and responsibility. Other authors have argued for the need to increase environmental awareness through knowledge acquisition and skill-building. Specifically, developing an understanding of environmental issues (Barrett 2006) and how to address them (Frick, Kaiser, and Wilson 2004) are espoused as key elements for increasing environmental caring expressed through attitudes and behaviors. Still others propose that environmental identity, or incorporating the environment into the sense of self, is essential to developing environmental care (Stets and Biga 2003).

Connectedness with nature

As one conduit for enhancing environmental care and concern, a growing body of research has begun to explore the connections between humans and nature (e.g. Barrett 2006; Guiney and Oberhauser 2010; Vining, Merrick, and Price 2008). The notion that people seek out connections with things of or related to themselves, which allows for further connections, is thought to facilitate a connection between nature and the self when nature is related to the self (Vining, Merrick, and Price 2008). Connectedness with nature is a psychological construct that reflects the degree to which individuals perceive they are part of the natural environment (Schultz 2001, 2002). People higher in connectedness with nature have self-schemas in which their concept of self overlaps with their concept of nature. Conversely, the self-schema of individuals lower in connectedness with nature includes views of the self as different or separate from nature.

Connectedness with nature is related to positive proenvironmental behavior (Chochola 2009; Gosling and Williams 2010) and greater environmental concern (Schultz 2001; Schultz and Tabanico 2007). For example, environmental activists report greater connectedness with nature compared to college students, suggesting that connectedness with nature may be related to proenvironmental attitudes and behaviors (Bruni and Schultz 2010). In addition, increases in feelings of connectedness with nature are associated with greater likelihood of engaging in outdoor activities and stewardship behaviors (Andrejewski 2011).

Not only is connectedness with nature related to proenvironmental attitudes and actions, but it also appears to be malleable through experiences in selected settings that focus on the natural environment (e.g. zoos and hiking trails; Bruni, Fraser, and Schultz 2008; Schultz and Tabanico 2007). For instance, spending a day in a zoo-like setting increased connectedness with nature in a sample of adult park visitors (Schultz and Tabanico 2007). Similarly, spending time walking in a natural setting (15 min) increased connectedness with nature in a sample of college students (Mayer et al. 2009).

Connectedness with nature has been measured using both explicit and implicit measures. Explicit measures include self-report scales and surveys (Brügger, Kaiser, and Roczen 2011; Cervinka, Roderer, and Hefler 2011; Mayer and Frantz 2004; Nisbet, Zelenski, and Murphy 2009; Schultz 2001, 2002). For example, Nisbet, Zelenski, and Murphy (2009) created a measure of nature relatedness that taps the affective, cognitive, and physical relationship individuals have with the natural world. Mayer and Frantz (2004) created the Connectedness to Nature Scale, which purports to measure individual differences in emotional connections to the natural world. Finally, Schultz (2001) created a single item measure of inclusion of nature in self that highlights an individual's beliefs about the degree of overlap between themselves and the natural environment.

All of these explicit measures are subject to social desirability bias in that reports of connections between the self and the natural environment may be inflated to create the illusion of being proenvironmental. Thus, to circumvent this social desirability bias, some researchers have attempted to measure connectedness with nature using implicit measures (Devine 2001; Nosek, Greenwald, and Banaji 2005), including the Implicit Association Test for Nature (IAT Nature: Schultz et al. 2004; Schultz and Tabanico 2007). Implicit measures (such as the IAT Nature) are based on reaction time data and presumably far less influenced by social desirability biases. Furthermore, implicit measures may provide insight into influences on connectedness with nature that are outside of people's awareness of deliberate control.

In general, an IAT is used to detect the strength of a person's automatic association between concepts (e.g. 'Nature' vs. 'Built') when paired with an attribute (e.g. 'Me' vs. 'Other') by measuring that person's reaction times in word categorization tasks (Greenwald, McGhee, and Schwartz 1998). In the IAT Nature, participants categorize stimuli into the concepts of either 'Nature' or 'Built' when paired with the attribute of 'Me' or 'Other' under instructions to make these categorizations as quickly as possible. The differential speed in performing a series of these categorization tasks is used to quantify the strength of an individual's association between 'Nature' and 'Me' (rather than 'Built' and 'Me'). Specifically, faster reaction times when the category 'Nature' is paired with the attribute 'Me' compared to when the category 'Nature' is paired with the attribute 'Other' are indicative of stronger connectedness with nature. In the research reported here, an implicit measure of connectedness with nature was used to evaluate the impact of different elements of a program designed for youth.

Get to Know Program

For more than 20 years researchers and educators have called for environmental education of youth in order to foster conservationism, environmentalism, environmental learning, and proenvironmental behavior (e.g. Bakken et al. 2001; Barrett 2006; Hacking, Barratt, and Scott 2007; Bonnett and Williams 1998; Chawla 1998; White 2004; Winter 2000). One program designed to foster environmental awareness and action through increasing youth's connectedness with nature is the Get to Know Program (Get to Know; see <http://www.get-to-know.org>). Since its inception in Canada in 2000, Get to Know has blossomed into an international program that engages youth from preschool through high school in activities focused on connecting youth with nature. These activities range from an annual creative arts outreach event (Creative Arts Contest), to an interactive outdoor hike (Natural Treasure

Adventure) to a virtual nature hike that is completed online. The main premise of the Get to Know creative arts outreach is that participants spend time in nature and visit nature-based settings (such as museums with paintings of wildlife, zoos, and aquariums) while gathering inspiration for their projects. Similarly, the outdoor hike and virtual hike provide nature-based experiences for youth to increase their awareness of nature. Through these experiences, youth ‘get to know’ wildlife and nature, thereby increasing their knowledge and relationship to nature.

Get to Know, as a whole, includes a range of activities, only a subset of which are evaluated in the studies described here (including a conference for youth and outdoor educators, online materials and resources, and a mobile application used to augment nature learning and engagement). The Creative Arts Contest, the Natural Treasure Adventure, and Virtual Hikes were the cornerstone activities of Get to Know at the time the studies described in this paper were conducted and no previous evaluation research on Get to Know had been published. The purpose of the current studies was to examine the effectiveness of the different Get to Know program activities (Creative Arts Contest, Natural Treasures Adventure, and Virtual Hike) in fostering connectedness with nature among youth. Three separate studies were conducted to examine if connectedness with nature increased after participation in these events. Across all three studies, a game version of the IAT Nature, known as FlexiTwins¹ (Bruni and Schultz 2010), was used to measure implicit connectedness with nature.

Study 1: Creative Arts Contest

A unique feature of Get to Know is its emphasis on connecting children with nature through the use of creative arts (see Bartram 2005; Wallen 2003). Song (2008) suggests that by incorporating art into environmental education, ‘children can learn about nature in a fun, stimulating, and hands-on way’ (19). This type of programming may be more likely to engage youth who otherwise might remain disinterested in environmental issues (Brady 2007) or disengaged from educational programs in general (Brown, Benedett, and Armistead 2009). The Get to Know *Creative Arts Contest* is designed to encourage children to gather inspiration from the outdoors, aquariums, natural history museums, and other nature-based sources and incorporate them into artistic mixed media projects (e.g. written narratives, photographs, paintings, drawings, collages, and sculptures). The specific type of inspiration, length of time spent gathering nature-based inspiration, and the actual activities in which children participate vary among children. For instance, some children may go for a three-hour hike as a means to draw inspiration for their art, other children may spend a day at a local aquarium, and still others may spend multiple days across a variety of nature-associated settings. Contest submissions are considered for publication in a calendar that is produced through the program and winners receive various forms of recognition (see <http://www.get-to-know.org/contest/>). The purpose of Study 1 was to assess the effect of participation in the Creative Arts Contest on youths’ implicit connectedness with nature.

Method

Participants

One hundred and seventy-eight students recruited from six classrooms in southern California schools participated in this study. The participants included 81 males and

73 females from 3rd grade ($n = 24$), 4th grade ($n = 12$), 5th grade ($n = 91$), and 6th grade ($n = 51$) classes. Due to remote participation from one school and the inability to observe participant characteristics, gender information from the 3rd graders as well as the age of the participants was not collected.

The study participants self-selected whether or not to participate in the Creative Arts Contest. However, all of the study participants took part in school-based and extended experiences with nature (such as things they might have done with family or friends) during the approximately 30 days between the pre- and post-test assessments. These experiences included visiting nature centers, taking outdoor hikes, viewing nature films, and studying information about the environment.

Procedure

Those participants who did not return an opt-out form played a computer-administered game version of the Implicit Association Test called FlexiTwins (Bruni, Fraser, and Schultz 2008; Bruni and Schultz 2010) both before (pre-test) and after (post-test) their participation in the Creative Arts Contest. Although participants completed FlexiTwins individually, the testing sessions were conducted in a group setting within their classrooms. As part of their participation in the Creative Arts Contest, participants gathered nature-based inspirations from a variety of sources, with each choosing his or her own nature-based experiences. Rather than being directive as to the specific nature activities or experiences that participants used for inspiration, the goal of the Creative Arts Contest was not to encourage individualized nature-based inspiration for submissions. Information regarding the specific types of experiences that children engaged in for inspiration, as well as the time engaged and other information pertinent to these experiences was not collected.

Eighty-six participants submitted at least one entry to the Creative Arts Contest resulting in a total of 164 entries. The entries included 67 pieces of artwork, 61 written pieces (brief narratives), and 36 photographs. Participants who did not provide submissions may still have created rough drafts of narratives, paintings, or have taken photographs, but these were not submitted. All participants were encouraged to participate fully, and we simply distinguish between entrants and non-entrants without an ability to account for why non-entrants did not provide submissions. Some effort was involved in creating the submissions and entering them into the contest. However, participating classrooms had support from lead teachers who assisted with uploading entries to the website and providing supporting information to Get to Know program administrators when received from students.

Participants were given approximately one month to find nature-based inspiration for their submissions, create their submissions, and enter them to the Creative Arts Contest between completing the pre- and post-test measures. Students and teachers from each classroom involved in the evaluation were supplied with nominal gifts of appreciation (i.e. students received nature-themed school supplies and teachers received a small poster for their classroom), regardless of their actual participation in the study.

Measures

The FlexiTwins game version of the Implicit Association Test (IAT Nature: Schultz et al. 2004; Schultz and Tabanico 2007) was used to measure implicit connectedness

with nature, and more specifically, the strength of associations between self-concept ('Me' vs. 'Other') with the categories 'Nature' and 'Built.' In the FlexiTwins game, participants sorted words that appeared on the computer screen (stimuli) into one of two category sets ('Nature' or 'Built'; 'Me' or 'Other'), according to a predetermined set of criteria across seven levels (blocks). To measure these associations between paired concepts and categories, the participant's name was used as stimuli for the 'Me' category, and a random list of other names was used as stimuli for the 'Other' category. The stimuli for the 'Built' and 'Nature' categories were taken from previous work using the IAT-nature (Bruni and Schultz 2010). The following words were used as the stimuli for the 'Built' category: boat, car, chair, and truck. The 'Nature' category used the following words as stimuli: tree, mountain, butterfly, and flower.

Within each level of the game, two categories are presented at a time (one on the left and one on the right) and these categories vary across levels. Stimuli are scored as correct when they are placed into the category to which they belong. For example, the stimulus 'butterfly' corresponds to the category 'Nature' and would be correctly categorized when placed into the category 'Nature' but not the category 'Built.' See Table 1 for a list of levels, level categories, and number of stimuli by level presented in FlexiTwins. The amount of time (in milliseconds) it took participants to correctly categorize each word was recorded and used in the computation of an index of implicit connectedness with nature.

In the current study, word stimuli were presented at the top of the screen and fell to the bottom of the screen. Stimulus fall duration was set to four seconds, with the stimulus resting at the bottom of the screen until correctly categorized. Immediately following the correct categorization of the stimulus word the next stimulus word appeared at the top of the screen for categorization. The game offers three background selections and in the current study the background was turned off, presenting a plain green background. Game sound and feedback reminders were turned on, which provided feedback for correct and incorrect responses.

The FlexiTwins game yields a series of scores that are used to assess reliability as well as connectedness with nature compared to connectedness with built environments. To assess the internal consistency of the game, the difference between response times associated with nature (e.g. plants or animals) and built environments (e.g. vehicles or buildings) on practice and test blocks was computed as incompatible blocks ('Built/Me' and 'Nature/Other') minus compatible blocks ('Nature/Me' and 'Built/Other') to produce D1 (practice blocks: levels 3 and 6) and D2 (test blocks: levels 4 and 7) scores. Compatible blocks are blocks in which categories are

Table 1. Breakdown of FlexiTwins levels (blocks) and stimuli (trials).

Block (game level)	Block type	Category	# of trials (stimuli)
1	Practice	'Me' and 'Other'	8
2	Practice	'Nature' and 'Built'	8
3	Compatible practice	'Nature/Me' and 'Built/Other'	24
4	Compatible test	'Nature/Me' and 'Built/Other'	48
5	Practice	'Built' and 'Nature'	8
6	Incompatible practice	'Built/Me' and 'Nature/Other'	24
7	Incompatible test	'Built/Me' and 'Nature/Other'	48

easily associated. Incompatible blocks are blocks in which categories are not easily associated. In this case of assessing connectedness with nature, when the category 'Nature' was paired with the category 'Me' or the category 'Built' was paired with the category 'Other' it was considered a compatible block; whereas, when the category 'Nature' was paired with the category 'Other' or the category 'Built' was paired with the category 'Me' it was considered an incompatible block. Comparing D1 and D2 provides a measure of internal consistency essentially by quantifying the consistency of responses across the game. Significant positive correlations suggest good internal consistency.

Implicit connectedness with nature was assessed by examining the difference between response times associated with nature and built environments by taking the average of practice (D1) and test (D2) scores to produce a D-score (for more detail about the scoring algorithm, see Bruni and Schultz 2010; Greenwald, Nosek, and Banaji 2003). Although there is no absolute upper or lower limit, D-scores on FlexiTwins generally range from -2 to 2 , with positive scores in the higher range being indicative of greater implicit connectedness with nature and lesser connectedness with built environments. The higher range of negative D-scores are indicative of greater implicit connectedness with built environments and lesser connectedness with nature. Mid-range scores (around zero) imply near equal perceptions of connectedness with natural and built environments. Importantly, FlexiTwins D-scores as absolute measures should be interpreted with caution (Blanton and Jaccard 2006) as the absolute zero point does not mean absence of a connection with nature.

Results

One hundred seventy-seven students played FlexiTwins before the Creative Arts Contest (pre-test). Approximately one month later, 173 students played FlexiTwins following the contest (post-test). In addition to the four participants who did not complete the post-test, six participants were excluded from further analyses due to incomplete data (i.e. students moved from the school or were absent for one of the test administrations). An additional 34 participants were excluded from analyses due to high error rates (less than 65% correctly categorized stimuli) or because of extreme inconsistency in their FlexiTwins scores that resulted in difference scores between D1 and D2 that were greater than 1 or less than -1 (see Bruni and Schultz 2010; Schultz et al. 2004). Means (M), standard deviations (SD), minimum, and maximum scores are reported in Table 2. In addition, the D1 and D2 FlexiTwins game scores were correlated to assess the internal consistency of the game. A significant correlation between D1 and D2 scores indicates that the game is internally consistent. Both administrations of the game were found to be internally consistent (pre-test: $r = .53, p < .01$; post-test: $r = .45, p < .01$).

An independent samples t -test was conducted on FlexiTwins pre-test game scores to determine if participants who provided one or more submissions for the contest (entrants: $n = 65$) differed from those who did not (non-entrants: $n = 74$). This pre-test comparison revealed no difference in FlexiTwins scores between the two groups, $t(137) = 1.41, p = .13, d = .25$ (d represents effect size as measured by Cohen's d , Cohen 1988).

To test if participating in the Creative Arts contest affected connectedness with nature, paired samples t -tests were conducted in which implicit connectedness with nature scores recorded before the contest (pre-test) and those recorded after the

Table 2. Means and standard deviations of pre-test and post-test FlexiTwins D-scores between entrants and non-entrants in the Get to Know Creative Arts Contest, and D-score in the Natural Treasure Adventure and the Virtual Hike.

	<i>n</i>	<i>M</i>	SD	Range	
				Min	Max
Creative arts contest					
<i>Entrants</i>					
FlexiTwins scores pretest	65	.48	.40	-.49	1.23
FlexiTwins scores posttest	65	.56	.38	-.34	1.43
<i>Non-entrants</i>					
FlexiTwins scores pretest	74	.58	.39	-.40	1.40
FlexiTwins scores posttest	74	.49	.37	-.57	1.43
<i>Natural Treasure Adventure</i>					
FlexiTwins scores pretest	23	.51	.48	-.95	1.54
FlexiTwins scores posttest	23	.47	.44	-.09	1.82
<i>Virtual Hike</i>					
FlexiTwins scores pretest	32	.58	.46	-.29	1.67
FlexiTwins scores posttest	32	.60	.36	-.08	1.22

contest (post-test) were compared separately for Creative Arts entrants (children who provided one or more submissions) and non-entrants (children who did not provide a submission). For entrants, the paired samples *t*-test revealed no changes in implicit connectedness with nature (pre-test: $M = .48$, $SD = .40$; post-test: $M = .56$, $SD = .38$), $t(64) = -1.37$, $p = .17$, $d = -.21$). For non-entrants, the paired samples *t*-test also revealed no changes in implicit connectedness with nature as a consequence of participating in the Creative Arts Contest (pre-test: $M = .58$, $SD = .40$; post-test: $M = .49$, $SD = .37$), $t(73) = 1.76$, $p = .08$, $d = .21$).

Finally, a difference score was created between each participant's pre-test and post-test FlexiTwins scores to provide a single number that could be used to directly compare changes in D-scores between entrants ($n = 74$) and non-entrants ($n = 65$). For each participant, this difference score was created by subtracting the FlexiTwins D-score after the contest (post-test) from the FlexiTwins D-score before the contest (pre-test). Direct comparison of these difference scores showed a significant effect in the predicted direction, $t(137) = -2.20$, $p < .05$, $d = -.37$. Specifically, implicit connectedness with nature increased significantly more for children who provided one or more submissions for the contest ($M = .08$, $SD = .47$) than for children who did not enter the contest ($M = -.09$, $SD = .45$).

Discussion

Participating in the Creative Arts Contest by providing one or more submissions was related to significantly greater change in implicit connectedness with nature compared to not participating. This result suggests that active participation in the Creative Arts Contest can increase connectedness with nature and builds on past research that suggests that incorporating art into environmental education can be an effective tool to engage youth in environmental programs (Bartram 2005; Brady 2007; Brown, Benedett, and Armistead 2009; Flowers et al. 2014; Song 2008; Wallen 2003) and also that art can effectively increase connectedness with nature among youth. Importantly, the effect reported here was observed immediately

following the contest experience. Further research is needed to determine if there are any longer-term effects of participation in the Creative Arts Contest on connectedness with nature. We theorize that there may be an underlying association between types, degree, or forms of experiences that were more likely to both lead to submissions of entries and enhanced connectedness with nature, but these dynamics are not distinguishable in the Study 1 findings.

We cannot provide further insights into the scope of experiences acquired individually or in groups, the parties with whom those experiences were gathered (e.g. with family or classmates), the variety of experiences, the actual time spent in each experience and cumulative time across the approximate 30 days period from pre-to-post, nor the dynamics behind decisions to provide submissions or not provide submissions. All of these might be useful follow-up points of inquiry for researchers and evaluators hoping to better understand the Get to Know Program beyond what is offered by our findings. The follow-up inquiry may be worthwhile given the nature of this program.

Study 2: Natural Treasure Adventure

Another facet of the Get to Know program are the outdoor hiking experiences that are aimed at getting children out into nature (The Natural Treasure Adventure). The Natural Treasure Adventure begins with an online introduction to a specific trail location along with a map. The website directs participants to print out the activity map and then visit the actual trail location. At the location, the printed map directs visitors to follow clues in order to find impression stations along the trail. At each impression station, trail visitors create rubbings from a series of small metal plaques (each depicting a specific plant or animal species) using a crayon or pencil to document completion of that activity. Through these activities, trail visitors experience the outdoors while at the same time learning about the surrounding environment by reading the background information on the map and other supporting materials. After gathering the complete set of rubbings, visitors are directed to return to the website where they can enter the clue solutions in order to unlock further features on the website such as fun facts and more in-depth information about the environment (see <http://www.get-to-know.org/games/play/cleveland/>).

The purpose of Study 2 was to examine the effects of participating in the Natural Treasure Adventure on childrens' connectedness with nature using pre- and post-test measures taken at the trail on the day of the hike. We suspect there are other likely outcomes from participation in the Natural Treasure Adventure; however, these are outside of the focus of this paper.

Method

Participants

Participants in the Natural Treasure Adventure were 35 youth (19 males and 16 females) recruited from local youth organizations (e.g. a Boys & Girls Club and a local youth soccer club) in San Diego County, California. Participants ranged in age from 6 to 16 ($M = 9.66$, $SD = 2.33$) and were in school grades ranging from Kindergarten to 10th grade. These age ranges mirror the target audiences for the Get to Know Program.

Procedure

Participants completed a measure of implicit connectedness with nature (FlexiTwin) both immediately before and after participating in the Natural Treasure Adventure. The Natural Treasure Adventure for this study consisted of a hike in the Laguna Mountain Recreation Area, located on the Cleveland National Forest in San Diego, California. As part of the Natural Treasure Adventure, each participant received an adventure map and a writing instrument from the research team. Next, an adult leader led groups of children along the trail. Adult supervision was organized through the organization's contacts, and sometimes included adult family members serving as chaperones. The participants hiked the trail for approximately 45 min, working to find each of the impression stations and gathering the rubbings to complete their adventure maps. Participants were encouraged to look around as they hiked the trail, make additional notes or observations of things they saw, and to read short informational passages on the map. Participants received no additional assignments or instructions; thus, they experienced the hike in a similar way to how they might have had they come with family members or other groups not involved in the study.

Measures

Similar to Study 1, this study utilized FlexiTwin as a measure of implicit connectedness with nature. However, in this study, participants played FlexiTwin using an iPad version² rather than on a computer as in Study 1. The iPad version of FlexiTwin allowed for in-the-field data collection using a portable device.

Results

Thirty-four participants played FlexiTwin before beginning the Natural Treasure Adventure hike (pre-test). Immediately following the hike, 35 students played FlexiTwin (post-test). FlexiTwin game scores from 12 participants were excluded from analyses due to high error rates (less than 65% correctly categorized stimuli), inconsistency of scores within FlexiTwin (difference scores between D1 and D2 greater than 1 and less than -1), or missing data. Means (M), standard deviations (SD), minimum, and maximum for scores before the hike (pre-test) and after the hike (post-test) are reported in Table 2. Both administrations of the game in Study 2 were internally consistent (pre-test: $r = .58$, $p < .01$; post-test: $r = .61$, $p < .01$).

To assess the effect of participating in the Natural Treasure Adventure on participants' connectedness with nature, a paired samples t -test was conducted on implicit connectedness with nature scores recorded before the hike (pre-test) and after the hike (post-test). This test revealed no changes in implicit connectedness with nature as a consequence of participating in the Natural Treasure Adventure hike (pre-test: $M = .51$, $SD = .48$; post-test: $M = .47$, $SD = .44$), $t(22) = .39$, $p = .70$, $d = .17$.

Discussion

In contrast to the results of Study 1, in which participation in a Get to Know program activity seemed to increase implicit connectedness with nature, we did not detect any significant effects of participating in the Natural Treasure Adventure hike. We suspect that implicit connectedness with nature was not affected because of

mitigating aspects of the experience. First, while the participants were on a hike in a natural setting, they were focused on finding impression stations (built object). It is not uncommon for children to use built devices in nature. For instance, Larson, Green, and Cordell (2011) found that using electronic devices outdoors was among the most common reported outdoor activities for children. Past research suggests that activities conducted in nature mitigates an experience's impact on connectedness with nature (Schultz and Tabanico 2007). Schultz and Tabanico found that spending time in a natural environment increased connectedness with nature in places such as a hiking trail and the beach, but that spending time on a golf course, where the focus is on golf rather than the outdoors per se, did not change connectedness with nature. Similarly, the activity in this study was game-based. It is possible that the focus on the activity or game (e.g. completing the Natural Treasure Adventure and making notes about the surrounding environment) may have inadvertently directed attention away from the surrounding nature and hindered increases in implicit connectedness with nature. That is, the focus on the activity itself, rather than the environment, may have been problematic. Secondly, children found additional distractions while onsite that may be typical of children in such experiences. For example, one group of hikers entertained themselves by racing between impression stations and other forms of play outside of the intended experience. Future research could examine potential effects of time on the trail, time allocated to the natural experiences in the setting, and how tasks associated with that visit impede or enhance connectedness with nature.

In addition to mitigating aspects of the Natural Treasure Adventure that may have worked against positive changes in connectedness with nature from pre- to post-hike, the actual time spent in nature may have been insufficient to produce large or detectable changes in connectedness with nature. During the Natural Treasure Adventure, participants spent approximately 45 min hiking. Past research has suggested that as the time spent hiking in nature increases so does connectedness with nature (Schultz and Tabanico 2007). Thus, although no immediate increase in connectedness with nature was found pre- to post-hike in this study, increasing the amount of time spent hiking (both in minutes and visits) may have more positive impact on connectedness with nature. Future research could examine this potential effect in more detail, including the possibility that participants coming on their own rather than as part of an organized study may spend more time along the trail and surrounding area, with consequent enhancement of the Natural Treasure Adventure experience.

The lack of significant effects might also be the result of a small usable subset of the sample ($n = 23$). In addition, this study involved a wide age range of children (6 through age 16), thereby involving very different childhood stages of development. For instance, Larson, Green, and Castleberry (2010) found that children from different age groups experience nature in different ways. Specifically, children older than eleven years of age tend to experience nature through social interactions, whereas children younger than eleven seem to experience nature through exploration and direct contact. Similar findings were also reported by Liefländer and Bogner (2014). In that study, younger children (ages 9–10) were more likely to exhibit positive shifts in their attitudes toward the environment than older children (ages 11–13). Future research could benefit from a larger sample that also includes adequate numbers of children at different stages of development. It may be that experiences such as the Natural Treasure Adventure have greater impact at certain

ages. It is also possible that participation in the Natural Treasure Adventure has beneficial effects on other outcomes associated with proenvironmental attitudes or behaviors not captured in our focus on implicit connectedness with nature.

Finally, the Natural Treasure Adventure is designed as a multi-stage experience, starting with an off-site visit to a website where the participant registers, downloads and prints a map, and gathers initial information. The second stage was captured in our study, involving the onsite experience. After the onsite hike, participants following the full program design were directed to return to the website, unlock clues, and engage in further games and environmental learning. We are not able to draw conclusions about the Natural Treasure Adventure as a whole experience; this analysis only examined onsite participation in the hike and its immediate pre- to post-experience effects. It may be that the combined effects of a virtual and onsite nature experience, with pre and post-onsite hike elaboration of experiences and games, may work differently than the onsite hike alone.

Study 3: Virtual Hike

Study 3 examined the effects of participating in the Get to Know Virtual Hike, featuring trails in the Cleveland National Forest. In this online hike, participants are free to explore trails through a website and to look for various plant and animal species in each scene. Participants track their progress along each trail by viewing icons representing species they have located and are able to move among trails at their leisure. As participants locate each species, additional information about the species is displayed on the screen through narrative and sometimes video and audio displays. The amount of time spent reading and or listening to each display is at the discretion of the participant, as they are able to click out of the display and continue their virtual hike at any time. The stimuli are tailored for different age groups, which virtual hikers select when starting their profile for the online hike. Four trails are featured on the Virtual Hike and participants may visit any or all of the hikes as they choose (see <http://hikes.gettoknow.ca/cnf/>).

The purpose of Study 3 was to examine the effects of virtually hiking on children's connectedness with nature. The anticipated effect seemed possible given findings suggesting that virtual nature experiences can have an effect on connectedness to nature (see e.g. Mayer et al. 2009).

Method

Participants

Participants in the Virtual Hike were 50 youth (31 males and 19 females) recruited from local youth organizations (e.g. Boys & Girls Club, a charter school) in San Diego County, CA. Participants ranged in age from 7 to 14 ($M = 10.30$, $SD = 1.68$) and were in school grades ranging from 3rd to 8th grade.

Procedure

Similar to Study 2, participants completed a measure of implicit connectedness with nature (FlexiTwins) both immediately before (pre-test) and after (post-test) the Virtual Hike component of the Get to Know Program. During the study, virtual

hikers were encouraged to visit four different trails, although they could spend as much or as little time locating species and listening to the audio information or reading materials presented online once a particular animal or plant was located, mirroring the actual experience a person outside of the study would have. Participants were asked to spend at least 30 min online engaged in the Virtual Hike. Members of the research team sometimes offered brief prompts to remind participants to try to find the species and to spend at least some time on each of the trails. Participants monitored their own progress in locating species by viewing the appearance of images onscreen that indicated the particular plant or animal had been found. There was no requirement to find all of the species, although some participants expended considerable effort towards that goal. Here again, participants imposed a ‘competitive game’ aspect to the experience not organic to the program itself.

Measures

This study utilized the computer version of FlexiTwins (similar to Study 1) as a measure of implicit connectedness with nature.

Results

Forty-nine participants played FlexiTwins before the Virtual Hike (pre-test). Immediately following the hike, 48 students played FlexiTwins (post-test). Eighteen participants were excluded from analyses due to high error rates (less than 65% correctly categorized stimuli), inconsistency of scores within FlexiTwins (difference scores between D1 and D2 greater than 1 or less than -1), or missing data. Means (M), standard deviations (SD), minimum, and maximum for scores before the hike (pre-test) and after the hike (post-test) are reported in Table 2. Both administrations of the game in Study 3 were internally consistent (pre-test: $r = .64$, $p < .01$; post-test: $r = .32$, $p = .07$).

To understand if participating in the Virtual Hike had an effect on participants’ connectedness with nature, a paired samples t -test examined differences in implicit connectedness with nature between scores recorded before the hike (pre-test) and those recorded after the hike (post-test). This test revealed that implicit connectedness with nature did not change as a result of participation in the Virtual Hike (pre-test: $M = .58$, $SD = .46$; post-test: $M = .60$, $SD = .36$), $t(31) = -.25$, $p = .81$, $d = -.09$.

Discussion

Participants who completed the Virtual Hike showed no increase in their implicit connectedness with nature as a result of participating in the online hiking experience. This is in line with past research, which suggests that spending time in a built environment does not increase an individual’s connectedness with nature (Schultz and Tabanico 2007). Schultz and Tabanico (2007) found that participants who spent time at a gym, indoor rock climbing, and at the library did not show an increase in their connectedness with nature. While the Virtual Hike is geared toward immersing participants in nature through exploration of nature virtually, these elements are within a built framework and may not have the desired effect on connectedness with nature because of the characteristics surrounding the experience. Another way of

thinking about this is in terms of the focus of participants. In these studies, participants were focused on an experience rather than nature per se. For instance, in Study 2 and 3 the focus of participants was not on nature, but on finding impression stations that were in nature or finding links within the landscape on which to click for more information. In Schultz and Tabanico (2007) the focus was on working out while at the gym, climbing while at the rock climbing gym, reading while at the library, golfing while at the golf range. Thus, as suggested here, what individuals focus on, and especially when in nature, may be key to changing their connectedness with nature.

Similar to Study 2, time in nature or the nature experience may determine its impact on implicit connectedness with nature. In the Virtual Hike, participants only spent approximately 30 min hiking online. Thus, while no immediate increase in connectedness with nature was detected pre- to post-hike, increasing the amount of time participants spend hiking (both in minutes spent virtually hiking and visits to the site) may have more positive impact on connectedness with nature. Future research could explore in greater depth the amount of time needed in environmentally focused experiences to impact connectedness with nature. Findings would be of value to those offering environmental engagement programs, in terms of setting the length of the experience to enhance the probability of intended effects. It also may be that there was a small but statistically undetectable effect in the current study and with the FlexiTwins implicit measure (see Mayer et al. 2009 for a comparison of degrees of effect between virtual and natural setting exposures).

It may be that the Virtual Hike has other desirable outcomes outside the focus of this study. For example, virtual hikers may become familiar with the trails featured in the hike, and as a result seek out an actual experience in nature or one similar to it, and with subsequent benefits on proenvironmental attitudes and behaviors. It also may be that the Virtual Hike results in desirable outcomes even when an outdoor experience does not follow. For example, participating in the hike may stimulate curiosity about the species depicted, thus encouraging additional nature study. Future research could contrast virtual hikers with actual hikers on the same trails and on a variety of possible outcomes (including implicit connectedness with nature). In each case the hikers might be oriented in advance to the types of species that may be found during the experience, and a trail guide in the nature setting might work to mirror the types of information provided in the virtual hike. Using randomized groups would be especially effective in attempting to detect differences in outcomes between a virtual and *in situ* hike.

As noted in Study 2, our range of participants in Study 3 varied widely in age and likely developmental stages and it may be worthwhile for a future inquiry to examine if the virtual hike better serves a particular age demographic in fostering or enhancing connectedness with nature. We did not have adequate numbers of participants within different age groupings to address this question in our current inquiry, nor were we able to include assessments of developmental stages.

General discussion

As shown in Study 1, changes in implicit connectedness with nature differed between entrants and non-entrants in the Creative Arts Contest. However, much remains unknown about which components of an entrants' experience produced this effect. What we do know is that through the use of art specifically focused on nature

and submitted as part of the Creative Arts Contest of the Get to Know program, children increased their implicit connectedness with nature. Song (2008) suggests that by incorporating art into environmental education, ‘children can learn about nature in a fun, stimulating, and hands-on way’ (19) and that it facilitates an increase in connectedness with nature (Song 2012). Incorporating art into environmental education programs may focus participants’ attention on nature in ways that facilitates increases in connectedness with nature and also may have implications for environmental education programs, specifically classroom based programs.

Implicit connectedness with nature did not increase significantly as a result of participation in the Natural Treasure Adventure hike (Study 2) or the Virtual Hike (Study 3). Various types and levels of exposure to nature-related experiences are important to consider in interpreting these non-significant results. For instance, as seen in Study 2 the inclusion of impression stations (built objects) on the hike may have detracted from a focus on nature and worked against the positive effects that spending time in nature might have on connectedness with nature. In Study 3, hiking virtually may not have produced an increase in connectedness with nature because of the lack of time spent hiking in nature. However, creating virtual experiences of the specific hike locations may be of value in other locations where visits to specific hike locations are not possible. Actual nature visits may become less common, thus the impact of virtual nature experiences merits further inquiry (see e.g. Kahn, Severson, and Ruckert 2009). At this point we are unable to definitively conclude that virtual experiences will not influence connectedness with nature. Given evidence that positive effects may occur (Mayer et al. 2009), it would be important to further examine these virtual platforms for their role in enhancing connectedness with nature and other positive emotional outcomes that lead to green behaviors (Hartmann and Apaolaza-Ibanez 2008). For instance, future research could examine if children are able to hike virtually and gain similar benefits to an actual outdoor hike or if hiking virtually prior to hiking in a nature setting results in enhanced outcomes. In addition, other factors may have influenced these findings and more research is needed to parse out the specific factors involved in understanding when connectedness with nature increases and when it does not.

The set of studies has a number of limitations that future research should address. Regarding the Creative Arts Contest, research might provide participation diaries to students or classrooms so as to improve tracking of the forms and degrees of participation in nature-based inspirational experiences. This would represent an additional burden for participants and coordinating teachers, but may be worth the investment to better understand the relationship between outcomes and degree and form of participation. Importantly though, this increased commitment and investment in the activity could be integrated as part of the Get to Know Program itself. That is, it is possible that the additional measurement, which would require participants to document their nature experiences, might make them more aware of such experiences and enhance their impact. Findings from an investigation such as this could help guide recommendations to teachers on the types and nature of experiences that are most important in influencing desired environmental care and increases in implicit (and perhaps even explicit) connectedness with nature.

While our findings suggest the Virtual Hike did not produce desired effects among participants (as might be expected from a 45 min hike along actual trails), we were not able to contrast virtual and onsite experiences. Including control or other comparison groups in futures research is essential in helping determine casual

pathways between different types of hikes or outdoor and virtual experiences and environmentally-relevant outcomes (such as connectedness with nature).

Additional practically-focused research could explore ways to improve on the delivery of Get to Know Program components so as to maximize the likelihood and magnitude of desired outcomes. This is an international program, and there may be better supporting tools to foster connectedness with nature than a map in worksheet format that could be used across a broad range of international locations and these could be developed with the guidance of research findings. In fact, research suggests that creating a direct experience with nature fosters greater environmental knowledge than indirect experiences (Duerden and Witt 2010). Furthermore, increases in environmental knowledge seem to depend not just on direct experience, but on perceived freedom to choose these direct experiences. A recent development of a mobile application by the Get to Know Program allows youth the ability to access information in a game environment while hiking onsite on built trails in Canada and the United States, through an interactive adventure platform for specific trails. However, future research is needed to understand the effect of this new interactive adventure platform.

In conclusion, there are promising approaches to fostering connectedness with nature, such as the Get to Know program. More research needs to be conducted in order to better understand why the Natural Treasure Adventure and Virtual Hike did not produce increases in connectedness with nature in the studies reported here. The findings from such research would be important to agencies seeking to find or develop effective tools for outreach and connecting people with nature. Programs that are successful in connecting people to nature represent valuable tools for fostering environmental care and building a sustainable future. Evaluation of these programs aids our understanding of what is effective in connecting youth or other populations with nature and allows for wise selection of appropriate programs and fine-tuning of program components.

Author's notes

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Notes

1. In this game version, the basic IAT principles are integrated into a colorful, animated computerized platform in which two frogs are shown on lily pads, one on the left and one on the right side of the screen. Stimuli fall from top to bottom of the screen and participants receive points for correctly categorizing the stimuli by choosing the frog that corresponds to the correct category. More points are received for categorizing stimuli quickly and accurately (for example, participants match their own name with the category 'Me' or the category 'Other,' with participants own name being categorized into the 'Other' category being an incorrect response). In addition to animated frogs and falling stimuli, the game provides both visual and auditory feedback for correct and incorrect responses. FlexiTwins provides scores pursuant to an improved scoring algorithm (see Greenwald, Nosek, and Banaji 2003). When using word stimuli, FlexiTwins should only be used with participants who can read (~9 years old and up). Finally, FlexiTwins can be administered across several different platforms (e.g. PC, Internet, PocketPC, iPad) and is available for download at <http://faculty.csusm.edu/schultz/> or from the itunes store to download the app to an iPad.
2. Thirty-eight students from a Southern California school completed both the desktop version and the iPad version of FlexiTwins in order to validate the iPad version. In comparisons of sub-scores of the game (D1 and D2), both versions were internally consistent (iPad, $r = .71$, $p < .01$; desktop, $r = .71$, $p < .01$). The iPad D-scores ($M = .42$, $SD = .44$) were significantly correlated with the desktop version ($M = .61$, $SD = .49$), $r = .47$, $p < .01$. Order of administration was randomized, and no order effects were obtained for either the iPad ($t(36) = 1.31$, $p = .20$) or desktop version ($t(36) = 1.31$, $p = .20$). Finally, the D-scores of the iPad version were significantly correlated with an explicit measure of connectedness with nature (Inclusion of Nature in Self: Schultz 2001, 2002: $M = 4.03$, $SD = 1.13$), $r = .33$, $p < .05$. These results suggest that the iPad version of FlexiTwins provides a usable platform that is both reliable and valid.

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