

ENVIRONMENTAL EDUCATION

RESEARCH BULLETIN

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ABOUT THE RESEARCH BULLETIN

The Environmental Education Research Bulletin is a project of NatureBridge in partnership with Dr. Nicole Ardoin at Stanford University. It is designed to inform NatureBridge educators about recent relevant research, so the emphasis is on field science, stewardship behavior, and residential settings, among other topics. Other environmental educators might also find this bulletin useful, though, again, it does not cover all aspects of environmental education.

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INTRODUCTION

The most talented environmental educators we know are in the field, conducting place-based programs, collaborating with communities, and using hands-on strategies to make the critical link between environmental awareness, skills building, and informed action. Rarely do these committed professionals have time to keep up on the latest research, whose beneficial findings may enhance the effectiveness of environmental education (EE) programming.

To bridge the gap between research and practice, NatureBridge is partnering with Stanford University researchers to create a semiannual EE Research Bulletin. Our goal is to synthesize and summarize recently reported research that may help NatureBridge and environmental educators in other organizations and agencies critically reflect upon and improve their practice.

This second volume includes summaries of articles in the Journal of Environmental Education, Environmental Education Research, Applied Environmental Education and Communications, Journal of Experiential Education, International Journal of Science Education, Visitor Studies, Journal of Interpretation Research, and the Journal of Environmental Psychology. We reviewed all of the articles published in these journals since we produced the Summer 2011 Research Bulletin, and pulled out the articles we thought would be most relevant to NatureBridge educators. Each entry includes a synopsis of the article, a “Bottom Line” summary, and the full citations for those who wish to read the article in its entirety.

In this issue, you’ll find articles related to effective teaching methods, trends in teacher training, evaluation research, and more. In particular, this issue highlights more research on influencing environmental behavior, as this has been a hot topic in the published literature over the past six months. It also appears that new uses of technology and the Internet—including online ranger talks, online communities for people who care about climate change,

smart phones for zoo and aquarium visitors, and video diaries as evaluation tools—have caught the attention of environmental education researchers.

Because we are creating this document for you, we’re eager to hear your feedback. Please let us know if there are additional topics or journals you’d like to see covered or if there’s an alternative format that may be helpful. You can send all suggestions to jmorris@naturebridge.org with a header “EE Research Bulletin.” We’ll take these into account at the beginning of each cycle and try to adapt accordingly. And for another take on these kinds of articles, you may also want to check out the research blog available from the North American Association for Environmental Education (eelinked.naaee.net/n/ee-research).

We wish you all the best in your important efforts to integrate high-quality research into inspiring practice!



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BEHAVIOR



COMPARING GROUPS MOTIVATES BEHAVIOR

Research has shown that comparing people to others in their same group--called intragroup comparisons--can motivate engagement in sustainable behavior. For example, in a recent study, researchers told hotel guests that former occupants of the same room had conserved water by not sending towels to be washed daily. This comparison with guests in the same room served as an intragroup comparison, and it influenced the current occupants' towel use, causing them to also cut back on towel washing.

The research in this article focused on another aspect of social comparison, specifically whether intergroup comparisons, in which individuals compare their group to an outside group, can promote sustainable behavior. The authors explain that research has indicated that when members of one group (called the ingroup) perceive their group as different from another group (called the outgroup), they will "distance themselves from outgroup norms, to enhance their ingroup's distinctiveness relative to the outgroup." The researchers sought to determine whether this dynamic exists with sustainable behavior.

In this study, two experiments were conducted in which university students compared themselves with either a past or future generation and then reported their willingness to perform sustainable behavior. In the first experiment, 55 undergraduate psychology students completed an online survey for course credit. The survey either indicated that it was designed to help researchers understand the opinions of students in 1960 and 2010 or it said the survey would help them understand the opinions of students in 2010 and 2060. Half the students were assigned to each survey, in which they would compare their generation (in 2010) to either the past generation or the future generation. The students were asked to think about the important differences between their generation and the other generation before beginning the survey. They were then given a short passage to read about our current knowledge about climate change. After reading the information, the students completed questions about their willingness to engage in sustainable behaviors in the areas of transportation choices, energy and water conservation, and social advocacy.

The second experiment was much the same, except it added two new dimensions. First, the researchers also asked the students about their beliefs about climate change, in order to understand if the students' beliefs explained their behaviors. The second experiment also added support for environmental policies, and asked students about their support for taxes and regulations to help limit greenhouse gas emissions.

In both experiments, current students who compared themselves to the past generation reported more willingness to perform sustainable behaviors than the students who compared themselves to a future generation. The authors explain, "The comparative context provided a frame of reference for interpreting current students' norms as more sustainable by comparison with a past generation, but less sustainable by comparison with a future generation."

In experiment two, the students who compared themselves to students of the 1960s also reported greater support for taxes and regulations to limit greenhouse gas emissions. And the second experiment also revealed that the group that compared themselves to the past generation held more sustainable beliefs regarding climate change, and that these beliefs fully explained their willingness to participate in social advocacy, and support taxes and regulations. The beliefs partially explained their willingness to conserve energy and water, but they didn't explain their transportation choices. The researchers suggest that other psychological factors are needed to understand energy-conservation and transportation.

In conclusion, the researchers think this study suggests an important strategy for effectively motivating people to engage in more sustainable behaviors. By comparing an ingroup to a less sustainable other group, the ingroup will think of themselves as more sustainable. "Accordingly," the authors explain, "inducing intergroup comparisons that portray the ingroup as more sustainable relative to the outgroups could be useful for promoting sustainable beliefs, values, and behaviors, as they offer opportunities for ingroup members to affirm their distinctiveness from other groups."

THE BOTTOM LINE: When communicating about desired environmental behaviors, portraying the audience's group as more sustainable than other groups can lead the audience to shift their beliefs and intentions to act in ways that affirm their group's identity. In environmental education programs, educators could draw comparisons between their students and other groups to highlight differences where their students are more sustainable. But it's important to note that this study used only people's self-reported intentions to act, so it's not known how the comparisons affect actual behavior. And this study focused only on university students, so further research is needed to confirm the effectiveness of this approach with other audiences.

Ferguson, Mark A., Nyla R. Branscombe, and Katherine J. Reynolds. 2011. The effect of intergroup comparison on willingness to perform sustainable behavior. *Journal of Environmental Psychology* 31(4): 275–281.

OUTDOOR EDUCATION FOSTERS

PERSONAL GROWTH, CONNECTIONS

TO BEHAVIOR LESS CLEAR

It's well established in the literature that outdoor adventure education programs such as those provided by Outward Bound and the National Outdoor Leadership School (NOLS) can help foster personal growth. Specifically, outcomes such as increased self-awareness and self-confidence, leadership development, and increased respect for others have been studied and documented. The authors of this paper argue that many aspects of personal growth overlap with some of the predictors for environmentally responsible behavior (including environmental sensitivity and empowerment), and so personal growth is an important dimension to consider when thinking about the longer-term implications of outdoor education for environmental behavior.

In this paper, the authors use transformative learning theory to examine the role of outdoor adventure education

in fostering personal growth and environmental behavior. They cite researcher Mezirow's definition of transformative learning as "the process by which we transform our taken-for-granted frames of reference . . . to make them more inclusive, discriminating, open, emotionally capable of change, and reflective . . ." The authors explain that this transformation is often preceded by a "disorienting dilemma," which causes a person to undergo a process of critical self-reflection, social interaction, planning for action, and building competence.

To examine participants' experiences and outcomes, the authors interviewed 23 former outdoor adventure program participants, who were aged 15 to 24 years and had participated in a range of programs that lasted from 16 to 78 days. Participants were either interviewed retrospectively, having participated in their program 1 to 5 years before; reflectively, directly after a kayaking course; or were interviewed before and after a course. Most of the participants were selected based on convenience. Some were recruited through Cornell Outdoor Education, suggesting that they have maintained a continued interest in outdoor experiences. Another group was selected from a trip led by one of the paper's authors, and were specifically selected because they were "individuals who had been particularly reflective about their experience during the trip." The authors acknowledge that the participants in their study are not representative of all outdoor education participants, but nevertheless believe that this is an appropriate sample for the qualitative interview methods they employ.

The authors found that, as expected, the participants revealed that the courses they participated in had contributed to personal growth. Four elements emerged as important contributors to personal growth: living in pristine nature, experiencing a different lifestyle, being part of the course community, and dealing with the intensity and challenges of the course. Living in pristine nature seemed to contribute to psychological well being, connection to nature, and awe and inspiration. Participants also described how the process of breaking from "normal life," experiencing a new lifestyle during the course, and

returning home contributed to personal growth through experiencing a different lifestyle. Participants also described how the close-knit, supportive course community supported their growth, and how the challenges of the course led to engagement and empowerment.

According to the authors, many of these important course aspects--including especially breaking from normal routines, living in new social contexts, and course challenges--represent disorienting dilemmas for participants. And the process of learning new skills in order to meet the challenges of the course align with the transformative learning theory principles of building competence and self-confidence. The authors note that, "Courses also integrated other elements of transformative learning including opportunities for self-examination, reflection, social interaction, and mastering challenges."

In terms of changing behaviors, participants largely talked about how the course fostered personal growth, and how some aspects of that growth in turn led to a commitment to conserve nature. For example, participants who develop awe and inspiration for nature and feelings of empowerment could direct those feelings toward more pro-environmental behaviors. But the authors did not report any specific links to behavior changes. They do, however, suggest strategies to link experiences on the course with their behaviors after they return. Some of the strategies they suggest include: creating post-course communities of practice to extend the social learning of the course, relating environmental behaviors learned on the course (such as Leave No Trace practices around camp) to behaviors in "real life," and more approaches such as those offered at NOLS base, which showcases solar panels and composting toilets, and Outward Bound, which includes community service activities on many trips.

In the end, the authors conclude that "Transformative learning theories provide insight into how [outdoor adventure education] might further contribute to the instrumental goals of environmental education while retaining its personal growth outcomes, through connecting on-course experiences to learning, action, and community post-course."

THE BOTTOM LINE: Outdoor adventure education clearly contributes to personal growth in participants. And many aspects of personal growth are associated with pro-environmental behavior, including feelings of connection to nature, empowerment, and self-confidence. Outdoor education programs can do more to link personal growth to behavior change, especially by leveraging the social learning aspects of outdoor education, demonstrating more stewardship behaviors on courses, and making connections between on-course environmental practices and at-home environmental behaviors.

Galaen D'Amato, Laura and Marianne E. Krasny. 2011. Outdoor adventure education: Applying transformative learning theory to understanding instrumental learning and personal growth in environmental education. *The Journal of Environmental Education* 42(4): 237-254.

RESEARCHERS ARGUE FOR POST-VISIT RESOURCES TO CHANGE BEHAVIOR

Human behaviors are at the heart of many of today's most pressing environmental problems. And although formal education can play an important role in helping motivate environmentally friendly behavior, the authors of this paper cite a surprising statistic: "over the course of a lifetime, the average citizen spends only only 3% of [his/her] time in school or formal education experiences." Informal, or "free-choice," learning experiences create the bulk of the opportunity for learning. Among free-choice learning opportunities, wildlife tourism is one that has not yet garnered much focus from the science education community, but that holds tremendous promise as it is a growing industry worldwide. And research suggests that consumers are looking not just for tourism experiences that give them opportunities to view wildlife, but also that promote a conservation ethic.

The authors conclude that wildlife tourism "has the opportunity to play a positive role in helping to solve global

environmental problems by providing environmental education experiences that promote a fundamental change in people's everyday behavior and lifestyle." But, they argue, it's an opportunity that's easily missed in many free-choice learning settings. In this paper, the authors don't report on recent research; instead, the paper reviews the potential of free-choice learning to change behavior, and suggests ways to achieve that potential.

First, the authors explain that while wildlife tourism (and, often, ecotourism in general) offers an exceptional opportunity to reach people with a strong conservation message, it's often a missed opportunity. They cite research from Australia in which researchers recorded tour operators' talks in protected areas for 60 hours, and found just one message encouraging conservation action. In another example from an American zoo, docents were observed sharing simple facts about animals, instead of tying those facts to the zoo's larger conservation messages.

Clearly, in many instances, message delivery needs to be refined if there's any hope of spurring behavioral change. But even when messages are more clear, it's not well known how long the impacts will last. The authors cite past research that has tied free-choice learning experiences to gains in knowledge, attitudes, and behavioral intentions. But, they explain, "Little is known . . . about the impact of such experiences on visitors' adoption of environmentally sustainable practices after they leave the site."

Unfortunately, although many people leave a visit to a zoo or aquarium feeling committed to changing their behaviors for the better, the authors cite several studies that suggest that without reinforcement after the visit, those changes in commitment or planned action fade over time. The authors themselves conducted previous research in Australia that found that immediately following a wildlife tourism experience, visitors' intentions to "do the right thing' for the environment" rose, but those intentions fell back to pre-visit levels within four months. And 93% of visitors failed to take the intended actions after four months.

The authors argue that theories of learning and behavior could help shape tourism experiences that are more likely to lead to lasting behavior changes. They suggest targeting three key areas: pre-visit learning predispositions, on-site experiences, and post-visit reinforcement. In terms of visitors' pre-visit dispositions for learning, the authors argue that every audience is different, and messages must be tailored to the audience. They suggest that "Tourism providers thus need to collect information about their visitors' entering attributes, including their existing knowledge and beliefs, and their motivations regarding their visit, in order to ensure that educational messages are relevant and effective."

A variety of learning and behavior theories can inform on-site learning. The authors particularly emphasize the need to incorporate both cognitive and affective elements in visitors' experiences, fully engaging visitors and causing them to reflect on their experiences. It's also important, they note, to consider both the sociocultural context and the physical environment. For example, this might include ensuring that visitors have opportunities to see animals up close (addressing the physical environment) or that staff are available for questions (sociocultural context).

Finally, the authors explain that while visitors may leave with the best intentions to support the environment, they "need to be supported and encouraged . . . to translate their good intentions into real actions." The authors call for specially designed educational materials, which they refer to as action resources, that reinforce conservation messages, provide examples of desired behaviors, and motivate visitors to take action. They suggest print and web-based learning materials, including social media, that offers a range of suggested actions so that visitors can select the actions appropriate for them. And, in fact, they cite current research that's in press that suggests that this kind of approach has been effective at motivating long-term behavior change.

THE BOTTOM LINE: Visitors often leave free-choice learning experiences, such as visits to zoos or aquariums or other wildlife tourism experiences, intending to improve

their environmental behaviors. But those intentions tend to fade over time. If an institution's goal is to motivate environmental behavior among visitors, this goal needs to be approached explicitly. Messages and tactics must be targeted to the audience. Learning experiences must be designed with behavior change in mind. And visitors need to be supported with follow-up information or action resources after their visit. The resources must be clearly behavior-oriented and offer examples, models, and motivation.

Ballantyne, Roy and Jan Packer. 2011. Using tourism free-choice learning experiences to promote environmentally sustainable behaviour: the role of post-visit 'action resources.' *Environmental Education Research* 17(2): 201-215.

COMMITMENT TO THE

ENVIRONMENT PREDICTS BEHAVIOR

Researchers have looked at many aspects of people's relationships with nature, including factors such as people's feelings of connection with nature, the extent to which they include nature in their conceptions of themselves, their environmental identities, and many others. In this study, the researchers wondered if people's relationships with nature could be similar to people's interpersonal relationships. Specifically, could the researchers build a model of commitment to the environment that's based on previous research that examines commitment in relationships?

According to past work, commitment to a relationship depends on a person's satisfaction with, investments in, and alternatives to a relationship. The more satisfied a person is with what they get from a relationship, the more committed he or she is. Likewise, the more a person has invested in a relationship, in terms of tangible resources (e.g., money) or intangible resources (e.g., time), the more committed they will be to the relationship. Finally, the more alternatives a person sees to a relationship--in other words, the more other ways they think they could

derive the same benefits--the less likely they are to remain committed.

The authors predicted that these same factors might also explain a person's commitment to the environment. They hypothesized that the more investments in the environment (for example, in terms of time and effort spent in helping the natural environment), the greater their satisfaction with the environment (for example, in terms of how much they enjoy spending time in natural areas), and the fewer alternatives to the environment (for example, the perception that there are many other ways a person might enjoy spending their time other than in natural areas), the greater a person's commitment was likely to be. Following that, the authors predicted that the more committed a person was, the more likely he or she would be to sacrifice for the environment and report engaging in pro-environment behaviors.

The authors surveyed nearly 250 undergraduate students who were completing a required introductory psychology course. The survey included a scale to measure a person's commitment, but also included scales to look at other person-environment relationship measures, including a person's inclusion of nature in their conception of himself or herself, environmental identity, connectedness to nature, and ecological worldview. The survey also assessed the students' general ecological behavior and willingness to sacrifice for the environment.

As predicted, the students who reported greater satisfaction with and investments in the environment reported greater commitment to the environment. Alternatives did not turn out to be connected to commitment, and that finding is in line with other research that has applied these measures to non-romantic relationships, such as a person's commitment to friends or sports. Because these are non-exclusive relationships, the presence of alternatives probably is not as important.

Moreover, the researchers found that students with greater commitment to the environment were more likely to report a willingness to sacrifice for the environment and

performance of pro-environment behaviors. This finding was true even when the researchers controlled for other factors such as the respondents' ecological worldview, connectedness to nature, inclusion of nature in the self, and environmental identity.

The researchers think that while this finding has interesting academic implications because it "highlights the underpinnings of commitment," it also has practical applications. They explain,

In the present study, we learned that satisfaction with the environment and investments in the environment are associated with greater commitment. Theoretically, interventions designed to enhance individuals' experiences or perceptions of satisfaction (e.g., experiences in the natural environment that yield benefits to individuals) or investments (e.g., actions individuals take that expend effort to benefit the natural environment) should lead to greater felt commitment to the environment, and therefore greater pro-environmental behavior.

THE BOTTOM LINE: Although this was a small study, the results suggest that people who want to encourage environmental behaviors in the audiences they serve should emphasize the satisfaction people derive from the environment and the investments they've made in the environment. In this research, these two factors contributed to people's commitment to the environment, which in turn made them more likely to engage in pro-environmental behaviors.

Davis, Jody L., Benjamin Le, and Anthony E. Coy. 2011. Building a model of commitment to the natural environment to predict ecological behavior and willingness to sacrifice. *Journal of Environmental Psychology* 31:257-265.

EDUCATION AND TECHNOLOGY

EQUALLY EFFECTIVE AT ACHIEVING

ENVIRONMENTAL BENEFITS

Across Australia, people use wood-burning stoves to heat their homes in winter. It's a relatively inexpensive heating method, but the stoves generate air pollution that causes public health problems. In Perth alone, the health cost of wood smoke pollution was estimated at over \$20 million.

The authors of this paper investigated two main ways to address this environmental problem: education and technology. The educational approach involved a multimedia educational campaign that emphasized the health risks associated with wood smoke and the best ways to minimize it. The technological approach involved the installation of a small device that has been shown to reduce particle emissions in wood stoves by up to 50% in the laboratory. The authors wondered which approach would yield a larger reduction in wood smoke pollution, or whether the two approaches combined would be most effective.

To find out, they worked with one small Australian community. Researchers knocked on the doors of residents in each of the main sections of the city and invited one adult per household to participate if he or she used a wood heater as the main source of heat for the home. Using this method, the researchers recruited 316 participants. On average, the participants were long-term residents of the community, about evenly distributed between males and females, and more than half had completed two or more years of college. The participants were randomly assigned to one of four groups: one group received educational materials, another the technological fix, the third received both education and technology, and a fourth group received neither.

The education approach followed the recommendations of the Community Based Social Marketing approach, which advocates identifying barriers to a desired action and using psychological tools to help overcome them.

Focus groups in the community revealed two main barriers standing between residents and limited wood smoke emissions: lack of knowledge about how to properly operate the wood stove and lack of knowledge about the health effects of wood smoke pollution. The education materials developed to address these barriers included pamphlets with information about health issues and best practices for operating wood stoves to limit pollution. The education materials also included a DVD that provided behavioral modeling of the best way to operate the stove and refrigerator magnets to remind participants of the best way to operate their stove.

The technological approach, called SmartBurn, is a canister that is placed in the woodstove. It improves combustion efficiency, causing the fire to burn hotter and reducing particle emissions. This technological fix is designed to produce pollution reduction without any change in people's behavior. Participants who received the SmartBurn device were instructed in how to place the device in their heaters but did not receive any educational materials. Participants in the "no treatment" group were asked not to use a SmartBurn device, which is commercially available, during the duration of the study.

The researchers trained raters who visited each house in the study and visually inspected the smoke rising from each home. They developed a rating system to gauge the amount of particle emissions from each chimney. The raters visited the homes six times before the treatments were administered, and six times after. Each home was visited by two raters to ensure agreement about the ratings. Because participants were not always home when the raters visited, the researchers averaged the three highest scores for each home before and after the treatments.

Interestingly, the researchers found that the education and technology approaches achieved about the same results, and there didn't seem to be any additional benefit in doing both. It's important to note, though, that the results were modest; the reduction in emissions was not dramatic. Also of interest was the fact that the emission reductions in the education group was almost entirely because of participants'

increased knowledge about how to properly operate their wood stoves. This group had no better understanding the health risks associated with wood smoke pollution as a result of reading the educational materials.

In reflecting on the effect of the education materials, the authors caution that, “Although the education and technology-based interventions produced similar results in the current study, the reader should not assume that the two interventions are interchangeable. There may be other contextual factors that may lead to the preference of one intervention over the other.” They note that this study took place in a university town where residents are relatively well educated and may be more enthusiastic about education materials.

They also wonder whether the relative ineffectiveness of the information related to health risks is because of psychological factors or the quality of the materials. They surmise that it’s possible that this result “simply reinforces previous findings concerning a gap between people’s awareness of environmental threats and their willingness to act on that knowledge.” They also note that previous reviews have “found that environmental education interventions that targeted behavior directly tended to be more effective than interventions that aim to influence behavior by changing cognition.” But, they emphasize that they provided less health information than other types of information, and the design and style of the health information was different. It’s possible that people didn’t pay as much attention to this information because there was less of it and it wasn’t as well-designed, organized, or compelling. They call for further research to better evaluate different types of information and their presentation.

Although the results were modest, the authors think that this research does demonstrate that education and technology are both viable approaches in dealing with environmental issues, such as air pollution.

THE BOTTOM LINE: This study demonstrates that education can be an effective tool to directly improve

environmental conditions such as air quality. In this study, education was just as effective as a common technological fix in reducing air pollution from wood smoke. The educational approach in this study was based on Community Based Social Marketing, where the authors identified barriers to the desired behavior, and developed an education campaign to target the barriers. The campaign included information, behavioral prompts, and behavioral modeling. But the study has significant limitations: it is a small study conducted in one town, where residents are relatively well educated and may have been more open to an educational approach. This underscores the need to know your audience. In other situations, a technological approach might be more appropriate.

Hine, Donald W., Navjot Bhullar, Anthony D.G. Marks, Patricia Kelly, and John G. Scott. 2011. Comparing the effectiveness of education and technology in reducing wood smoke pollution: A field experiment. *Journal of Environmental Psychology* 31:282-288.

FEEDBACK HELPS PEOPLE

CONSERVE WATER

California faces an environmental challenge that many places face: demand for water is rising while supply is falling. Water managers across the country are looking for ways to help their customers cut back on water use. In Sacramento County, the water management agency offers two free water conservation programs to any of its customers who request them.

In the Water Wise House Call (WWHC), a trained water efficiency professional visits a customer’s home, checking appliances, plumbing, irrigation systems, and other areas to look for leaks and optimize for conservation. The technician explains his or her findings, and provides recommendations and any necessary training. The technician also leaves the customer with informational brochures, toilet leak detection tablets, and a watering schedule, and provides the customer with a written report of the findings and recommendations within 10 days of the house call.

The agency's other program, the Data Logger service, offers customers detailed information about their water usage. The agency installs a water meter on the customer's home for one week. The meter reports the water usage at each fixture in the home, including irrigation, appliances, faucets, tubs and showers, and can even detect leaks. The customer receives a detailed report that reveals their patterns of water use, and can show whether high water use is caused by personal habits or leaks. As in the WWHC program, the customer also receives written recommendations, but in neither program do the reports suggest a target amount of water use the customers should aim for as they go forward.

The Sacramento County Water Agency has offered these programs since 2000. The authors of this paper took the opportunity to investigate the impact of the programs, as the agency had data about customer's water use before and after participating in the behavior-modification programs (in the form of the customers' water bills, which indicate their water usage). The agency also had data from all customers who didn't participate, creating a control group.

The researchers randomly selected 50 households that participated in the WWHC program and 50 that participated in the Data Logger program. Each group was matched with a control group of 50 households of similar lot size. The researchers compared the water usage of all the groups for 5 to 6 months before and after participating in the program (the control groups were compared during the same time period). The researcher believed that this longer duration would help control for unusual spikes or dips in water usage that might occur during shorter periods of time, and also would allow for plenty of time for customers to adjust their habits based on the interventions.

What they found was interesting. Both groups who participated in the water conservation programs did, in fact, significantly reduce their water use, and the control groups didn't. The WWHC program was effective for 62% of people participating (the remaining 38% did not decrease their water use), while the Data Logger was effective for 84% of participants. The authors speculate that the Data Logger program may have been successful for more people

because it provided more detailed feedback: "This greater level of detail likely leads to more meaningful, actionable, and effective behavior changes."

But, it's important to note that the people who participated in the two programs had much higher levels of water use than the people in the control group. These programs are voluntary, and appear to attract people who have above-average water use and want to reduce it. After participating in the programs, these customers' water use fell to the average water use of the control groups. The authors suspect that this level of water use represents "a status quo, a water consumption level that is comfortable." Also notably, the customers for whom the programs were not particularly effective had a lower average water use than those who benefited from the program. The authors explain that "these results suggest that water conservation programs may be most effective in reducing water usage for households that use substantially more water than the comfortable status quo." The authors suspect that getting people to move from their comfortable water use level to something lower would probably require "greater motivating forces" than this approach employed.

THE BOTTOM LINE: The approach investigated here--giving people who were motivated to change their behavior specific information about the desired new behavior and feedback to help them gauge their success--did achieve water conservation results. However, it's important to note that reductions were only achieved by people who had abnormally high levels of water use at the outset, and they reduced their use to average levels. The program was not successful at moving people from average water use to greater water conservation. Getting those results would likely require more intensive behavioral interventions, such as creating specific targets, using normative influences, offering incentives, or other techniques that were not part of this study.

Tom, Gail, Gail Tauchus, Jared Williams, and Stephanie Tong. 2011. The role of communicative feedback in successful water conservation programs. *Applied Environmental Education and Communication* 10(2): 80-90.

VIDEO FOSTERS EMOTIONAL CONNECTIONS AND INTENTIONS TO ACT

Psychologists have long known that emotions can be a powerful motivator in moving people to action. What's less clear is how to spark emotional connections with audiences. In the interest of learning how better to create these connections, this paper's author compared the effects of different ways of presenting a message (message modality) and different kinds of messages (framed in terms of gains or losses) on people's emotional response and their intentions to engage in pro-environmental behaviors.

The author, a psychologist, presented 161 university students with messages related to environmental issues. Some students viewed messages presented only with text, while others read the same text and also viewed a short (15 to 20 seconds) video with no audio that complemented the text's theme. The researcher prepared two types of text and video messages. One was framed positively, in terms of gains, while the other type was framed in terms of losses. For example, in two texts related to South American rain forests, the losses-framed message indicated that an extensive amount of forests have been lost, and indicated the implications of this forest loss for contributing to climate change. The gains-framed message, on the other hand, focused on how conservation efforts have been successful in preserving pristine forests, and indicated the associated benefits for limiting climate change. The accompanying video for these texts (shown only to half the students) complemented the text, depicting either the loss of forests or the gain of protected areas.

After presenting the students with the messages, the researcher gave the students a short survey, which included Watson and Clark's Positive and Negative Affect Scale, which is designed to measure emotional responses. The students indicated the degree to which they felt negative emotions such as fear, irritability, guilt, or distress and positive emotions such as determination, enthusiasm, excitement, and interest. The instrument also included a

items assessing their intentions to engage in environmental behaviors, such as the likelihood that they would join an environmental group on campus.

The researcher found that the students who viewed video clips were more likely to report intentions to engage in pro-environmental behaviors than students who did not see the associated short videos. The researcher did not find any correlation between the students' behavioral intentions and the message frame. The researcher had hypothesized that the loss-framed group might experience greater behavioral intentions, based on previous research related to environmental behavior. But, the author notes, "that these findings are not consistent with previous research on message framing and environmental communication may not be surprising." Findings in other fields have yielded mixed results in terms of the effectiveness of losses- or gains-framed messages in spurring behavior. Other fields have, however, consistently tied emotional arousal with behavioral intentions, and this research was in line with those other findings. The author found that there was a reliable relationship between students' emotional arousal and their intentions to act for the environment.

The author acknowledges, though, that there is a difference between behavioral intentions and actual behaviors. And the author also notes that while it's clear that emotional responses lead to intentions to act, it's not clear from this research how to best elicit emotional responses, or what kinds of factors influence a person's emotional response.

THE BOTTOM LINE: This research suggests that helping an audience make an emotional connection to an issue can lead to more positive intentions to engage in pro-environmental behaviors. And it appears from this research that film can enhance a message beyond simple text, leading to more positive behavioral intentions. But the participants in this experiment were no more motivated by messages framed in terms of losses than messages framed in terms of gains. Previous studies have yielded mixed results on the question of the relative effectiveness of gains- and losses-framed messages, and this research did not help clarify that controversy. But

it does reinforce what is probably an instinct among environmental communicators: it's important to make an emotional connection with the audience, and enhancing text with film can be an effective way to do that.

Perrin, Jeffrey L. 2011. Emotional responses to environmental messages and future behavioral intentions. *Applied Environmental Education and Communication* 10(3): 146-157.

ONLINE SOCIAL NETWORK HELPS

USERS LEARN ABOUT CLIMATE

CHANGE AND TAKE ACTION

In the United States, almost three-quarters of teenagers who are active on line participate in social networking sites, and social networking's fastest-growing demographic is users over the age of 25. Social networking sites are an important part of life, and this paper's authors believe that environmental educators could use better use social networking to connect people and spur action. The authors report on how participation in a climate change-related application in Facebook called Hot Dish affected people's knowledge and behaviors related to climate change.

The Hot Dish application--part of a larger research-and-development project to use social media to increase civic engagement around climate change issues--helps people share information and ideas, and provides incentives and recognition for performing pro-climate behaviors. The authors explain,

Key features included the ability to post original story entries; share articles from online sources; browse or read deeply; curate, rank, and comment on posted entries; craft a personal profile; showcase usage statistics and contributions; and participate in Action Team challenges, or activities both online and offline, such as recycling, volunteering for an environmental organization, writing

a letter to the editor, or signing an online petition, that upon completion were showcased within the Hot Dish environment.

This format was inspired by ideas related to free-choice learning, social learning, and behavior change, and the researchers sought to find out how the application affected what users learned and did.

The researchers analyzed user statistics, administered an online survey and online focus groups, and analyzed users' comments during an 8-week launch and promotion period. The survey was administered at the end of the launch period, and asked users about their knowledge and behaviors. The researchers conducted two online focus groups, one with medium-to-high-frequency users and the other with low-frequency users and covered topics such as why users joined, what they learned, and so on. Finally, the researchers also analyzed the comments users posted on the most-discussed stories and analyzed the comments "for evidence of learning and behavior changes."

The researchers found that Hot Dish users were more informed about climate change than the general public. Nevertheless, there were gaps in their understanding. For example, more than a quarter of respondents did not understand the function of the ozone layer, confusing it with the greenhouse effect. The results also indicated that Hot Dish users joined because they wanted to interact with like-minded people, and that they "benefited from the social learning environment of online discussion." Users' comments and choices of articles to share indicate an interest in learning about positive environmental behaviors. Stories on responsible consumerism were the most popular, and comments often reflected participants' interest in doing more to limit their carbon footprint.

Users' reports of environmental behavior support this finding. Users reported their behaviors before and after participating (though they reported all of this on one survey administered after they had participated), and there was a significant difference in the reported behavior. Although

the difference was significant, it was small. The researchers surmise that the users were already engaging in many pro-environmental behaviors before participating in the program. But the authors think that any increase in behavior in such an already-motivated group is an important finding. Users also enjoyed the competitive aspects of the program, either engaging in behaviors in order to earn points, or simply being happy to receive recognition for the things they were already doing. In all, users reported completing over 1,500 challenges during the study period. Although the program created an online community, many of the challenges helped people connect to their local community. Of the completed challenges, 22% were activism in the local community, such as attending a town meeting, volunteering for an environmental group, or writing a letter to the editor of a local paper.

Although this study suggests that Hot Dish users increased knowledge and behaviors as a result of their participation, the authors note that this was a self-selected group with already-high levels of knowledge and civic engagement. In addition, this study involved a relatively small number of participants for a short period of time. Another limitation was the technique of asking about behaviors before and after exposure to Hot Dish in the same survey. It's always difficult to know how accurate self-reported behaviors are, and asking for this information all at once makes these results less reliable. Finally, while the authors believe that the results indicate that online social networks may be an effective tool for spurring knowledge and action, they don't believe that online experiences can replace actual experiences outdoors.

THE BOTTOM LINE: This analysis of an online social networking application in Facebook called Hot Dish suggests that educational social networks are a promising new area for environmental education. This application offered users the chance to share information and ideas about climate change and what we can do about it, and provided recognition and incentives for positive behaviors. The approach embraces the ideas of free-choice learning and social learning theory. But this research was highly descriptive and represents only a first step in

understanding the true impact of this approach to online education through social networks. Much more research is needed to understand how best to use these tools to educate large numbers of people, and, perhaps more importantly, move them to action.

Robelia, Beth A., Christine Greenhow, and Lisa Burton. 2011. Environmental learning in online social networks: Adopting environmentally responsible behaviors. *Environmental Education Research* 17(4): 553-575.

STUDENTS' VALUES, PLACE

ATTACHMENT TIED TO RECYCLING

USED BATTERIES

Researchers studying what motivates people to adopt pro-environmental behaviors have developed and refined many models to explain what motivates people to engage in behaviors that help the environment. While we once thought simply learning about an issue might lead to a change in attitudes, which in turn led to action, we now know that, in fact, behavior is more complex. Many factors play a role in influencing most behaviors.

This research investigated the role of several different factors in motivating a pro-environmental behavior: socio-demographics, environmental knowledge, perceived behavioral control, attitudes toward recycling, neighborhood attachment, and pro-environmental values. The study focused on the recycling behavior of 107 teenage students in a French school that instituted a program in which students could bring used batteries to the school for recycling.

The author administered a short survey collecting information about the students' socio-demographics and values. A week later, the students received a lesson in their sustainable development class about the effect of waste on the environment, which included information about the problems associated with throwing away batteries. The following week, the researcher administered another

survey that measured students' reported recycling behavior, perceived behavioral control, environmental knowledge, neighborhood attachment, and attitudes toward recycling batteries. When the students completed this survey, they were informed of the new program at the school through which they could bring in used batteries for recycling. The students were then asked to indicate on their survey form whether they intended to participate in the program. For the following four months, the researcher tracked the students' recycling behavior by monitoring the students' participation in the program.

During the study period, nearly three-quarters of the students (73%) used the battery recycling program; the remainder (27%) threw away their batteries. This level of use is good, but it should be noted that 28% of the students already were recycling their batteries through other outlets, which means that 55% of the students (those who were already recycling plus those who continued to throw away batteries) showed no change in their recycling behavior.

In terms of the variables that affected recycling behavior, two values--"self-transcendence" and "openness to change"--correlated with recycling behavior. The researcher also found a positive connection between neighborhood attachment, perceived control, and attitude toward battery recycling and recycling behavior.

But socio-demographic variables such as the students' age, gender, or parents' profession were not correlated with recycling behavior. Similarly, self-enhancement values, which normally are associated with not performing pro-environmental behavior, did not have an effect on the reported recycling behavior of these students. (The author notes that it's possible that this reflects a problem with the questions used to measure self-enhancement values instead of a challenge to the findings of previous research. The questions used in this study were originally developed for adults, and may not have resonated with teens.)

THE BOTTOM LINE: This small study confirms other studies that indicate that environmental behavior is complex. In this study, the pro-environmental behavior of

battery recycling was associated with pro-environmental attitudes and values, attachment to the neighborhood, and perceived control. Unlike other studies, the students' behavior in this study did not appear to be related to socio-demographic factors. The take-home message for environmental educators is simply a reminder that behaviors are complex, and motivated by a range of factors, including not just what people know, but also their values, attitudes, place attachments, feelings of control, and other factors.

Rioux, Liliane. 2011. Promoting pro-environmental behaviour: Collection of used batteries by secondary school pupils. *Environmental Education Research* 17(3): 353-373.

STAKEHOLDERS IDENTIFY BARRIERS

TO BEHAVIORS THAT STOP THE

SPREAD OF INVASIVE SPECIES

The spread of invasive species is a critical environmental issue that threatens biodiversity, human health, and, increasingly, economic health. One recent estimate of the impact of invasive species in the United States puts the cost at over \$143 billion annually. Human behaviors contribute to many invasive species introductions and can help species spread faster once introduced, so influencing human behavior has become an important part of the strategy to fight invasives.

But, as the authors of this paper learned, getting people to do the take expert-recommended actions to help stop the spread of invasive species is not easy. The authors focused on four groups, all of which engage in leisure activities with the potential to add to the invasive species problem: hunters, gardeners, fishers, and boaters. The authors conducted focus groups with people who participate in each of these activities to better understand the barriers to behaviors that help prevent the spread of invasive species (for example, behaviors such as washing a boat with bleach

to kill invasive aquatic weeds, washing the mud from car tires after a hunting excursion, or pulling invasive weeds from gardens).

The researchers, located in Oregon, conducted the focus groups--which included between five to eight people each--with local users who they believed had already been exposed to some level of education about invasive species. The researchers explain, "This generated a purposive sample population comprised of the 'low-hanging fruit': members of groups who would most likely change behaviors because they are already aware of the problems associated with invasive species." The focus groups centered around a set of semi-structured questions that were the same for all four user groups.

In analyzing the results of the discussions, the researchers focused on three key areas: participants' attitudes (which they defined as "whether or not a person perceives that the behavior will effectively produce a desired outcome"), subjective norms ("perceptions of what others think or do regarding the desired preventive behavior"), and behavioral control beliefs ("perceived levels of self-efficacy to perform a behavior," or in other words, whether people feel capable of performing the behavior).

Participants in all four groups shared two key attitudes regarding the preventative behaviors. First, they questioned whether many of the preventative measures might do more harm than good. For example, they questioned whether using herbicides to kill invasive weeds might harm beneficial plants. Likewise, they questioned the use of bleach to clean boats, when the bleach could easily enter the waterway and harm the ecosystem. Second, the participants expressed a feeling that their efforts might be futile in the face of much larger environmental changes such as global warming, globalization, land use changes, pollution, and other large-scale changes over which they had little control.

In terms of subjective norms, participants in all four groups expressed a feeling that institutions were not doing all they could to stop the spread of invasive species, adding to their

feelings that their individual actions were not likely to be effective. The groups also all shared an impression that the general public is not interested in or knowledgeable about the issue. And since it takes just one species introduction to create a larger invasion, participants felt that the actions of many knowledgeable people could easily be undone by one or a few people who don't know about the issue.

Finally, the stakeholder groups identified two key behavioral control beliefs. First, they felt frustrated by a lack of clear, actionable information about what to do. Many participants felt they were not able to properly identify invasive species, or were confused by overly general behavioral requests, such as the request to "clean your boat." And when they did understand what to do, many felt that the requested behaviors were too difficult to perform. One boater explained, "One of my boats is 22 feet long and has several motors on it and the thought of cleaning the whole thing down with bleach . . . it is not very practical."

Although this research was conducted with a small number of participants who were not randomly selected and who were relatively homogeneous in their socioeconomic backgrounds, the research does shed light on challenges faced by managers fighting the spread of invasive species. The results indicate the need for clear, specific information about what to do to help stop the spread of invasives. People need to feel more confident in their ability to identify invasives, and reassurance that their actions will make a difference. Working with user groups such as those identified in this study can help create peer networks that reinforce social norms that support engaging in the preventative behaviors. And government institutions may have to do more to demonstrate their own commitment to the problem.

THE BOTTOM LINE: Although this was a small study of a narrow group of users, it reinforces the need for clear, practical advice about how to effectively perform a behavior. Research has shown that a lack of this kind of action knowledge can be a barrier to adopting a behavior. This research also serves as a reminder of the importance

of making environmental problems feel manageable. Numerous study participants felt overwhelmed by the problem of invasive species, and skeptical that their actions would make a difference. This is a challenge common to many environmental issues, and this research underscores the need to be clear about how people's actions will help. People need clear and specific information about what to do, the request must be reasonable, and they need to know that if they do it, it will make a difference.

Prinbeck, Gwenn, Denise Lach, and Samuel Chan. 2011. Exploring stakeholders' attitudes and beliefs regarding behaviors that prevent the spread of invasive species. *Environmental Education Research* 17(3): 341-352.



EVALUATION

EVALUABILITY ASSESSMENT GAUGES

PROGRAM'S READINESS FOR EVALUATION

Hoping to generate more opportunities for underserved youth to spend time in the outdoors, the U.S. Forest Service created the More Kids in the Woods (MKIW) grant program. During its first funding cycle, 2007-2008, the initiative funded 26 programs in 17 states with awards ranging from \$27,300 to \$165,000. The programs were selected based on the extent to which they were likely to engage partners, reach underserved youth, use innovative or proven techniques, develop recreational skills, improve environmental literacy, involve children in stewardship activities, be sustainable over the long term, and evaluate results.

Rather than attempting a full evaluation of this complex grant program (evaluations of grant programs are infrequently published), the authors instead conducted an evaluability assessment. The authors explain that "Evaluability assessment is an analytical, diagnostic pre-evaluation activity intended to (1) determine a program's evaluability (i.e., readiness for evaluation) and (2) obtain insight into what type of evaluation will be useful to decision makers." According to the authors, programs are not ready for a full evaluation when they lack clear objectives or if the objectives far exceed the plausible outcomes of the program activities, are not implemented as intended, or have not taken into account stakeholders' interests in the evaluation. Evaluability assessments can be helpful in determining if programs are ready for evaluation and in shaping an evaluation that will meet stakeholders' needs. The authors think that this approach should be used more widely, and hope that this paper will serve as a model for how to do it.

The authors first created a logic model for the MKIW initiative based on a review of the funded project proposals. They then used the logic model to develop a questionnaire that was sent to the project leaders for each of the 26 funded projects. The survey contained both closed- and open-ended questions and gauged the funded programs' objectives, implementation, perceived success, and interest in evaluation. The response rate was 73%.

Responses to the surveys indicated that most of the projects were implemented as planned. Most of the programs reported successfully

employing partnerships, reaching their target audience, and providing opportunities for youth to spend time in natural areas. Most reported that they thought their participants were satisfied with their experience. Most believed that the programs had an effect on participants' environmental behaviors, but most based this belief on assumptions about the outcomes of project activities (for example, program planners/implementers believed that participants who spent time in remote wilderness areas would have a greater respect for nature). Although most (87%) of the program leaders could point to evaluation data supporting participant numbers and satisfaction, few (13%) had evaluation results supporting participant outcomes. And although most of the respondents indicated they were interested in evaluation, most also indicated limited expertise in and resources for evaluation.

Based in the results of the evaluability assessment, the authors conclude that the MKIW program is ready for a full evaluation because it has clear objectives, the projects are being implemented as planned, the program has plausible benefits, and project leaders are interested in evaluation. And the full evaluation can be informed by this initial assessment. For example, the authors note that an evaluation of the programs' impacts on participants' knowledge and attitudes would be appropriate. They are more skeptical, however, of the benefits of evaluating changes in behavior, as previous research suggests that programs must deliberately focus on behavior change, with a longer-term focus and a basis in behavior-change theory, to be effective. The programs assessed in this research did not meet these rigorous criteria for being likely to affect behavior.

The authors note that few evaluations have been conducted of the overall impact of grant programs (rather than each individual project funded under the grant program), and that this assessment "suggests that grant programs can make significant contributions to environmental education through the partnerships they foster." The authors also hope this research spurs more environmental educators to use this approach, even if it may seem like more work. "We recognize that

evaluability assessments may be perceived as yet another layer of evaluation," they explain, "but . . . we believe that its benefits outweigh costs."

THE BOTTOM LINE: Evaluability assessments can be a helpful tool in determining whether a program is ripe for a full evaluation. Such an assessment can reveal if the program's objectives are clear and reasonable, if they're being implemented as planned, and if the stakeholders' interests are accounted for. If the assessment reveals that these criteria are met, the evaluability assessment can also point to specific areas for investigation in the full evaluation. This kind of assessment isn't necessary in every program evaluation, but it can be appropriate and helpful in certain situations.

Zint, Michaela T., Beth A. Covitt, and Patrick F. Dowd. 2011. Insights from an evaluability assessment of the U.S. Forest Service More Kids in the Woods initiative. *The Journal of Environmental Education* 42(4): 255-271.

SCALE MEASURES CHILDREN'S

ENVIRONMENTAL CONCERNS

The Environmental Motives Scale (EMS) is a research instrument that has been widely used to examine adults' environmental concern. The scale is based on the Value-Belief-Norm model, which indicates that a person's concerns about environmental issues are determined by their values and beliefs, and specifically by the relative importance he or she places on him or herself (called an egoistic value), other people (altruistic values), or nature (biospheric values). The researchers call this a three-factor structure (with the the three key factors being egoistic, altruistic, and biospheric values), and it's been widely tested and used.

This study aimed to find out if the EMS could be used with children in the same way it's used with adults. The authors made small adjustments to the standard EMS questionnaire that they thought would make it more accessible to children. Specifically, the authors explain,

“the measure was worded more concretely and focused on a specific environmental problem (pollution), rather than the abstract wording used in the previous versions with adults (harming nature).” The survey contained brief demographic questions, the modified EMS, a question that measured the child’s feelings of connectedness to nature (the question was presented graphically with a set of circles that overlapped to varying degrees, with the highest degree of overlap indicating the greatest connection to nature), and a question that measured the child’s concern about environmental issues.

The researchers administered the survey online to 305 students between the ages of 9 and 18 in a public school district in Escondido, California. And they found that the survey worked. The authors even retested the children a year later to check for consistency in the results over time. The authors point out that, “Our results here are noteworthy in that very few studies of environmental attitudes include test-retest analyses of one-year. Most studies only span a few days or weeks in their analyses of test-retest.”

But the authors did have to remove two of the four questions related to the altruistic factor, which could prove problematic over the long term. So they did a second study with two revised questions to measure altruism. The second study was carried out in much the same way, with 220 students of about the same age (10 to 18) and demographic mix in the same school district.

This time, the revised scale worked well, and they believe that the results support the idea that in children, as in adults, concern about environmental problems is rooted in values and the relative importance children place on themselves, other people, and nature. But the authors note that for younger children, the results were stronger for questions that contained words that were specific (for example, “tree,” “plant,” or “me”) than they were for more abstract words (such as “my future,” or “others”). The researchers suggest that if the scale is to be used with younger kids, more concrete language might work better. They also note that while this child-friendly test version

of the scale used “pollution” as a concrete example of an environmental problem, anyone using the scale in the future could substitute another environmental issue or problem to make the scale relevant to their program.

With these tweaks for specific audiences, the authors think this scale “provides a useful tool for educational programs, interventions, and developmental research focused on environmental attitudes.” Specifically, they suggest the children’s EMS can be used in an environmental education program “to understand the impact of the program and changes in environmental concern among children participating in the program.”

THE BOTTOM LINE: The Environmental Motives Scale (EMS) has been modified slightly for use with children, and this research suggests it’s a reliable, valid tool that’s ready to use with kids ages 10 to 18. The scale can be used in evaluations of environmental education programs to help gauge how the programs affect children’s environmental concerns. The scale should be modified with more concrete language for younger kids, and the environmental problem named in the scale can be swapped for a problem or issue that reflects the content of the program being evaluated to make it more relevant.

Bruni, Coral M., Randie C. Chance, P. Wesley Schultz. 2011. Measuring values-based environmental concerns in children: An environmental motives scale. *The Journal of Environmental Education* 43(1): 1-15.

VIDEO DIARIES HELP EVALUATE

STUDENT LEARNING

The UK’s University of Gloucestershire has a partnership with Uganda’s National Teacher’s College, Kaliro, which is located in an isolated, rural area of Uganda. As a component of the partnership, the University of Gloucestershire sends students on annual 17-day field visits to Uganda. To justify the program’s expense, risks, and even its environmental impacts, organizers of the field course wanted to evaluate

the program's effectiveness, particularly with respect to what the British students learned about sustainability.

The researchers were frustrated that during conversations in the field, "students made deeply personal verbal comments on their learning, the development of their world view and how they felt themselves transformed by their experiences." But, when asked to complete evaluation forms, "students tended to respond with very mundane comments about the organisation, transport arrangements, food, etc. and did not focus to any great extent on their learning, even when asked directly to do so."

With the hope of getting more authentic, personal responses that could better gauge the nature of students' learning, the authors offered students the opportunity to record video diaries. They point to previous research that indicates that video diaries can encourage self-reflection and produce particularly rich data that can even surpass the quality of interview data. The medium can also help people with poor writing skills to express their thoughts, and can even allow experienced writers to expound on complex ideas because the format is less structured. The researchers do note, however, that drawbacks to the approach include the facts that researchers cannot ask follow-up questions to further explore ideas, and that, in some ways, video diaries can be "self-conscious performances in front of the camera."

Students from two field classes (2006 and 2007) were offered the opportunity to record the diaries. Participation was voluntary, and the students could edit the content of the tapes before giving them to the researchers. Although the researchers were most interested in what the students were learning about sustainability and sustainable development, they instead asked students to talk about what they were learning about Uganda, the UK, their subject area, the other field class students, and themselves. The researchers thought that talking about these aspects of the program would come more naturally to students than talking about sustainability, but that their learning about sustainability might be gauged by their responses to these other prompts.

Because of both technical issues and the very close quarters of the groups, only a small number of students completed the task. But, the authors think that "Despite the small number of participants, the video diaries yielded very rich data about the student experience during the field class." As they reviewed the diaries, the researchers found thoughtful commentary, much of which was related to sustainability. In general, the researchers found females to be less self-conscious than males in making the diaries. Some students made recordings with one or more friends, which seemed to work well for female-female and male-female pairs. "It was markedly unsuccessful for male-male pairs," though.

As the researchers analyzed the tapes, they uncovered ample evidence of learning related to sustainability, whether or not the students were aware of their own learning or the role of the field program. The authors conclude that the video diary approach was more effective than written evaluation tools. And the authors think it's an approach that others should consider: "That the method worked so well in the highly inconvenient circumstances of rural Africa bodes well for its transferability to a range of other contexts as a tool to investigate learning."

THE BOTTOM LINE: Video diaries could be a useful evaluation tool, especially if more traditional paper-based methods such as surveys are ineffective at encouraging participants to engage in reflection. This research suggests that video diaries could be particularly appropriate for subject matter that it is complex and difficult for people to explain in writing or in short verbal answers, or when evaluators want to document potential changes over time. This paper did not, however, offer specific guidance about how to analyze video diary data or directly compare video data with other evaluation tools.

Roberts, Jane. 2011. Video diaries: a tool to investigate sustainability-related learning in threshold spaces. *Environmental Education Research* 17(5): 675-688.

A REVIEW OF ZOO AND AQUARIUM

EVALUATION LITERATURE

Worldwide, zoos and aquariums reach an estimated 620 million people each year. In the United States alone, the Association of Zoos and Aquariums (AZA, the organization that accredits 223 North American zoos and aquariums) estimates that these institutions reach 175 million people a year. The authors of this paper reviewed the existing evaluation literature related to zoo and aquarium visits to paint a picture of zoo and aquarium visitors and the effectiveness of education they receive during their visits.

AZA research indicates that women and mothers between the ages of 25 and 35 are the most frequent zoo visitors, and the average household income of zoo visitors is similar to the average U.S. household income. Although these are the most common demographics, zoos nevertheless serve a wide diversity of people from a range of ages, races, and socioeconomic backgrounds. In fact, the authors note that “zoo and aquarium visitors are diverse compared with those served by other environmental education institutions.”

Research also reveals that two-thirds of adults who visit zoos come with a child, making educational programs for these intergenerational audiences a high priority at many zoos. And educating these audiences requires that program developers and evaluators keep this in mind: zoo and aquarium visitors are knowledgeable about wildlife and conservation and may have more positive attitudes toward conservation than the general public. Program developers should also consider that visitors’ motivations for coming to the zoo range widely across a spectrum of “purely recreational to primarily educational.”

When visitors engage in learning at zoos and aquariums, they largely find what researchers call “free-choice” learning opportunities. That means that the visitors are free to choose when, where, and how they learn. Of course, the centerpiece of zoo and aquarium education is live animals. The authors’ literature review discusses how having live animals on display can give visitors the chance to “make

personal connections with wildlife, which may promote emotional growth as well as curiosity and learning.”

The researchers’ literature review revealed a variety of motivations for conducting evaluations: improving programs, demonstrating successes for stakeholders, leveraging funds, and even peer pressure from other institutions. When evaluations are conducted, they most commonly focus on how education programs affect knowledge, attitudes, and behaviors of visitors. The authors also point out that actual conservation outcomes are increasingly of interest to evaluators. That is, institutions are starting to look more closely at how their programs contribute to their ultimate mission of improving the conservation status of wildlife or their habitats.

“Despite many reasons to support evaluation,” the authors find that “many institutions are not conducting social research.” Personnel are most likely to name a shortage of time, money, and expertise as reasons to skip evaluations. Other researchers have found that the possibility of poor results, and the daunting nature of a comprehensive evaluation as further barriers. The authors conclude that zoos and aquariums can do more to evaluate their education programs: “Although evaluation efforts are growing in number, recent research suggests that they are still not common practice for many institutions.” Moving forward, the field should work toward removing the barriers of time, money, and expertise. Doing that, the authors contend, “will lead to programs that are more adept at affecting visitors in ways that render positive outcomes for wildlife, habitats, and people--for now and for generations to come.”

THE BOTTOM LINE: Zoos and aquariums are a key venue for environmental education in the United States and abroad. Evaluation studies in these settings are important for crafting more effective education programs, but many institutions are not taking advantage of the potential of evaluations for program improvement. Time, money, and expertise are the most common barriers to evaluations in these settings, and, going forward, more effort needs to be made to find creative ways to remove these common barriers to evaluation.

Khalil, Kathayoon and Nicole Ardoin. 2011. Programmatic evaluation in Association of Zoos and Aquariums-Accredited Zoos and Aquariums: A literature review. *Applied Environmental Education and Communication* 10(3): 168-177.

TEENS' PERSONALITY NOT A MAJOR INFLUENCE ON THEIR ENVIRONMENTAL WORLDVIEW

In evaluating the effectiveness of EE programs, many researchers turn to the New Ecological Paradigm (NEP) scale. This validated scale measures a person's environmental worldview, largely by juxtaposing a person's anthropocentric (people exist separate from and over nature) and ecocentric (people are part of nature) beliefs to gauge their overall worldview. The scale has been revised for use with children; it is a well-accepted and often-used tool in the literature.

But when using the NEP, it's important to control for outside factors that can also explain differences in worldview. Socio-demographic factors, such as a person's income, age, education, or others, can influence the results, for example. In this study, the authors question whether personality is another variable for which researchers should control in studying adolescents' ecological worldviews. After all, they note, previous research indicates that people whose personality reflects an internal locus of control are more likely to take pro-environmental action. (People with an internal locus of control believe that they are responsible for their own success or failure.) Other research indicates that people who are self controlled, organized, and goal oriented are more likely to engage in pro-environmental behaviors. Maybe personality is an important aspect that should be considered in evaluating education programs for their ability to shift a person's world view. The authors explain, "Such a relationship could make some respondents either more or less susceptible to environmental education, meaning that changes observed in their environmental

worldview could represent personality traits rather than a real shift in the subject's ecological worldview."

The authors used a small-scale, exploratory study to investigate this relationship. The researchers compared the personalities of 959 Flemish teens between the ages of 14 and 19 to their ecological worldviews. They used what they believe is a more holistic approach to studying personality than the more discreet personality aspects studied in other research (such as locus of control). The researchers assessed the students' personalities using the Big Five approach, which is a widely used approach that has been modified for use with children and divides personalities into five domains: extraversion, benevolence, conscientiousness, emotional stability, and imagination.

Their results confirmed earlier research that girls tend to hold a more pro-environmental worldview than boys. Controlling for gender is common practice because of this known relationship. But the researchers did not find any need to control for personality traits. Although they did find some correlations (adolescents who are well-organized and goal-oriented were more likely to be ecocentric, while teens who are selfish, quickly irritated, and dominant hold a less ecocentric view), the correlations were small and the patterns were not deterministic.

This finding is important for two reasons: first, it indicates that evaluators using the NEP to assess the impact of EE programs on adolescents' environmental worldview need not control for personality traits. Second, and perhaps more importantly, the authors explain, "these results indicate that worldviews are not stable or innate characteristics within individuals, but can be influenced by interactions between the individual and his or her context." In other words, a teen's worldview is not predetermined by his or her personality; EE programs could help shift a teen's worldview.

THE BOTTOM LINE: If you're using the New Ecological Paradigm (NEP) scale to evaluate the effect of an education program on adolescents' environmental worldview, it's not necessary to control for personality

traits. Previous research suggests that certain aspects of personality can influence a person's environmental attitudes and behaviors, but this research did not find strong or deterministic correlations between personality and worldview. That's good news, because it suggests that a teen's environmental worldview is not determined by his or her personality, but instead can be influenced by, among many other things, environmental education.

Boeve-de Pauw, Jelle, Vincent Donche, and Peter Van Petegem. 2011. Adolescents' environmental worldview and personality: An explorative study. *Journal of Environmental Psychology* 31:109-117.

TEACHING METHODS

PLANTING TREES IMPROVES KNOWLEDGE

OF AND ATTITUDES ABOUT PLANTS

According to at least one expert, many students today suffer from what has been termed “plant blindness,” or an inability to notice plants or recognize their ecological and aesthetic importance. In some ways this blindness might also extend to the outdoor education community, because the authors of this paper note that most research focused on outdoor education does not measure the effect of programs on students’ perceptions of and attitudes toward plants.

So the authors of this study investigated plants specifically. Because research reveals that traditional classroom techniques such as lectures and memorization often result in negative attitudes toward science, the authors asked whether an outdoor education program focused on trees could help relieve “plant blindness” and encourage more interest in biology. In particular, the authors considered whether the outdoor education program affected students’ knowledge of and attitudes toward plants, and whether having a garden would influence students’ attitudes toward plants. The researchers also investigated the role of students’ gender on their attitudes and knowledge of plants, and examined whether participation in an outdoor education program could boost students’ interest in biology as a school subject.

The researchers worked with fifth graders from an urban school in Slovakia. The experimental group, which consisted of 17 students, planted trees in a meadow near the school and participated in several non-formal botany lessons and outdoor activities related to plant identification. Another 17 students were part of a control group that was allowed to visit the meadow and play sports, but did not receive the corresponding botany instruction while in the field. Using assessments given two days before the experience, three days after the experience, and again three months later, the researchers were able to look for changes in the students’ knowledge and attitudes toward trees and plants.

The researchers found that the outdoor education program positively influenced students’ attitudes toward plants. There were also significant increases in knowledge of plants, even three months after completing the program. Having a garden at home proved to have



no association with better baseline knowledge of plants. Females were found to capture more knowledge of plants than males, although attitudes increased similarly across both genders. And, the study's findings suggest that the outdoor program made biology a more attractive school subject. The authors conclude that "Outdoor programs can therefore play a promising role in improving 'plant blindness' and building more positive attitudes towards biology in general."

THE BOTTOM LINE: Although this project had a very small sample size, the experimental design and results indicate that outdoor education programs are important tools to supplement traditional classroom education. These programs do not have to be cost-prohibitive--even taking students outside to learn about plants in the schoolyard can positively affect students' attitudes toward and knowledge of science.

Fančovičová, J. and P. Prokop 2011. Plants have a chance: Outdoor educational programmes alter students' knowledge and attitudes toward plants. *Environmental Education Research* 17(4): 537-551.

VIDEO PODCASTS ENHANCE

COLLEGE COURSE

Video podcasts seem to hold immense potential for engaging students in ways that more traditional media can't. Especially in the context of environmental education, with so much content related to exotic ecosystems or hard-to-reach field sites, video podcasts could bring students into the field virtually. The authors of this paper sought to clarify some of the perceived benefits of video podcasts among university students in Britain. The researchers examined student engagement with the technology, students' perceived value of the podcasts, and actual student learning with and without the podcasts in an undergraduate course in Biogeography and Conservation.

The course lecturer prepared six video podcasts that covered course material related to two ecosystems: hot

deserts and tropical rainforests. Three 15- to 20-minute podcasts were developed for each ecosystem and included material shot digitally in the field. The students could access the podcasts online from home at any time, and the students also were offered built-in course time to access the podcasts on campus to ensure that the students would not consider the podcasts to be optional, but rather recognized as an integral element of the course.

Following the course sessions supported by the podcasts, the authors administered questionnaires and conducted focus groups, and when the course concluded, the authors analyzed the results of the course's final exam. In general, the students responded positively to the podcasts. The students thought the visual presentation helped them better understand the material, added variety to the course, and was useful as a tool to help review material at the end of the course. The students didn't think the podcasts could replace lectures, but instead viewed them as helpful additional resources.

The podcasts did not seem to affect students' scores on the final exam, however. The authors compared the average grades for the exam questions related to the podcast content in a previous year, when the podcasts were not available, to the scores on the same questions in the year when the students viewed the podcasts. There was no significant difference in the student scores with and without the podcasts.

The authors concluded that while a key benefit of the podcasts is their flexibility, allowing students to review the content at any time at home, a better way to use the podcasts is within the context of the course. The authors note that the students "perceived the primary strength of the podcasts to be helping them remember facts, as opposed to facilitating deeper understanding of processes." Making this technology more useful in building deeper knowledge requires the social context of the classroom: "Students and teachers still need to work together in a social constructivist mode."

Based on their results, in subsequent courses, the authors integrated the podcasts into group seminars, using the

podcasts to spur dialogue. The seminar leader's goal was to move the students from the realm of factual information to higher-order comprehension, application, and analysis with the technology serving as a starting point.

THE BOTTOM LINE: Video podcasts can bring faraway or hard-to-reach ecosystems to life for students. They can also be helpful study tools, because students can access the podcasts at any time to review key information. But this research indicates that the technology does not necessarily improve student performance. The responsibility remains with the instructor to use the technology effectively within the context of the course, leveraging the podcasts to spur interest so that deeper understanding can occur through discussion and reflection in the social context of the classroom.

Hill, Jennifer L. and Amanda Nelson. 2011. New technology, new pedagogy? Employing video podcasts in learning and teaching about exotic ecosystems. *Environmental Education Research* 17(3): 398-408.

PROGRAM EDUCATES DALLAS

STUDENTS ABOUT THEIR WATERSHED

In urban environments, many people can become disconnected from the natural resources on which they depend. That's especially true when it comes to water, which spills effortlessly from faucets in homes and businesses every day, whether the actual water supply is abundant or scarce. This paper's authors aimed to bring more awareness of the watershed to Dallas-area residents between 2006 and 2010.

The authors began with a telephone survey of 1,000 adults who live in the Upper Trinity River Watershed, which comprises 14 counties—including Dallas County with a population of over 2.3 million—in North Central Texas. The survey collected demographic information and gauged residents' knowledge of the watershed.

In general, the results indicated that citizens were not very knowledgeable about their water supply. Less than 8% of respondents were aware that they live in a watershed. Respondents with lower incomes were less likely to know about the watershed than those with higher incomes. Forty-five percent did not know where their water comes from, with Hispanics and African Americans being much less likely than others to know this fact. Lower levels of education and income were also associated with less knowledge of the area's water source. A similar pattern emerged with respect to knowledge about where water goes when it leaves the home. On the other hand, a majority of survey respondents (77.7%) were concerned about the adequacy of their water supply.

To help address the general lack of knowledge about the watershed, the authors designed educational materials for residents. They decided to target 5- to 10-year-old children because of research suggesting that information and behaviors learned at early ages can lead to long-term pro-environmental behaviors. The authors worked with elementary and middle school teachers to develop classroom activities aligned with national and state science standards and that focus on the area's urban watershed issues, and they hired certified elementary and middle school teachers (who were in college working toward graduate degrees in environmental science) to teach the 45 to 50 minute lessons.

All of the activities included a water conservation theme. The kindergarten activity ("Drip! Drop! Water Does Not Stop!") used models to show that there is a limited amount of available water, and included a discussion of how to help conserve water. Students were sent home with a cup and a note to parents explaining that the kids could show how they save water by brushing their teeth with only the water in the cup. In first grade, the activity "Here I Go 'Round My Watershed" used mathematics skills to teach students about the water cycle and the limited amount of available fresh water. The students took home a water cycle bracelet that provided visual and tactile reminders of the water cycle. In second grade, with "Now You See It—Now You Don't," students focused on what happens to water when

it leaves the home. They simulated the water treatment process, experimented with different filtration materials, and took home a “Water-Saving Guide” worksheet. Third graders experienced “Name That Surface Water,” in which they created model watersheds and took home a “Personal Water Use Survey.” The students were asked to document their water use, take a water-saving action, and then complete the survey again and graph the results of their conservation efforts. In fourth grade, with the “H2O Is Underground, Too!” activity, students created models of an aquifer to learn about underground water storage, and what happens if the resource is overused. Finally, in the fifth grade “What-a-Shed” activity, students were divided into two families. One family simulated the water use of a typical American family while the other demonstrated water-saving behaviors. The aim of the activity was to demonstrate that the typical behaviors result in double the water use of a more conservation-minded family.

All of the students also had the opportunity to commit to specific water-conservation behaviors at the conclusion of their activities, based on research that specific commitments are more likely to lead to actual behavior changes.

Results of teacher evaluations indicate that the program was well received. Teachers were asked to evaluate both the lesson and the presenter. The average overall program score was 9.6, based on a scale of 1 to 10. Evaluations did not examine changes in the students’ knowledge or behavior (though the authors note that 94% of the students committed to turn off the water when brushing their teeth). Although the authors acknowledge the need for more evaluation, they think this is a program that can be replicated in a variety of communities.

THE BOTTOM LINE: This Dallas-area water-education program is designed for elementary school students, with separate activities for each grade level. The activities are hands-on, age-appropriate, and action-oriented. The activities conclude with asking the students to make a specific behavioral commitment, which research suggests is an effective strategy for spurring action. Although teachers rate the program well, the effectiveness of the

activities in changing knowledge and behavior has not been tested. And, interestingly, though the research that informed the development of the program identifies racial and socioeconomic disparities in watershed knowledge, this curriculum does not address that issue.

Thompson, Ruthanne “Rudi,” Alice Coe, Irene Klaverr, and Kenneth Dickson. 2011. Design and implementation of a research-informed water conservation education program. *Applied Environmental Education and Communication* 10(2): 91-104.

SOME ENVIRONMENTAL EDUCATION

PROGRAMS INCREASE

CONNECTIONS TO NATURE

Much recent political will in the United States has been directed toward increasing Americans’ experience in nature – think, for example, of President Obama’s “America’s Great Outdoors Initiative.” Two of the assumptions behind such initiatives are that increased exposure to nature will lead to a feeling of connection to nature, and that the connection will in turn lead to conservation-oriented attitudes and behaviors. This study investigates the first assumption: does participation in EE programs increase children’s connectedness to nature?

The authors studied seven EE programs run by the U.S. Fish and Wildlife Service in different parts of the United States. The programs were selected for maximum diversity and difference in participant age, program type, and program duration, with the goal of making the results widely relevant. The authors conducted pre- and post-experience surveys with two groups of students at each site: one group of students who participated in the EE program, and a second control group of students at the same school who did not participate in the EE program.

The authors used two sets of questions to measure connectedness to nature. One set included 16 questions that had been used and refined in a variety of contexts

by other researchers; the second set included 11 questions developed for this study. To assess whether the EE programs affected connectedness to nature, the authors compared responses of students in the groups that had attended the EE programs with those who had not attended; they used the pre-test data to account for any differences in students' initial levels of connectedness to nature.

The authors found no differences in 'connectedness to nature' as measured by the pre-existing group of questions. Using the group of questions created for this study, the authors found modest differences in two of the seven programs – they found that students' connectedness to nature increased following the EE experience. The two programs for which degrees of connectedness changed shared two characteristics: participants were the same age (third and fourth graders), and the programs both had a "time-frame of sufficient duration" (e.g., a week-long day camp).

The authors point out numerous limitations of this work (e.g., the fact that the EE experiences weren't randomly assigned, so the groups who attended the programs weren't necessarily equal in all other respects to those who did not), and so greatly caution against drawing solid conclusions from their results. They do, however, suggest that two factors may be critical for the ability of EE programs to foster connectedness to nature: time (duration) and age.

That time (program duration) seems to be an important factor is supported by both the literature and case-based analysis of this study's results. Literature suggests that change in connectedness to nature "requires long-term or repeated experience;" this study's results support that claim. The age of students also may be important. Literature suggests that early exposure to nature, in particular time spent in nature before the age of 11, is especially important. The two programs that exhibited changes were those with the youngest of all study participants; students in these two programs were in third and fourth grade; other study participants were in grades 5 through 12.

THE BOTTOM LINE: The researchers found differences in EE program participants' "connectedness to nature" ratings in two of seven programs analyzed. The two programs for which the authors found increases in connectedness to nature shared characteristics, suggesting that connectedness may be increased by programs that are longer in duration and that work with children under the age of 11. The authors suggest many methods-based reasons for the lack of significance in their findings, however, and encourage future research.

Ernst, J. and S. Theimer. 2011. Evaluating the effects of environmental education programming on connectedness to nature. *Environmental Education Research* 17: 577-598.

STUDENTS' MORAL REASONING

SHIFTS WITH THEIR PERSPECTIVE

As China's economy booms, factory emissions are soaring and, at the same time, more and more families are enjoying the opportunity to purchase a car. As a result, China is emerging as a world leader in greenhouse gas emissions. Reconciling economic growth with environmental concerns is just the kind of challenge that's ripe for teachers to explore in the context of socio-scientific issues. This type of educational exploration is gaining favor among science education experts as way for students to build science literacy with real-world problems, forcing students to consider different perspectives as they make informed decisions.

According to the authors of this paper, moral reasoning is an important part of the process of analyzing socio-scientific issues, but it's often overlooked by science educators. In the context of climate change, there has been a lot of research about what kids know about the science of climate change, but far less is known about students' moral reasoning around the issue. So the authors embarked on this study to better understand students' moral reasoning.

The authors enlisted a Chinese biology teacher from a Beijing university to conduct interviews with nine students from Chinese Green Schools, which explicitly focus on environmental education. The students were 14 years old, in seventh grade, and were selected based on their willingness to participate. Interviews were conducted in small groups of three students each.

The results of the interviews reveal that students understand that CO₂ is a major cause of the greenhouse effect, and they identify emissions from cars and factories as two major causes of climate change, which is accurate, especially in China with its coal-fired factories. The students seemed to focus on the role of the individual in solving climate problems. But, interestingly, the authors note that “the students’ interpretations of individual took two different positions, individual as self and individual as others.” When the students considered possible solutions from their own perspective, many were more concerned with their own interests than those of the natural environment. But, the authors observe that “When the individual is ‘someone else’, the students seem to advocate a keen concern for the environment” For example, when asked about what to do about polluting factories, many students indicated that they should be closed down. But, if probed about what they would do if they owned a factory, the students conceded that they would not shut it down.

Also interestingly, when asked about whether they would buy a large or small car, most of the students said they would buy a smaller, less-polluting car. But when probed about whether they were telling the truth, some admitted that, in fact, they’d like to buy a larger, more comfortable car. The authors surmise that the students wanted to please the interviewer with the “‘morally correct’ answer,” but when they realized that the interviewer was not their teacher and this was not an exam, they felt more at ease to speak freely.

The authors conclude that the students’ moral reasoning shifts depending on whether they consider issues from their own perspective or that of someone else. Their conceptions of government and society also shift with

their perspective. If the students imagine themselves as polluters, they see government and society’s role as relatively supportive. But if they think about other people as polluters, the students think government should play a more “controlling and punishing” role, having the authority to shut down factories or force other changes.

These results are aligned with other research that suggests that moral reasoning depends on the context. The authors argue that “moral reasoning depends on content, audience, and situation,” and “to equip students as future decision-makers teachers should not avoid talking about moral, social, and societal aspects” of these issues.

THE BOTTOM LINE: In thinking about complex socio-scientific issues such as climate change, students appear to view solutions differently depending on who is making the sacrifices. They are more likely to expect others to make difficult changes, and less likely to place the same burden on themselves. They also may shift their thinking depending on who is asking. For example, they might be inclined to give what they think is the “right” answer to a teacher, but give a different answer to a peer. Teachers using socio-scientific issues to build literacy and decision-making skills should consider these differences in moral reasoning as perspectives shift, and work to help students better understand issues from multiple perspectives.

Sternang, Li and Cecilia Lundholm. 2011. Climate change and morality: Students’ perspectives on the individual and society. *International Journal of Science Education* 33(8): 1131-1148.

FIELD TRIPS AND FAMILY

OUTINGS HAVE VARYING

EFFECTS ON LEARNING

Desert ecosystems such as Arizona’s Sonoran Desert are environments that are defined by complex interactions among plants, animals, and people. Understanding natural environments such as these requires that students

grasp these interactions, and many teachers believe that bringing students to natural environments on field trips can boost the students' understanding of the ecosystems. This study aimed to explore how a field trip and a family trip to a desert environment affect students' mental models of the ecosystem.

The students in this study were in grades 4 and 7 and learned about the Sonoran Desert. Teachers in the control group received training in using activities provided by the Sonoran Desert Center (SDC) and implemented the activities in the classroom. Teachers in the experimental group used the same activities, and supplemented the activities with two visits to the Sonoran Desert Center, where instruction complemented the in-class activities. During the course of the school year, three of the seventh-grade teachers in the experimental group invited students and parents to Family Science Club activities at the SDC. They organized hands-on activities for students and their families on two Saturdays. Twenty-three students and their families participated.

To assess the students' mental models of the ecosystem, the researcher asked students to draw and explain a desert environment. The researcher asked the students to make a drawing before the experiment and then again several months later after the field trips. Mental models are illustrations of a person's thinking. The author cites previous research that has established this kind of draw-and-explain task as a valid method for understanding students' perceptions and gauging the sophistication of their ideas.

The researcher used a rubric to categorize the drawings as novice or sophisticated and also categorized the drawings into one of four basic mental models:

Model 1: A place where animals/plants live--a natural place;

Model 2: A place that supports life (animal, plant, and human);

Model 3: A place impacted or modified by human activity or intervention; and

Model 4: A place where animals, plants, and humans live.

For the fourth graders, the researcher's analysis did not find that field trips made any difference in the type or sophistication of mental models students depicted. Among seventh graders, there was no difference in sophistication of mental models between students who went on field trips and those who did not. There was a small but significant difference in mental models, though, for seventh graders who went on a field trip. This group shifted slightly away from mental model one (desert as a place where plants and animals live) to mental model two (a place that supports life). Still, most of the fourth and seventh graders, regardless of whether they took a field trip, held mental model one.

The results for the seventh graders who participated in the Family Science Club were more dramatic. These students experienced an eight-fold increase in using Model 2 in their drawings. The researcher explains that this "indicates students understanding the concept that the desert is more than a venue but is itself an active natural world or ecosystem." What's more, these students were the only ones to demonstrate an increase in sophistication in their models from before the assessment to after.

These family outings were clearly more effective at altering mental models. According to the researcher, "the Family Science Club events transpired quite differently than the classroom-based field trips. With three teachers, plus a volunteer astronomer, plus parents all on hand, the discussions about the environmental activities were numerous, participatory, and highly engaging." By contrast, the class field trips "often involved one teacher, with raised voice, projecting directions to a large group of students."

The author notes that many of the teachers in the experimental group mentioned informally that they were happy to give their students the chance to experience a

ECO-SCHOOLS IMPROVE STUDENTS'

ENVIRONMENTAL KNOWLEDGE

natural area first hand. The author reflects, “Essentially, the teachers made a dangerous assumption that exposure to nature obliges deeper (or more connected) understanding. Unfortunately, this may too often be only a hopeful desire of educators who expose students to the outdoors but who do not deliberately plan to challenge students’ conceptions”

To be fair, the results of this research may be affected by the fact that the mental models used by the researcher to assess student comprehension were different from the specific learning objectives developed by the teachers for their students. The researcher notes that if the students and teachers knew that mental models would be used to assess students, activities that more explicitly used the models could have been developed so that students could learn to examine and refine their models, and, consequently, the results may have been different. And while the results for the group that also attended the family activities were dramatic, the researcher notes that this was a self-selecting group that could also have been more predisposed to learning about the environment.

THE BOTTOM LINE: Simply exposing students to the outdoors through field trips will not necessarily change their mental models of the ecosystem they’re visiting. Changing their ideas about the complexities of the ecosystem requires more explicit instruction. The results of this study also suggest that intergenerational learning opportunities could help students think in more sophisticated ways. But it’s not clear from this research what aspects of an intergenerational learning activity were most responsible for positive results, as the intervention also involved other differences from a standard field trip, including a greater variety of hands-on learning opportunities and a greater number of site visits.

Judson, Eugene. 2011. The impact of field trips and family involvement on mental models of the desert environment. *International Journal of Science Education* 33(11): 1455-1472.

In the Eco-Schools program, administered by the Foundation for Environmental education, any school can work toward the goal of becoming a certified Eco-School. Over 30,000 schools in 47 countries are now participating, reaching over 9 million students annually. Nearly 10,000 schools have been certified. According to this paper’s authors, “The main principle of the programme is that eco-thinking should become a way of life.” The program promotes interdisciplinary teaching that connects real, local environmental issues to global issues and concepts, and advocates a democratic decision-making approach.

The authors explain that it’s been well documented that these schools have improved their environmental performance with respect to waste management, water use, and energy conservation, “but the extent to which eco-schools also achieve an educational gain (i.e., an increase in knowledge, attitudes, affect) in their students remains a topic that has not received the necessary attention.” So the authors, who are in Belgium, selected 90 Flemish primary schools to study this question. Half the schools were eco-schools, half were not. In the end, 39 eco-schools and 21 non-eco-schools participated in the study, with a total of 1,287 students at the schools. The eco-schools were selected based on the amount of time they held their eco-school certification: only schools that had been certified for at least six years were included, so that the students in these schools would have experienced the eco-school education for their entire primary education. The non-eco-schools were located in the same vicinity as the eco-schools.

The authors administered surveys that measured students’ environmental knowledge (using the Children’s Environmental Attitudes and Knowledge Scale, or CHEAKS), attitudes (using the 2-MEV scale which measures preservation and utilization attitudes), and affect (using a modification of CHEAKS). The results indicate that students attending eco-schools know more

about the environment than students in non-eco-schools. The students in eco-schools, however, did not show more biophilic tendencies or hold more preservation attitudes than students in non-eco-schools.

But the researchers also included other variables in their study. They also looked at the effects of gender and socio-economic status on students' knowledge and attitudes. They found that boys outperformed girls on knowledge about the environment, and so did students with a more advantaged socio-economic background. Specifically, students with more educational resources available at home scored better on the exam. Students from more advantaged backgrounds also scored higher on biophilic tendencies (and girls scored higher on this measure than boys). Children who spoke a different language at home than the official instructional language (Dutch) scored lower on the knowledge test and held different attitudes about utilization of the natural world (they're less in favor of utilization).

When researchers analyzed all the variables together, they concluded that the students were not randomly distributed among the two types of schools, and the characteristics of the students in the two types of schools were more likely the cause of the differences between the two school types. After controlling for these other characteristics, the authors conclude, "the results of our analyses show that eco-schools have no influence on students' environmental affect but that they do have an influence on their knowledge about the environment."

The authors explain that in this region, parents can choose which school their children attend, and that this choice might have contributed to the study's result. They also note that further research could help uncover whether different instructional approaches in the schools lead to different results. By comparing instructional approaches within the eco-schools, researchers might be able to point to educational approaches that can do a better job at affecting students' environmental affect.

THE BOTTOM LINE: This research investigated Flemish eco-schools that are certified in an international environmental education program that's used in 47 countries. The researchers compared the environmental knowledge and affect of students in the eco-schools and in non-eco-schools in the same area. Interestingly, the researchers found that students in the eco-schools and non-eco-schools were not randomly distributed in terms of their socio-economic backgrounds and language spoken at home, and concluded that their findings these other characteristics explained many of the differences between the two types of schools. But, when controlling for these other variables, the findings did demonstrate an increase in environmental knowledge among eco-school students; however, there was no significant difference in affect among eco-school and non-eco-school students. More research is needed to see whether some of the eco-schools are better at influencing students' attitudes and values.

Boeve-de Pauw, Jelle and Peter Van Petegem. 2011. The effect of Flemish eco-schools on student environmental knowledge, attitudes, and affect. *International Journal of Science Education* 33(11): 1513-1538.

EDUCATIONAL SOFTWARE BOOSTS

INQUIRY SKILLS

Inquiry-based education has gained numerous supporters in the educational community, and many students enjoy learning in a more active, constructive, problem-based environment. But the challenge is that the educational results aren't always ideal. In fact, for some lower-performing students, the more open-ended nature of inquiry-based investigations can pose challenges, and researchers have argued that students need guidance in becoming effective investigators.

Building effective explanations and arguments is a key feature of most inquiry projects, and, one could argue, is a skill that's at the heart of good science. The authors

of this paper, researchers from Cyprus, argue that developing these skills requires a more reflective approach to inquiry in which students plan, monitor, and evaluate their investigation, and “reflective inquiry scaffolding” can help them do just that. They explain, “The term ‘scaffolding’ is used to describe situations when a more knowledgeable person helps the learner progress within their zone of proximal development, reaching the point where assistance is no longer required to perform the initial task.” In other words, an instructor—or, in the case of this paper, a computer program—helps a student along, providing guidance, prompts, suggestions, and other tools until a student understands what to do on his or her own.

Another key aspect of inquiry education is collaboration. Almost always, students work in groups to solve problems within the inquiry model. The authors cite previous research that has concluded, not surprisingly, that “merely having students work together will not automatically lead to increased cognitive gains.” Instead, they explain, “individual characteristics, group composition, and the nature of the task have been identified as important.” They also note that group size is important, with much of the research pointing to pairs and small groups as most effective for learning.

In this paper, the authors investigated the quality of work of students pairs on an ecological inquiry project. Could the students, paired according to their cognitive ability, develop valid, evidence-based explanations and arguments? And could a computer program that provided reflective scaffolding improve the results?

The researchers worked with two sixth-grade classes in a suburban school in Cyprus. Both classes were taught by the same instructor, using the same information, delivered in much the same way. Both classes used the web-based STOCHASMOS software to investigate a scientific mystery in which a large number of flamingos died suddenly at Larnaca Salt Lake. The software gave the students access to information and data about the ecosystem organized into meaningful chunks in the form of text, images, video, and sound. The software also included a glossary,

a graphing tool, and hints to provide help. Interestingly, the graphing tool is included because previous research indicates that certain smaller tasks within the larger task, such as creating a graph to make sense of large amounts of data, can be distracting for some students, causing them to spend too much time on the wrong task. The authors explain, “Providing tools to automatically create graphs can focus the learners’ cognitive resources on the conceptual issues of which graphs to generate and how to interpret them,” rather than on relatively less important details of how to construct the graph.

The students were asked to solve the mystery of why the flamingos died, presenting a persuasive argument to explain their position. The teacher instructed that the explanation should include the students’ claim, reasoning for the claim, and data to support the claim. The argument should also refute other possible explanations, with evidence to support why the other explanations are not accurate. The only difference between the two classes was the tools they were given to organize their arguments. One group was asked to use PowerPoint while the other class was given access to another part of the STOCHASMOS software called Workspace. Workspace includes scaffolds that help students organize their data and explain their arguments. The software includes templates that help students formulate their hypothesis, gather data, and support their explanation. PowerPoint was selected because it’s commonly used by the students but does not include scaffolding.

The researchers administered tests to determine the students’ cognitive ability, and asked the students to complete pre- and post-tests measuring their ecosystem understanding. The students were grouped in pairs according to their cognitive ability, either with both students of high ability, both low ability, or a mix of high and low ability. The researchers then analyzed the pairs’ final work products and the results of the pre- and post-tests.

For the students who used PowerPoint, the high- and mixed-ability groups outperformed the low-ability groups of students in developing their arguments. But in the

class that used the WorkSpace-scaffolded program, the differences disappeared; all of the groups performed about the same, regardless of their mix of cognitive ability. The results suggest that lower-ability students benefit from the scaffolding provided by the WorkSpace program. When the scaffolding wasn't available, the lower-ability students' quality of work was lower than their higher-performing peers. But in the class that used the scaffolding, the lower-ability students performed at the same level as their higher-ability classmates. The authors acknowledge, though, that the sample size for this study was small and that further research could confirm the results.

THE BOTTOM LINE: This research suggests that software designed to guide scientific inquiry with conceptual scaffolding can benefit lower-ability students. The research is specific to one type of software and involved a small sample size, but it supports previous findings. Inquiry-based activities can be engaging for students, but some students may need guidance in shaping their ideas and arguments. In designing environmental education programs with an inquiry focus, it's important to consider the role of scaffolding in helping students become more reflective learners. Although this research points to the effectiveness of one type of software, teachers and peers can also provide scaffolding to assist students in other situations.

Kyza, Eleni A., Costas P. Constantinou, and George Spanoudis. 2011. Sixth graders' co-construction of explanations of a disturbance in an ecosystem: Exploring relationships between grouping, reflective scaffolding, and evidence-based explanations. *International Journal of Science Education* 33(18): 2489-2525.

ONLINE RANGER TALKS NEARLY AS EFFECTIVE AS TRADITIONAL TALKS

Although national parks and other “free-choice” learning environments are increasingly turning to online resources to expand their reach, there has been limited research to date comparing the effectiveness of these electronic media

to more traditional interpretive programs. So the authors of this paper, one of whom is an interpretive ranger at Canyonlands National Park, adapted Ham and Weiler's assessment toolkit to investigate the park's use of “Ranger Minutes” video podcasts.

In a typical installment of “Ranger Minutes,” a uniformed park ranger delivers a 3-to-5-minute talk on topics such as the park's cultural history, geology, flora, and fauna. The ranger's overview is complemented with images and audio from the park. At Canyonlands, eight podcasts are available online as part of the “Inside Canyonlands” series. The researchers aimed to find out whether the podcasts were as effective as traditional ranger talks delivered in person at the park, and whether there was any difference in viewers' responses to the podcasts if they viewed them online or at the park's visitor center.

The same interpreter delivered the in-person talks and the video podcasts, which had identical content. The video podcasts were made available online on the park's website and in the park's visitor center. After viewing the interpretive talk (live or podcast), viewers were offered a post-test survey that measured their emotional, intellectual, and stewardship responses. The survey also collected background information related to the visitors' sex, ethnicity, education, and motivations for viewing the interpretive program.

The results for all types of the talk were positive, but the traditional interpretive talk scored highest overall as an effective interpretive tool. But the authors conclude that the online podcasts were only “slightly less effective interpretive tools than traditional ranger talks.” Looking more closely at the data, the authors believe that “online podcasts are nearly as effective as traditional programs for forging some intellectual and emotional connections, while traditional ranger talks are best at fostering stewardship.” They note the surprising finding that online viewers reported the highest scores of any group for curiosity and feelings of relevance, and they note that the higher knowledge scores among in-person-talk viewers could also be attributable to the fact that the visitors enjoyed the benefit of other

interpretive messages during their trip to the park. On the other hand, the podcasts viewed at stations within the visitor center returned the weakest results.

The authors conclude that video podcasts appear to be a wise investment for parks, especially “for parks with low visitation due to remoteness and/or lack of public awareness, for it generates similar intellectual, emotional, and stewardship connections to the resource despite the lack of actual visitation.” And they urge exhibit planners to question whether installing video viewing stations within visitor centers is a wise investment, or whether those resources might be better spent enhancing online resources.

The authors also acknowledge that further research would help clarify the picture. They note that the participants were not randomly assigned to viewing groups, and the research didn’t include control groups or pre-tests, which weakens the results. They also note that people were free to decline the survey after their interpretive experience, and thus the respondents might not be a true representation of all the visitors who viewed the talks. In particular, they note that from informal conversations with visitors, the authors know that children and students viewed the online podcasts, but no survey results were returned by children.

THE BOTTOM LINE: This research suggests that online video podcasts can be an effective interpretive tool. More research is needed to refine the results, but this research does seem to suggest that online video resources can boost a park’s interpretive reach and can get positive results. Video podcasts viewed in a park’s visitor center did not fare as well as in-person talks or online podcasts.

Henker, Karen B. and Greg Brown. 2011. As good as the real thing? A comparative study of interpretive podcasts and traditional ranger talks. *Journal of Interpretation Research* 16(1):7-23.

SMART PHONES AND TOUCH

SCREENS YIELD MIXED RESULTS

IN EXHIBITS

Technology for interpretation is becoming more common in places like zoos, science centers, and natural history museums with the use of touch-screen computer kiosks, cell phone tours, and videos in exhibits. But these approaches to interpretation assume that visitors are comfortable with this technology, and comfortable using it during their visit. These approaches also assume that concepts can be conveyed more effectively with these technologies and can lead to greater learning than would otherwise be possible. In this paper, the researchers consider two exhibits as case studies: *Call of the Wild* at the Jacksonville Zoo and Gardens, which uses smart phone technology to convey about the nature of science, and *Wild Research*, created in a joint effort by Miami University (Project Dragonfly), the Cincinnati Zoo and Botanical Gardens, a consortium of AZA institutions, and the Institute for Learning Innovation, which uses touch-screens to connect ideas between exhibits. Both exhibits primarily rely on technology to convey content.

In the *Call of the Wild* study, researchers prototyped cell phone activities to see how visitors felt about using cell phone apps during their visit to the zoo. They observed visitors who agreed to test the apps on an iPod provided by the researcher and then interviewed visitors about their experience. In the *Wild Research* study, researchers observed visitors interacting with exhibit elements. They also used questionnaires and structured interviews to ask zoo visitors about their experiences in the exhibit.

The *Call of the Wild* study found a hierarchy: Smartphone activities were the most enticing; calling activities were the least; and texting fell between the two in terms of visitor interest. Smartphone activities “enhanced and extended visitors’ experiences at the corresponding exhibits.” Researchers found that zoo visitors tend to represent the general public in their use of cell phones and smartphones, and that there is a “distinct subset of the population who,

when given the opportunity, do choose to interact with hand-held technology around an exhibit.” The researchers observed that visitors who used the applications stayed at exhibits longer than those who did not. Visitors suggested that they might not want to use mobile phones during their zoo visit because it might detract from family time; however, observations by the researchers did not support these statements. The researchers report that “mobile phone activities such as those created for Call the Wild clearly have the ability to play a key role in delivering educational media to visitors during a zoo visit.”

In the Wild Research study, researchers reported that a significant portion of zoo visitors found technology use to be attractive. They also reported that not all visitors who engage with technology will remain engaged. Lastly, researchers report that visitors “perceive these types of exhibit components enhance...learning opportunities.” The researchers did not find any evidence as to whether technology in zoos improves learning outcomes more than traditional approaches to education, such as signage or observing animals.

Overall, the researchers conclude that technology works well for some learners or learning situations, but does not always lead to improved learning outcomes. Using technology to encourage interaction between zoo visitors “may be a useful endeavor for furthering the experience of many visitors.” However, research into predictors of technology use among visitors may allow us to understand visitor behavior and their connection to learning outcomes.

The bottom line: The use of technology for interpretation in zoos, aquariums, natural history museums, and other education settings seems promising, but there is a great deal more we can learn about how visitors use these technologies, as well as their motivations and barriers. With this information, we can use technology in ways that more effectively influence learning outcomes for visitors to our institutions.

Yocco, V., E. H. Danter, J. E. Heimlich, B. A. Dunckel, and C. Myers. Exploring use of new media in environmental

education contexts: Introducing visitors’ technology use in zoos model. *Environmental Education Research* 17(6): 801-814.

STORY-TELLING RAISES AWARENESS

AND ACTION AMONG VERY

YOUNG STUDENTS

Research suggests that lasting attitudes toward nature and the environment form in the first few years of a child’s life; thus, instilling environmental awareness in very young children represents a key challenge and an exciting opportunity for environmental educators. Although firsthand experiences in nature in early childhood have been shown to contribute to environmental awareness, educators working in urban areas may find it difficult to arrange such experiences. In these circumstances, fictional or non-fictional narratives about nature and the environment may offer an alternate means of exposing young children to environmental subjects.

To investigate the effectiveness of storytelling as an environmental education tool, the authors of this study developed a short, fictional, preschool-level story about deforestation. The authors structured the story around the “binary opposite” concepts of security and insecurity (i.e., trees provide security, while deforestation leads to insecurity). Prior research has shown that this type of simple dichotomy, especially when paired with other narrative tools such as mystery, imagery, morals, and metaphor, can effectively capture the attention of very young children and help them construct meaning from new experiences.

In addition to the story, the authors designed a second lesson to present the same ideas in a more traditional expository format. Both the story and the expository lesson included information about important environmental regulation functions that trees perform, such as oxygen production, flood control, and air filtration.

The study took place in Southeastern Europe, a region heavily affected by deforestation. A total of 79 students from eight urban preschools with attendance from predominantly middle-class families, participated in the story-based lesson, while a control group of 80 students from the same schools received the expository lesson. Researchers assessed all students' ideas about the importance of trees, and level of interest in tree planting as a free-time activity, prior to the lessons. A second assessment took place one week after the lessons, and a third followed about two months later.

In reviewing the assessment results, the authors found that students in the storytelling group demonstrated significantly better recall of key ideas from the lesson. One week after the lessons, when asked to explain why trees are important to humans, students in the story group focused almost exclusively on environmental regulation functions. Students in the expository group mentioned fewer regulation functions, and many students also mentioned raw material functions such as making furniture or paper. The differences between the two groups became even more pronounced eight weeks after the lesson, suggesting that the storytelling approach also improved long-term retention of the lesson material.

Both lessons increased students' interest in tree planting as a free-time activity. Prior to the lessons, only a few students in each group chose planting trees in their hometown when asked to select two free-time activities from a list of seven options. In post-lesson assessments, over half of the students in the storytelling group and about one-third of those in the expository group selected tree planting. The authors surmise that the students gained new interest in planting trees as a result of learning about trees' ecosystem functions and role in supporting human life. Students in the story group, who demonstrated a more significant knowledge benefit from the lesson, also exhibited a greater awareness of deforestation as a problem and a stronger motivation to act.

Despite the effectiveness of the storytelling approach, presenting very young children with vivid narratives

about environmental problems does raise ethical issues. As the authors note, stories that evoke powerful anxiety are usually inappropriate for young children. Children exposed to these narratives could develop negative feelings about the environment in general, and a desire to disengage from the natural world.

However, shielding children from environmental problems is both inappropriate and impractical. Societies will need long-term engagement from their youngest members to address these issues. And in many parts of the world, even the youngest children already have firsthand experience with the consequences of environmental degradation. Given these observations, the authors conclude that stories designed to communicate both knowledge and hope can give young children a healthy awareness of environmental problems and help them contribute to long-term solutions.

THE BOTTOM LINE: Presenting information about an environmental problem in the form of narrative (fiction or non-fiction) may help raise environmental awareness among very young students. In this empirical study, students who participated in a story-based lesson about deforestation retained more key ideas about the problem, and demonstrated higher motivation to contribute to solutions, than did students who participated in a content-equivalent expository lesson. Stories aimed at young students should be structured around "binary opposite" concepts (such as security in a healthy environment versus insecurity in an unhealthy environment) and should include vivid imagery as well as elements of mystery and wonder. For young students in particular, stories about environmental problems should emphasize solutions and hope.

Hadzigeorgiou, Yannis, Barbara Prevezanou, Mary Kabouropoulo, and Manos Konsolas. 2011. Teaching about the importance of trees: A study with young children. *Environmental Education Research* 17:4, 519-536.

NATURALISTS MUST EXTEND CONTACTS WITH PARTICIPANTS TO BUILD ENVIRONMENTAL IDENTITIES

Nature study, once a common component of formal education, has fallen by the wayside in today's standards-driven classrooms. To learn about natural history today, most people must visit parks, nature centers, and museums, where interpretive naturalists bear the bulk of responsibility for introducing people to natural history as well as sparking and maintaining their interest. This is a heavy burden, and one that many interpreters might resent, given that developing a deep interest in natural history is a long-term process, but most interpreters spend just minutes or hours with a visitor.

The authors of this paper follow up on two previous papers that reported on The Environmental Socialization Project, which identified the key characteristics in the life histories of natural history-oriented professionals. In this third paper, the authors offer concrete examples of ways that interpreters can help connect a single interpretive program to a participant's long-term socialization process.

The Environmental Socialization Project used in-depth interviews with 51 "highly motivated and/or exceptional field naturalists who were hobbyists, informal-setting educators, and/or professional conservationists" to identify the key factors in their environmental socialization. The researchers found five opportunities common to the natural-history enthusiasts and professionals:

- access to natural environments,
- social support,
- accumulation of environmental experiences,
- development of environmental competencies, and
- environmental identity formation.

The authors offer a range of suggestions for ways that naturalists can engage participants in each of these domains. For example, to increase access to natural environments,

interpreters can: provide opportunities for free, self-directed exploration in natural areas before, after, and during scheduled programs; offer travel programs to expose people to different environments; designate areas where kids can play freely in natural settings; and create programs that help kids develop wayfinding skills so they can explore farther. Social support can be bolstered by creating programs that help create social groups through repeated interactions (such as clubs), offering social events in conjunction with learning programs, helping participants with similar interests build relationships, using online social networking tools, giving away memberships as incentives and rewards, and making participants aware of other local organizations that might be of interest to them.

To help participants build environmental competencies, some of the authors' suggestions include: providing instruction in outdoor recreation (being careful to focus on skills related to natural history and not those related to thrill-seeking adventure travel), creating positive introductions to outdoor experiences, allowing participants to check out equipment such as insect nets or bird identification guides so they can explore on their own and hone their skills, and helping participants build their tolerance for things like bad weather and getting dirty. The authors suggest that to help in the accumulation of outdoor experiences, interpreters might: provide resources so that participants can continue activities after a program ends; promote other upcoming programs, including programs at other institutions; strive to constantly offer novel activities that can keep participants returning; and offer opportunities for staff to mentor young people who have unusually deep interests in natural history.

Finally, the authors suggest a range of ideas for helping foster environmental identity formation, including: informing young people about environmental careers, serving as role models for environmental careers, and using clubs or social groups to create positive social support for kids who have a level of interest in natural history that makes them out of the mainstream in other social groups.

The authors emphasize that developing an environmental identity takes time. Although interpreters' interactions with

participants might be limited, they can nevertheless play an important role in a person's longer-term development: If there is one larger concept that emerges from the environmental socialization project it is the importance of frequent and repeated experiences with nature within a supportive social world. We strongly encourage that as part of every program interpreters provide information to their audiences about how to extend the experience after the program. Just as a good interpreter develops transitions between subthemes within a program, they must also help audience members transition from program to program. We advocate for adding a formal "Program-to-Program Transition" (PTPT) component to interpretive program plans and that interpreters work to be especially cognizant of the range of local and regional opportunities for visitors to have further natural history opportunities inside and outside their organizations.

THE BOTTOM LINE: People don't develop deep and meaningful connections to the natural world overnight. Recognizing that interpretive programs are just one relatively short point of contact in a person's environmental socialization process, naturalists and interpreters should work to connect their programs to other opportunities for people to continue their development. Interpreters and program managers should also find ways to create positive social environments for people who are developing an interest in natural history. The authors of this paper argue that interpretive program plans should formally adopt this way of thinking, creating a standard transition at the end of programs that points participants to more opportunities for social or educational events that can help foster their interest in natural history.

Bixler, Robert D., J. Joy James, and Carin E. Vadala. 2011. Environmental socialization incidents with implications for the expanded role of interpretive naturalists in providing natural history experiences. *Journal of Interpretation Research* 16(1):35-64.

SENSE OF PLACE

WHAT HAVE 40 YEARS OF PLACE

ATTACHMENT RESEARCH TAUGHT US?

The connections that people have to places are rich and multi-faceted. These connections are mediated by a multitude of factors such as social context (e.g., relations between neighbors) and physical infrastructure (e.g., high-rises vs. single-family homes), among others. The ways that people connect with places have been studied for over 40 years in disciplines as diverse as geography, anthropology, psychology, and sociology. This wide-ranging field of study of people-place connections is most referred to as “place attachment” or “sense of place” research.

In an effort to bring sense to this diverse and often divergent field, this paper’s author reviews more than 400 academic articles addressing concepts that fall under the sense of place/place attachment umbrella. The author summarizes the state of knowledge in three main areas (research, method, and theory) and then suggests fruitful areas for future work.

Some of this research review’s findings most relevant to environmental education are that:

- Place appears to remain important to people despite increased mobility and globalization.
- Social diversity in most studies decreased attachment (i.e., people were less attached to more ethnically diverse neighborhoods).
- “Home” plays a prominent role; people are strongly attached to the locations of their homes.
- There may be a “curvy” pattern of attachment to different scales: Attachment may be highest to home and to city, and lowest at neighborhood level (although these differences disappear in small towns and rural areas--places where ‘neighborhood’ is less meaningful).
- Experiences in or attachment to larger spatial scales (such as a feeling of global identity) does not seem to erode attachment to local places.



- When given the choice to report attachment to both social and biophysical components of places, people rate the biophysical features as highly as or more highly than social features.
- The amount of time a person has lived in a place and the strength of local community ties are the strongest predictors of attachment to that place, when compared with a variety of other demographic variables such as age, education, or mobility.
- The relationship between mobility and connection to place is unclear. There are different forms of mobility (for example, commuting and vacationing), and it seems that these different forms of mobility affect place attachment differently.
- People report higher levels of attachment in places with single-family homes than in places with high-rise apartment homes.
- There is little solid support for the suggested link between attachment to place and place-related behaviors or action.
- People report stronger levels of place attachment also report higher levels of satisfaction with their lives.

The author also summarizes the methods that have been used to explore place attachment, with the principal distinction being between methods that produce qualitative and quantitative data. To generalize, qualitative methods are those based on verbal or visual analysis, while quantitative methods are those based on analysis of people's ratings of survey questions. Place studies began as largely qualitative and descriptive; within the last 15 years, the field has shifted toward quantitative measurement. The author suggests that a combination of these two types of methods allows the fullest understanding of people's relationship with place. Quantitative methods lend insight into differences between people and the strength of ties to places, and qualitative methods help to answer questions of how and why people are attached to places.

The author organizes the discussion of theory using a three-part categorization of studies of place attachment: Person—Place—Process. As may surprise some environmental educators, academic place research has thus far focused more on the social and psychological aspects of place attachment (“Person”) than on the physical (“Place”). That is, the contributions of the biophysical environment have been less studied overall. Similarly, the reasons, or mechanisms, behind place attachment (“Process”) have received less attention. The author suggests that these two areas—“Place” and “Process”—should receive more study.

THE BOTTOM LINE: A wide variety of researchers have studied people-place connections, and many interesting insights have resulted from this work. The body of research, however, could be described as lacking a singular and unifying underlying theory, so drawing conclusions is difficult. Going forward, place studies would benefit from (1) a better organized the work more coherently and (2) dramatically increase focus on both the ways that the biophysical environment (as opposed to the social environment) contributes to those connections, and the reasons behind the connections.

Lewicka, M. 2011. Place attachment: How far have we come in the last 40 years? *Journal of Environmental Psychology* 31: 207-230.

URBAN ARBORETUM ASSOCIATED

WITH VARIETY OF USER VALUES

In highly developed urban areas, undisturbed natural landscapes take on heightened ecological, aesthetic, and emotional value. Nearby residents visit urban parks and open spaces to view wildlife, participate in sports and recreation, socialize with friends and family, or enjoy a tranquil respite from a hectic urban lifestyle. These diverse experiences shape the meanings that users assign to a natural landscape, and contribute to each user's unique sense of “place-based” attachment.

A growing body of literature has investigated these meaning-attachment combinations, collectively termed “sense of place,” in an effort to better understand how individuals perceive and value places such as natural areas that figure prominently in their lives. The authors of this study conducted a qualitative evaluation of sense of place among users of an urban arboretum in Madison, Wisconsin. The study focused on local members of a conservation advocacy group associated with the arboretum. Sixteen members of this group participated in phone interviews with researchers, in which they responded to questions focused on their use of the arboretum, feelings about arboretum management decisions, and perceptions of the arboretum’s impact on their community and personal property.

Interview responses suggested that users in this group associate the arboretum with four main meanings or values: natural values, such as the chance to view native flora and fauna; recreational opportunities, such as running, hiking, and boating; spiritual benefit derived from peace and tranquility in the natural environment; and societal implications, including community advocacy work, land management policies, and impacts on neighborhood quality and property values. Many of these values included a social element—for example, interviewees mentioned observing wildlife with family or running with a group. The four value types occurred simultaneously in a single individual or even in a single activity, as in the case of one user viewing arboretum wildlife while jogging through the arboretum.

Although most users saw the arboretum as a community asset, several mentioned management problems. For example, interviewees living on the arboretum’s borders complained of deer and unwanted plants invading their property. This view contrasted with the positive value that most interviewees, including some of the same individuals who complained about plant and animal invasions, placed on the opportunity to view flora and fauna in their natural environment. Other interviewees mentioned that certain management policies, such as a “no dogs” policy, negatively impacted their recreational enjoyment. Many also expressed concern about how local development projects would affect the arboretum’s ecological health and natural aesthetic.

Despite the small sample size, these results demonstrate the diversity and complexity of meanings that different individuals may associate with a single place. Although the results of this study should not be considered statistically representative of the general population of arboretum users, they could nonetheless help guide policy and advocacy. The study authors suggest that managers use the results of “sense of place” research to hone in on problems, such as animal and plant invasions, and engage users in constructive solutions. Similarly, advocates and policymakers might tap into arboretum users’ sense of place when conducting public outreach efforts. Emphasizing common meanings that form the basis for attachment to the arboretum—such as its natural aesthetic, opportunities for socialization and recreation, and positive impact on local property values—could enhance the power of appeals for funding and improve the effectiveness of campaigns aimed at raising public awareness of the arboretum’s importance to the community.

THE BOTTOM LINE: Sense of place studies can help scholars, managers, and advocates understand the diverse meanings and values that different individuals ascribe to natural landscapes. In this study focused on an urban arboretum, researchers found that arboretum users associated this local resource with a range of values that included natural aesthetic, recreation, spiritual rejuvenation, and social structures and functions. The authors suggest that knowledge of these values could help managers and advocates identify and correct problems, balance the desires of stakeholder groups, and target outreach efforts to tap into local citizens’ sense of place attachment with the arboretum.

Spatz, James Z. and Bret R. Shaw. 2011. Place meanings surrounding an urban natural area: A qualitative inquiry. *Journal of Environmental Psychology* 31: 344-352.

TEACHER TRAINING

EXPERIENTIAL TRAINING NEEDED FOR

EXPERIENTIAL EDUCATION

Teacher training is an important part of many EE providers' programs, but for few programs is teacher training as essential as it is at Expeditionary Learning (EL) schools. In these schools, students are engaged in real-world, problem-based learning that takes them out of the classroom and into the community to learn with a constructivist, experiential approach. The challenge for EL is sufficiently training its teachers, most of whom have never experienced this kind of education for themselves. The authors ask, "how can teachers begin to re-imagine schooling when many of their own educational experiences emphasized rote memorization, compartmentalized knowledge, and surface understanding of content?"

The authors of this paper--a university researcher and an EL regional director--contend that in order to become effective experiential educators, teachers must become immersed in the very activities in which their students will be engaged. In EL's view, experiential teaching requires experiential learning. The authors analyzed EL's approach to teacher training to learn the key components of experiential professional development, its strengths and weaknesses, and how it affects teachers' classroom teaching.

Previous research has established the following key characteristics of effective teacher training:

- immerses teachers in content and pedagogy
- extends over a long term (in total hours and in the span of time)
- provides support materials that reinforce the key concepts
- allows teachers to apply ideas and reflect on what they're learning
- creates a collaborative peer environment

The authors of this paper add to this previous knowledge base two additional theories to guide their thinking about what makes an effective teacher training program for experiential education. First, they looked to the Outward Bound process model, which involves "immersing teachers in a unique experience, creating curiosity or



adaptive dissonance by offering challenging tasks that require development of skills, providing opportunities to demonstrate progress and/or mastery of tasks, and applying learning to other situations.” Second, they draw from Putnam and Borko’s ideas on social learning. According to these thinkers, the physical and social aspects of learning are important and often overlooked. The authors explain that “location and context--how and where teachers learn--matters.”

The authors used a case-study approach to analyze EL’s teacher training methods. While EL has over 140 schools, with over 4,000 teachers and over 50,000 students, this research focused on EL secondary schools in the New York City area. The authors invited all the teachers in the area to participate and selected the first eight teachers to respond to participate in their study. The teachers were mostly female (6 of 8 participants), were in their 20s or 30s, taught a variety of subjects, and ranged from 1 to 5 years of teaching experience. The researchers conducted multiple interviews with each teacher, observed professional development activities, spent two school days with each participant, and reviewed a variety of materials related to EL’s professional development program, including monthly newsletters, support materials, curriculum materials, project samples, teacher training agendas and planning materials, and more.

The authors identified four key components of EL professional development that make it successful: immersion in student experiences, creation of discourse communities and networking, opportunities for reflection, and learning general strategies through specific content. The core of EL teacher training is a Secondary School Institute in which teachers are immersed in a 5-day course that mimics the student experience of an expedition. For example, science and mathematics teachers in Portland, Oregon, participated in a program in which they learned about watersheds. The teachers hiked in the watershed, read articles, viewed videos, met with experts and scientists, conducted water and soil tests, and created and presented strategies to help protect watersheds. Most of the teachers named this immersive experience in the

role of a student as the most important aspect of their professional development.

The researchers also point to teachers’ initiation in discourse communities as a key aspect of success. They define discourse communities as “instances where teachers use EL terminology to describe what they do and how they do it.” This common language is essential in facilitating conversation among teachers about what they do. EL works to foster this common language with direct instruction and by inserting the principles in instructional guides, workshops, and other training opportunities. Although EL was successful with this in many ways, the researchers point to specific examples of teachers using terminology incorrectly. They conclude that teachers need constant exposure to key terms, along with discussions and models of their meanings, to keep their common language consistent.

A third key component is reflection. According to the authors, “Without reflection on the meaning of what happened in a professional development experience, there is a danger that the experiences will be ‘misunderstood,’ not be applied to classroom practice, or be implemented in ways that are not aligned with EL philosophy.” The authors found that, particularly with an approach such as this one, in which the teachers are immersed in the student experience and specifically urged not to think about how they would teach the material, finding the right balance of reflection can be a challenge. “We urge others using experiential professional development to provide time and structure for teachers to return to the planning context after implementation to further reflect, conceptualize, experiment, and plan.”

Finally, the authors identified the “acquisition of general strategies through specific content” as the fourth contributor to success. As an experiential process, teachers learned about how to teach by learning specific material themselves. And by modeling with actual content, the material teachers learned often became material that they used in the classrooms themselves. This seemed especially useful for teachers with less experience, as it gave them

tested, effective material that they could use in their classroom.

Although the method has challenges, the authors conclude that their research “suggests experiential professional learning strategies can be instrumental in supporting teachers in making sense of a teaching model that requires them to rethink conventional methods of curriculum design, pedagogy, and assessment.”

THE BOTTOM LINE: Experiential learning may sound like a good approach to many teachers, but the teachers may have little practical experience with the approach. To teach educators how to implement experiential education in their classrooms, experiential professional development may be a good approach because it models the process for teachers. But care should be taken to be sure that teachers clearly understand the new terminology and are given plenty of time to reflect on what they’re learning and think about how to transfer it to their own classrooms. This research represents a small case study of one regional program and is not definitive evidence that this is a superior approach to other teacher training methods.

Klein, Emily J. and Meg Riordan. 2011. Wearing the “student hat”: Experiential professional development in expeditionary learning schools. *Journal of Experiential Education* 34(1): 35-54.

CONSTRUCTIVIST PROFESSIONAL DEVELOPMENT BOOSTS INQUIRY- BASED TEACHING

The authors of this paper, who aimed to provide training to teachers to boost their use of inquiry-based science teaching methods in elementary school, first interviewed teachers about their feelings toward inquiry in the classroom. The teachers’ initial comments might sound familiar to environmental educators engaged in teacher training:

As far as state standards [objectives], there are X amount of topics that I have to cover in a couple of weeks. If they want to go off on a tangent with volcanoes, that’s great, but we don’t have time to let them.

I have to admit sometimes I feel that I’m in second grade and they know a lot more than I do. That makes me feel--that scares me as a teacher. I’m supposed to be teaching and I don’t know.

These feelings of doubt about the feasibility of inquiry-based methods (both in terms of time and teachers’ expertise) likely contribute to the low rates of adoption of this method among elementary school teachers. In fact, science instruction of any kind is limited in elementary schools. According to one study, 25% of elementary teachers do not teach science, and if it’s taught at all, it only adds up to 2 hours of instruction per week. And most of that instruction comes in the form of traditional worksheets and other didactic approaches.

Because the National Science Education Standards recommend a move toward more inquiry-based, student-centered, constructivist teaching approaches, this research focused on the best ways to prepare teachers for this kind of teaching. The authors of this paper lament that “Too often, professional development activities are based on a training approach in which teachers are presented with ideas and are expected to return and duplicate them in their classrooms.” But, they explain that research shows that “professional development is effective when it is sustained, consists of hands-on applications of content, integrated into teachers’ daily responsibilities, and involves group participation.”

The research reported in this paper investigated this engaged, constructivist, social model of teacher education. In a three-year study, 30 K-5 teachers from a rural elementary school participated in long-term professional development in which “the teachers were encouraged to construct their own meanings of inquiry through immersion, implementation, and reflection.” In the first

phase, the teachers participated in a two-week workshop that included hands-on, inquiry based explorations of a schoolyard habitat. The activities addressed local standards and included time for group discussions, grade-level study groups, team planning, and implementation of instruction. In summer study group sessions, teachers selected reading material from a list provided by facilitators, and met several times over the summer to discuss and plan units. In the second phase (years two and three) the teachers implemented and reviewed their units and continued to meet with their grade-level groups in off-site meetings with project facilitators. These sessions helped teachers further refine their instruction.

The researchers analyzed the programs' effectiveness with interviews and semantic maps, and found that the approach did indeed help teachers move toward more inquiry-based teaching. The researchers believe that "The opportunities to discuss their prior experiences, constraints, and conceptions while participating in the workshop activities were crucial to the teachers' learning." Only by thinking about potential barriers could the teachers plan for change. The researchers found that the teachers not only were beginning to move toward more inquiry-based methods in the units they implemented from the training, but also modified some of their lessons on other topics. They introduced more activities with a question and added more time for students' discussions. And they perceived greater interest and motivation from students as a result.

The semantic maps confirmed the interview data, with the teachers demonstrating a transformation in their ideas about teaching science. The researchers noted a change from more traditional approaches to what they called a more transitional style, where the teachers demonstrated some, but not all, aspects of reform. Transformational change, in which teachers' approaches were strongly aligned with inquiry-based reform, occurred in only two of the thirty teachers. Nevertheless, the researchers see these results as a success, and they credit the teachers' involvement in the project planning and decision-making, the constructivist nature of the activities, opportunities for reflection and

revision, and the long-term nature of the project as key factors in its success.

THE BOTTOM LINE: With heavy emphasis on reading and math in elementary school, getting teachers to focus on science can be a challenge. And getting them to use reform-based, inquiry-led approaches is even harder. This research suggests that in order to support teachers in adopting this method, a long-term, constructivist approach to professional development may be effective. The method investigated here involved inquiry-based workshops with activities that modeled constructivist teaching, grade-level study groups, team planning, implementation of new teaching methods, and whole-group and grade-level group discussions over a long term. The researchers think it was vital to involve teachers in the program's development, model inquiry-based activities, provide opportunities for reflection and revision, and provide support over the long term.

Brand, Brenda R. and Sandra J. Moore. 2011. Enhancing teachers' application of inquiry-based strategies using a constructivist sociocultural professional development model. *International Journal of Science Education* 33(7): 889-913.

OTHER RESEARCH

CHILDREN EXPRESS ECOPHOBIA IN

THEIR OWN WORDS

Fear, cynicism, pessimism: increasingly, research suggests that these are the feelings kids have about environmental issues and the future of the planet. David Sobel has termed these feelings “ecophobia.” The author of this paper explains that kids “are worried about environmental problems and feel powerless to change current conditions.”

So this study aimed to look at the situation from children’s perspective, and focused on American children because much of the current research is focused on kids outside the United States. The researcher interviewed 50 fifth graders (about half boys and half girls, from various ethnic and socioeconomic backgrounds) in the Denver area about their environmental concerns and emotions. The kids’ parents completed a demographic questionnaire, and the kids talked with the researcher about how they define the environment, their awareness of environmental problems, and their concerns and feelings about those problems. The kids also had the opportunity to draw pictures of how they thought the Earth might look in 100 years.

As in previous research, the interviews revealed that “children’s concerns for the environment were commonly expressed through the emotions of sadness, fear, and anger in reaction to environmental problems.” The environmental problems kids mentioned most were destruction of nature (56%), global warming (38%), air pollution (38%), and killing animals (38%). Of the nine children who did not express negative emotions, seven were not aware of any environmental problems, and therefore had no concerns about them. And two kids were aware of environmental problems, but were not worried about them.

A majority of the children (72%) also expressed pessimism about the future Earth. Many held apocalyptic visions of the future, saying things such as, “everything is going to get destroyed,” or “maybe there is not going to be 100 years,” and “the world might flood from the heat getting too much.” Some, however, tempered their visions with an alternate, better scenario, which depended on humans taking action before it’s too late. The 28% of children who were



not pessimistic about the future envisioned a better future thanks to new technologies and better behavior. They tended to picture a world with “sugar cane-powered cars,” “less pollution coming out of the mufflers,” and “smarter” people who “are realizing that there are things you can actually do.”

Seventy percent of the children named television, news, and movies as the source of their fear. Some specifically mentioned The Discovery Channel and many discussed the movie *The Day After Tomorrow*, in which the New York City endures apocalyptic and rapid changes in response to climate change. The author concludes that “television, news and movies have a powerful impact on children’s feelings about environmental problems perhaps heightening anxiety about, and fear of, environmental problems.” Interestingly, however, the children who talked about a future brightened by environmental solutions and green behavior said that parents or teachers had taught them about these solutions. “This tentatively suggests,” the researcher concludes, “that children who are made aware of solutions to environmental problems may be less likely to feel pessimistic about the future state of the Earth.”

Unfortunately, the results of this and previous research indicates that most kids get their environmental information from television and movies, which makes them fearful and frustrated. But, this research also indicates that parents and teachers can “provide antidotes to the prevailing pessimism” with age-appropriate and positive information about environmental solutions. The author suggests that environmental educators, in particular, can encourage a more positive outlook among young people by sharing solutions, and encouraging students to build a sense of agency through developmentally appropriate environmental projects close to home.

Ultimately, though, the author acknowledges that just because a fifth-grader feels pessimistic about the future does not necessarily determine what they’ll do, now or as an adult. The author acknowledges that “given the tenuous relationship between environmental concern and behavior, one may question the importance of researching

children’s environmental concerns.” The answer isn’t clear, but the author points to recent research on adults that suggests that strategies of fear and guilt are not effective motivators for environmental behavior, and to retrospective studies of adults who name childhood nature experiences and positive role models as important influences in the development of their environmental concern and activism. According to the author, this study has added to the body of evidence suggesting that kids are increasingly ecophobic. “The next step is figuring out if these feelings truly have long-lasting impacts.”

THE BOTTOM LINE: Most kids today are feeling sad, fearful, and angry about environmental problems, and are pessimistic about the future. Television and movies are their main source of information about these problems, and seems to be the main source of their anxiety. But this research also indicates that parents and teachers can balance negative messages with more positive and hopeful information focused on solutions. Focusing on positive, age-appropriate information that helps kids build a sense of agency in dealing with environmental problems can go a long way toward encouraging kids to envision a more hopeful future. But it’s important to note that this research did not explore how kids’ feelings about the environment affected their actual environmental behaviors. Much of the current research suggests that these kinds of negative feelings may not be linked to positive environmental behaviors, but some studies suggest that these feelings can motivate kids to take action. More research needs to be done to better understand how these feelings affect environmental behaviors in kids and as they mature.

Strife, Susan Jean. 2011. Children’s environmental concerns: Expressing ecophobia. *The Journal of Environmental Education* 43(1): 37-54.

CHILDREN EXTEND MORAL

REASONING TO THE ENVIRONMENT

Early research from pioneering psychologist Jean Piaget identified distinct stages of moral reasoning as children develop. Piaget's model saw young children in a stage of relatively black-and-white moral reasoning, where all rules are equally important. As they mature, the children would gradually shift to a different moral perspective that adds more grey areas, where some rules become more flexible.

This study followed a different line of research called social-domain theory, which suggests that even young children can differentiate between different kinds of moral transgressions. And the severity of the transgression depends on the context. Children judge moral transgressions, which are actions that harm others (such as hitting), most harshly. Social-conventional transgressions, which upset the social order (such as talking out of turn), are also seen as immoral, but are judged less harshly. Finally, most kids are hesitant to pass judgement on personal choices (such as clothing choices) and are unlikely to consider them as moral transgressions.

This study also explored children's reasoning for their moral viewpoints. Research indicates that there are two main types of reasons given for people's attitudes toward nature: Anthropocentric justifications that center around how the environment affects people (for example, opposing water pollution because it threatens humans' water supply) and biocentric views that lend moral standing to nature itself (for example, believing that a waterway should remain unpolluted for its own sake, and not because of the human benefits of clean water). Some previous research has indicated that biocentric reasoning may not develop until later childhood.

In this study, the authors hoped to understand whether children viewed environmentally harmful actions as similar to moral transgressions, social-conventional transgressions, or personal choices. And they also wanted

to know how the children explain their reasoning: would they express anthropocentric or biocentric reasoning?

The authors interviewed 61 children between the ages of 6 and 10 who were not randomly selected (the interviewer used a snowball sampling technique, asking participating children if they knew anyone else who might like to participate). All of the children lived in suburban areas of the Northeastern United States, and all but five were Caucasian. The researchers presented the children with twelve story cards that depicted three moral transgressions (stealing a quarter, pushing a classmate, and grabbing a toy); three social transgressions (eating salad with fingers, not pushing in a chair after class dismissal, and leaving a dirty wrapper on the table after snack); three personal choices (eating lunch with a certain group of friends, reading at recess, and coloring with a purple crayon); and three environmentally harmful actions (littering, not recycling, and damaging a tree). The researchers asked the children to rate the actions depicted on the card as "OK," "a little bad," or "very bad" and later converted their responses to a 0-to-2 scale, where 0 represented "OK" and 2 represented "very bad." The researchers also asked the students to explain their answer, and noted if the response reflected anthropocentric or biocentric reasoning.

The results confirm a more nuanced approach to moral reasoning among children. The children in the study "judged moral transgressions more severely than social-conventional transgressions and rarely condemned personal choices." When it came to environmentally harmful acts, children judged them more harshly than social-conventional transgressions, but not as harshly as moral transgressions. The authors think one way to interpret these results is that "these children may be conveying a belief that harm to the environment is bad, but harm to a human being is worse." In addition, the authors report that "Although typically thought to emerge later in adolescence, a willingness to grant nature respect based upon its own unique right-to-existence was present in our young participants." Though, they note, girls were more likely to hold a biocentric view than boys among the children in their sample.

The authors conclude that their results could signal the existence of a new domain, which they say is “one incorporating environmental concerns as less acute than humanitarian concerns but more important than concerns about arbitrary social conventions.” More research with a larger, more diverse sample would need to be conducted to confirm the results.

THE BOTTOM LINE: This research confirms previous research that suggests that children’s moral reasoning is more nuanced than once thought. And, importantly, the environment received moral standing among the children in this study, who were an average of 8 years old. The children rated the severity of environmental transgressions such as littering as more severe than social transgressions, but less severe than moral transgressions such as stealing. Children--girls more often than boys--also expressed a biocentric view, in which nature deserved respect in its own right and not just because of its connection to people. This was a very small study, however, and more research needs to be done to confirm the results.

Hussar, Karen M. and Jared C. Horvath. 2011. Do children play fair with mother nature? Understanding children’s judgements of environmentally harmful actions. *Journal of Environmental Psychology* 31:309-313.