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Measuring Environmental Education Outcomes



This e-book was produced by 20 environmental educators, participants of a project-based online learning community “Measuring Environmental Education Outcomes” conducted in May–October 2013 (facilitator: Alex Russ) as part of EECapacity. EECapacity is the national environmental education training program sponsored by the Environmental Protection Agency and led by the Cornell University Civic Ecology Lab, the North American Association for Environmental Education, and partner organizations.

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1. Introduction

Alex Russ

In this e-book, 20 educators across the U.S. are trying to offer a fresh look at environmental education outcomes and their measurement. Outcomes measures are used in environmental education program evaluation (Charleton-Hug, 2009; Thomson, 2005). A number of resources support educators' evaluation efforts (e.g., Bennett, 1989; Stokking, 1999; Simmons, 2004; Thomson, 2005; MEERA website). Yet educators continue to ask various questions related to outcomes: What counts as outcomes of environmental education? How can their measurement be part of environmental education curricula? How to monitor long-term impacts of environmental education programs? To address these and other relevant questions, in 2013 the EECapacity national environmental education training program organized an online learning community of environmental educators, "Measuring Environmental Education Outcomes" (MEEO), whose exchange of ideas and collaboration resulted in this e-book.

We define environmental education outcomes as any desired changes that result from environmental education programs and are intended to improve aspects of social-ecological systems, including human well-being. This broad definition was inspired by an earlier group of educators who took an online course on environmental education outcomes measure in fall 2012. In response to a question, "What are desired outcomes of your and other environmental education programs?" they brainstormed any kinds of short and long-term outcomes (Figure 1).

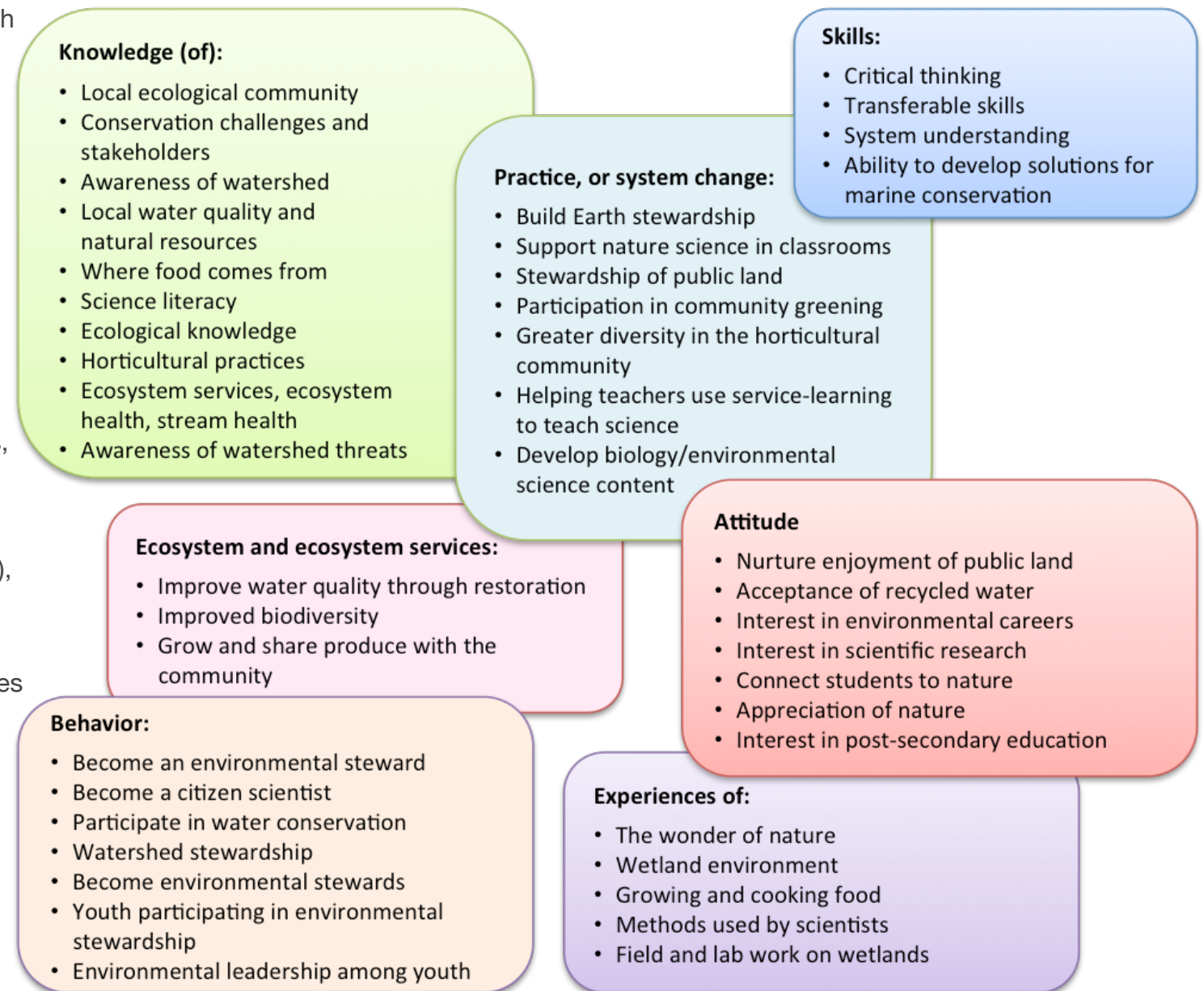


Figure 1. Possible environmental education outcomes listed by 20 educators participating in the "Measuring Environmental Education Outcomes" online course in fall 2012.

The diversity of possible environmental education outcomes from this exercise was quite impressive. These outcomes may occur in people, organizations, communities, or ecosystems. These outcomes may include perception of nature, social capital, environmental knowledge, ecosystem services, sense of place, positive youth development, environmental innovations, and effective governance institutions. Yet, interestingly, the literature shows that environmental education outcomes evaluation has been focused primarily on measuring environmental knowledge, awareness, attitudes, skills, and pro-environmental behavior (Leeming, 1993; Rickinson, 2001; Heimlich, 2010; Stern, 2013; Zint, 2013).

Measuring these or other outcomes can serve several objectives. It can help educators monitor the effectiveness of their programs, improve educational activities, and demonstrate the impacts of their work to funders and communities. Importantly, measuring environmental education outcomes can also help educators reflect on types of outcomes they are trying to achieve. This process can also help educators refine their practical theory of change—that is, any assumptions they have about how and why certain educational activities lead to specific outcomes. In fact, refining the desired educational outcomes and reflecting on assumptions of causality are some of the challenges in program evaluation (Heimlich, 2010).

To investigate some broad questions related to outcomes measurement, 20 environmental educators from different states participated in the MEEO project-based online learning community in May–October 2013 (facilitated by Alex Russ, with help from Jose Marcos-Iga). Educators' short biographies can be found at the end of this publication. Using an online learning platform, educators first exchanged relevant ideas and resources, and participated in several webinars, such as on the NAAEE Guidelines for Excellence (by Bora Simmons), and a webinar on qualitative and quantitative evaluation methods (by Tania Schusler). After this preliminary exchange of ideas, educators identified topics they would like to cover in their chapters in this e-book—topics that are relevant to their own programs and that can contribute to the larger field of environmental education. To write chapters, educators worked in small groups over three months. They were

encouraged to draw on MEEO online discussions, relevant literature, and their own experiences. This e-book is the result of educators' collective efforts.

To preserve the authors' original work, voice and style, the chapters underwent only minimal editing. Although the EECapacity program does not necessarily endorse the authors' viewpoints, this e-book can be a useful reading for other environmental educators who are measuring or reflecting on the outcomes of their programs.

Acknowledgement

The authors and editor are grateful to several people and organizations. The MEEO online community was part of EECapacity directed by Cornell University's Civic Ecology Lab (PI: Marianne Krasny) in collaboration with NAAEE and other partners. Marianne Krasny also helped to oversee the quality of this e-book. The idea of project-based online learning communities—i.e., communities of educators who produce an e-book or other materials on important environmental education topics—was proposed by Jose Marcos-Iga (EE-Exchange, NAAEE, EECapacity). Jose Marcos-Iga also helped us organize several webinars during this MEEO. We are also thankful to Kimaada Le Gendre who contributed to online conversations during this MEEO, and to several webinar speakers.

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2. What are environmental education outcomes?

Alison Paul and Michelle Byron

Environmental education outcomes can demonstrate successes and challenges of environmental education programs, help educators assess their impacts, and guide program changes. While the success of programs and services has in the past been measured by many different gauges, such as financial accountability, program products (outputs) and participant-related descriptors like demographics —outcomes specifically show us how programs make a difference and whether things are better as a result of the environmental education program (Plantz, 1997).

Environmental education outcomes help organizations achieve their goals and overall mission, and are best understood in the overall context in which a program takes place. Logic models provide graphical or narrative descriptions of the linkages between program resources and the program's intended impact (McCawley, 2001), and they provide a useful way to understand how outcomes relate to the overall goals and how they differ from other program components. There are many examples of logic models; here is one that helps us understand environmental education outcomes in context (Thomson et al., 2005; http://www.sagepub.com/upm-data/50363_ch_1.pdf):

Resources → Activities → Outputs → Outcomes → Impact

Logic models show the strategies that leverage resources to carry out activities that produce certain outputs. These outputs lead to the sought after results. Results are measured through the short, intermediate, and long-term outcomes, which lead to an ultimate impact. Using a logic model can be important in

program planning and ongoing evaluation efforts to adapt programs to best fit the context in which they take place.

Why do we use environmental education outcomes?

Environmental education outcomes help us measure the overall impact of a program, which is useful both to help improve programs moving forward and to garner support. Many donors have shifted to a more outcomes-driven type of evaluation in recent years as donors want to know not only what educators did, but also what changes their programs made in the world (National Council of Nonprofits, 2013). In a sense, the measure of success shifted from “does their model make sense?” to “does the model really work?” (Weil, n.d.).

Some outcomes of a program are the results the planners anticipated. Other outcomes are ones that nobody expected—and sometimes that nobody wanted —yet are important information for program improvements. If the strategies are not leading to the intended results, the activities need to change. As McNamara (2002) points out, using outcomes in evaluation is effective in answering whether “your organization is really doing the right program activities to bring about the outcomes you believe (or better yet, you've verified) to be needed by your clients.”

Outcomes versus outputs

Outputs are immediate and tangible results of programs (e.g., number of participants served), while outcomes are results that your program is trying to achieve (e.g., participants' increased environmental knowledge). Outputs are an

important part of program design and record keeping, which combined with outcomes, can help paint a good picture of environmental education program impacts and help us create meaningful and effective programs (Schueller, 2006). Outputs lead to program outcomes, but they are not themselves the impact or changes that you expect the program to produce. For example, an output such as the number of teachers trained in environmental education shows the direct result of a program, but it doesn't tell us the impact that the training had (i.e., if the teachers then implemented what they learned and if their environmental teaching had a significant impact on their students).

	Description	Examples
Outputs	Outputs are measurable, tangible, and directly related to program activities. Outputs often refer to the quantifying of program activities.	<ol style="list-style-type: none"> 1. Number of stewardship hours at a water restoration project. 2. The creation of an online Energy Usage Curriculum. 3. Number of teachers who completed a garden training program. 4. The hiring of a science consultant.
Outcomes	Outcomes are the intended results that your program aims to achieve if implemented as planned. Outcomes measure how people and the environment are impacted by your program.	<ol style="list-style-type: none"> 1. Increase in biodiversity due to the collective impact of waterway restoration. 2. Students analyze school energy use and implement energy saving initiatives at their schools. 3. Teachers and students create school garden that provides healthy food to the cafeteria and improves students' overall health. 4. Increase in the percentage of students with high science test scores.

Outcomes tell us about the big picture changes that occur due to environmental education programs; they show us what changes occur for individuals, groups, families, organizations, systems, ecosystems, or communities due to our programs. These changes can take place during or after a program.

What are typical environmental education outcomes?

Common desired environmental education outcomes are often based on the UNESCO Tbilisi Declaration on Environmental Education (UNESCO/UNEP 1978). However, environmental education programs are also trying to produce certain ecosystem-level and community-level outcomes.

1. **Knowledge.** Participants acquire knowledge about the environment, nature, and current environmental problems. They are able to recall from memory, comprehend the meaning, and/or explain it (UNESCO, 1978). Participants gain knowledge about the environment, the phenomena that shape it, and its associated problems and their potential solutions. This includes such things as basic science literacy, where food comes from, awareness of watershed, and horticultural practices (MEE0 2013 discussions).



Photo 1. Knowledge acquisition: Students learn to identify buckthorn on a Mighty Acorns field trip in Chicago's Calumet region. Educator: Alison Paul. Photo by Alex Russ.

2. **Awareness.** Social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems. Participants report or show a change in their sensitivity to environmental issues that helps impact their attitudes and pro-environmental behaviors.
3. **Attitudes.** Program participants develop empathy and beliefs that foster an ethic of environmental responsibility. Examples include positive attitudes towards nature, the built environment, and/or how humans relate to the environment (UNESCO/UNEP, 1978; Thomson et al., 2003).
4. **Skills.** Participants gain verbal, mental, or physical abilities needed to engage in desired behaviors. Such abilities often include critical thinking and action skills related to identification, prevention, and tackling environmental issues (UNESCO/UNEP, 1978), for example, being able to correctly identify and remove seedlings of an invasive species.
5. **Behavior.** Participants do things that benefit the environment, or that decrease human impact on the environment. This includes changing lifestyle habits, participation in restoration activities, environmental advocacy, and/or taking other actions aligned with environmental protection and improvement. Knowledge, awareness, attitudes, and skills are seen as prerequisites for behavior change (Thomson et al., 2005).
6. **Practice or system change in communities.** Communities increase or decrease their engagement in practices, norms, and/or repeated actions in a way that are beneficial to the environment. Examples include residents' participation in community greening, support of integrating environmental classes into all classrooms in a school district, strengthened social capital (MEEO 2013 discussions; Krasny et al., 2013a).
7. **Ecosystem and ecosystem services.** Ecosystems become more resilient through their restoration and overall improvement through implementation of successful managements plans. Some common examples: improve water quality through restoration integrated with education, grow and share garden produce with community members (MEEO 2013 discussions; Krasny et al., 2013b).

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3. Goals and audiences of measurement

Ashley Osborne

In 1978, the Tbilisi Declaration defined the goals of environmental education as “1. To foster clear awareness of, and concern about, economic, social, political, and ecological interdependence in urban and rural areas; 2. To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment; 3. To create new patterns of behavior of individuals, groups, and society as a whole towards the environment” (UNESCO/UNEP, 1978). The declaration stated that environmental education should be a “continuous lifelong process” encompassing all ages and stages of life (UNESCO/UNEP, 1978).

Historically, environmental education has been associated with educational programs related to conservation, nature, and sustainability (Heimlich, 2010; Monroe and Krasny, 2013). However, in recent years environmental education has expanded its community of educators and participants. Today’s environmental educator may be a naturalist, librarian, curator, Sunday school teacher, social worker, or... you fill in the blank. Carleton-Hug and Hug (2010) state that these and other educators who implement environmental education are “...passionate about helping their audiences come to a greater understanding of environmental topics and of personal responsibilities for addressing environmental issues.”

Environmental education can be integrated into all content areas, including arts, English, social studies, practical living, and health. A preschool teacher can use nature to teach about shapes and colors, a program coordinator at a senior citizen center can incorporate nature and exercise by encouraging individuals to go on a nature walk, a homemakers group can learn about native plants and their benefits during a gardening session, and so forth and so on.

Who is the audience?

The North American Association for Environmental Education (NAAEE) defines environmental education as education that “... teaches children and adults how to learn about and investigate their environment, and to make intelligent, informed decisions about how they can take care of it.” Environmental education is for everyone, children and adults. Obviously the participants will largely depend on the educator and their responsibilities within the organization they are employed with or volunteering for, as well as the overall goals and objectives of a particular program. Examples of audiences for an environmental educator may include youth clubs/associations (e.g., 4-H, Boy Scouts, Girl Scouts), homemaker groups, producer/farmer associations, senior citizens group, etc. Depending on the audience, not only may the program goals of the environmental educator be met, but the audience’s goals may also be achieved at that same time. For example, the Boy Scouts of America have to complete certain requirements to receive the Nature Merit Badge. The scout could attain some or all of the information he needs to meet these requirements by attending an environmental education program.

What are the goals?

Heimlich (2010) states that most organizations within the ecological or environmental field have one or more primary goals in their mission statement related to environmental conservation, protection, sustainability, and/or preservation. However, as noted previously, not all environmental educators may be associated with an organization specifically focused on ecological or

environmental issues. An environmental educator may be employed by a university, museum, daycare or church. These organizations may have mission statements that differ greatly from one another and may or may not have an environmental element included in the overall statement. An example is a rain garden program in Bourbon County, Kentucky. One of the main goals of the program was to educate local citizens on what rain gardens are, why they are beneficial, and how to install and maintain one. Four of the organizations involved in the program are listed below with each organization's mission statement. Although each mission statement differs, all of the organizations worked together to accomplish the program goal, which helped to achieve each organization's broader mission.

- Bluegrass Greensource's mission is "...encouraging small steps toward a sustainable future for our communities".
- The Paris-Bourbon County Library's mission is "...to inform, enrich, and empower every person in our community by creating and promoting easy access to a vast array of ideas and information, and by supporting an informed citizenry, lifelong learning, and love of reading."
- The Kentucky Cooperative Extension's mission is to "... serve as a link between the counties of the Commonwealth and the state's land grant universities to help people improve their lives through an educational process focusing on their issues and needs."
- Ruddles Mills Perennials and Native Plants' mission is "...to provide healthy, quality perennial plants which thrive in our climate; to offer organic soil conditioners, mulch and fertilizers; and to provide technical information on plants, planting and problem solving."

My experiences

The mission of the University of Kentucky Cooperative Extension Service is to make a difference in the lives of Kentucky citizens through research-based education. In 2003 I began my career with Extension as an Extension Associate for Environmental and Natural Resource Issues. My responsibilities include

program development and implementation, and educational materials development. My audience is very broad and includes all Kentuckians, from the preschooler learning about aquatic insects to the homemaker being taught how to improve their home's indoor air quality and everyone in between. Depending on the program I may work directly with participants, or I may work with county Extension agents who disseminate the information I provide them to those in their communities.



Photo 1. Kentucky middle school students enrolled in the University of Kentucky Robinson Center 4-H Natural Resource and Environmental Sciences Academy learn about the amount of fresh water available on earth. Photo taken by Stephen Patton, University of Kentucky.

Probably not all of the environmental programs that I teach are perceived by the audiences as environmental education. An example is a home pest management lesson created for the Kentucky Extension Homemakers Association, a volunteer organization that consists largely of women of retirement age. Many homemakers may think of this lesson as home health. However, the lesson is teaching participants how to prevent pests in their home and thus reduce pesticide use,

decrease allergens, and improve indoor air quality. I teach the lesson to homemaker leaders who then go back to their counties and distribute the information within homemaker clubs.



Photo 2. Middle school students enrolled in the University of Kentucky Robinson Center 4-H Natural Resource and Environmental Sciences Academy investigate the quality of a stream in Eastern KY by examining chemical, physical, and biological components of the waterbody. Photo taken by Stephen Patton, University of Kentucky.

When I develop a program, the goals of that program are more specific and detailed in regards to what the program is to accomplish. However, the goals still work toward achieving the broader mission of the university. An example is a stormwater education program developed and implemented by several colleagues and myself. The overall goal of the program is to explain stormwater issues and practical remediation strategies to Kentucky Extension agents highlighting efficient hands-on strategies. The goal of this program helps to achieve the overall mission of the organization.

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4. Qualitative and quantitative approaches

Sara Focht and Grace Segovia

There are many different methods that help measure the outcomes of environmental education. Some of them are numerical in nature (surveys, tests, or some other indicators), while others are more descriptive in nature (open-ended interviews, photos, narratives, journals). It is important to determine which method works best for your program, depending on your desired outcomes. The method you choose depends on the program results you anticipate, the type of outcomes you expect, your program goals, the extent of environmental education evaluation, and personal preferences of educators. This chapter will attempt to review these questions, and help educators decide what approaches they should take depending on their expected outcomes.

Quantitative approach

In some cases, a quantitative approach may work best for your outcomes measurement. This approach yields numeric results, statistics and percentages. Quantitative research often involves large groups, which can provide reliable data on specific behaviors or attitudes. When program funders or agency supervisors require reports regarding your program, this type of approach often works best. Oftentimes, the insights of an experienced outsider can help you survey program participants effectively, and observe and quantify what is going on in the program. There are various approaches to quantitative research. They can include self-completed paper-based questionnaires, web-based surveys, and close-ended interviews over a webcam or face-to-face.

Qualitative method

The qualitative method is another type of approach. It often deals with descriptive data. It is often used to answer the hows and whys of human experiences, or describe types of behaviors, and interpret why those behaviors are occurring. Observations during the fieldwork can often inform and correct the questions you ask (Patton, 2002). Participants' quotes or even photos can represent the program using qualitative approaches for program evaluation. The focus of qualitative research may derive from questions generated at the very beginning of the evaluation process, ideally through interactions with primary intended users of the findings (Patton, 2002). You may consider a qualitative approach in cases where you need more descriptive information such as stories, "rich descriptions" (Denzin, 2011), pictures, and quotes. Members of your community or even parents who partake in your program may also be interested in details behind the experiences and stories related to your program.

Both qualitative and quantitative approaches can be professional as well as meaningful to the audience. Choosing the right method to get the type of data for your intended audience is important. Ultimately, there is often more than one right way of conducting qualitative and quantitative research and analysis, although some methods are more advantageous for certain purposes than are others.

Evaluation methods

Now that we are familiar with two types of evaluation approaches (qualitative and quantitative) we can review the variety of methods that fall into those two categories. Research can be done either quantitatively or qualitatively, and by

using different methods varying in rigor. Low-constraint, qualitative research techniques may be naturalistic observations (such as similar to Jane Goodall and her methods of performance). High constraint, quantitative types of research may be, for example, a lab experiment within a control group. Both low and high constraint evaluations and everything in between can be valid and reliable.

When evaluating your program, you may ask questions that can be addressed both qualitatively (descriptions) and quantitatively (numbers, percentages):

- How satisfied are the program participants?
- What are the demographics of the program participants?
- Did the participants agree with the program fees?
- How did program participants' feelings and attitudes change after the program?
- Did the program increase stewardship behavior?
- What did the program participants learn from the program?
- Does the program have impacts on ecosystem services, biodiversity, water quality, solid waste and sustainability?

There are several methods that would work in answering each of these questions. Let's look back on the first question, (How satisfied are the program participants?), and explore different ways to answer this question.

1. **Survey.** This is a quantitative approach that helps answer this question. Written or electronic survey with a Likert-scale question written: "How satisfied were you with the program?." Responses could be: "Very dissatisfied," "Dissatisfied," "Neither dissatisfied nor satisfied," "Satisfied," "Very satisfied." Your survey results may determine, "80% of participants who completed surveys indicating they were very satisfied with the program." If you sampled your participants properly, or distributed and received surveys from everyone in the program (census), then "80% of program participants are very satisfied with the program."

2. **Open-ended survey.** An open-ended question on a survey may pose: "Tell us in your own words about your satisfaction level in the program." This is a qualitative approach that may produce a sentence or paragraph describing the participant's satisfaction level. From this survey you may be able to subjectively assign a satisfaction strength number in order to produce a quantitative reply. The qualitative description would allow you to obtain potential details and specific descriptions or quotes.
3. **Observation.** This method would require you to define visual evidence of satisfaction (e.g., participation, attentiveness, smiles, visual cues). The outcome of observation can be quantitative or qualitative. For example a quantitative result might be: "15 of the 17 children were highly engaged through the duration of the program." A qualitative result might be notes that indicated, "Most children were attentive and participating in the program for its duration."



Photo 1. Students from Napper Elementary School in Pharr learn about the 3 R's (Reduce, Reuse and Recycle) from Cyler the Robot. Also pictured are Grace Segovia, Environmental Education Coordinator, City of Pharr and Luis Marin Environmental Education Assistant—who are doing instruction *and* observation.

can demonstrate that a staff member may need to improve their interaction with students or is excelling in student interaction (with little details to offer). But with the accompanying qualitative question, one also could offer more specific information. In fact, this was a real scenario, in which a staff member had an overall stellar interaction with his students. However, we continued to get comments about how he started his discussion before everyone was at their station. From this qualitative information, we were able to give him specifics to work with and undoubtedly to help him increase positive interaction with students.

Quantitative and qualitative studies both have weaknesses and strengths. But when you use both methods together, you may be able to get the results that will be most helpful to guide, improve, and modify your program, and make it more successful.

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5. Short-term versus long-term outcome measurement

Fran McReynolds, CJ May and Christina Dembiec

Defining short- and long-term outcome measurement

What constitutes short-term versus long-term outcome measurement? Liddicoat and Krasny (2013) point out that for researchers studying the causes of behavior, it can be difficult to pinpoint a precise timeframe; for example, participants may be asked questions about significant life experiences over a lifetime. Various researchers have proposed that long-term outcomes range from six months post-experience to forty-five years post-experience and everything in between. Liddicoat and Krasny draw the line between short and long-term outcomes at one year post-experience.

For the purposes of this chapter, we will use this definition: Any outcome measured over one year post-experience is considered a long-term outcome measurement; outcomes measured less than one year post-experience are considered short-term outcome measurements. Both short-term and long-term evaluation methods may be used to measure outcomes from any experience, including day visits to zoos, museums, or nature centers, classroom programs, day camps, multiple-day residential environmental education or outdoor programs, or a longer-term immersion program. Below, we start by discussing advantages and challenges of short-term and long-term outcome measurement.

Short-term outcome measurement

Short-term outcomes can be measured during an experience, immediately after, or within up to a year of the experience. For example, during the experience, an educator might check with program participants to make sure that they understand concepts or can perform certain skills, adjusting the experience as

necessary to help ensure that learning outcomes are met. After the experience, the educator might interview, observe, or send a questionnaire to participants to determine outcomes such as their knowledge of local ecological principles, whether they have gained the skills to grow and harvest their own food, if they spend more time enjoying outdoor spaces, or if they have begun recycling.

There are several advantages of using short-term outcome measurement. First, participants can be contacted more easily during or immediately following the experience, while everything is still fresh in their memory and they are easy to locate. Feedback is provided quickly and may be used as formative as well as summative evaluation. Furthermore, expenses tend to be more manageable for short-term evaluation, since the evaluator can locate and follow up with participants in a timely manner.

On the other hand, there are drawbacks to short-term outcome measurement. Short-term outcomes may be temporary and measuring those outcomes may not measure real changes in behavior. Some outcomes or behaviors might take time to develop and might not be present soon after the experience. In addition, short-term evaluations can negatively impact the delivery of a program or experience. Pre-testing, post-testing, or being "quizzed" during an entertaining program could shift the students' perceptions of a "fun" experience to a more structured "school-like" program.

Long-term outcome measurement

Long-term outcomes can be measured from one year after the experience throughout a participant's lifetime. Long-term outcomes may include behavioral

or attitudinal changes, career choices, mental and/or physical health benefits, interest in the environment or in science, and other outcomes (Wells and Lekies, 2012).

Measuring long-term outcomes can create significant positive impact for programs and initiatives. Funders may be more likely to fund a program if it proves to have a long-lived influence on its participants. Knowing that their actions are being measured over time, participants may stay more actively engaged in their roles as environmentally responsible citizens. In addition, long-term evaluation encourages partnerships—not only with the program participants, but also with others, such as universities or government agencies that may play a role in long-term outcome measurement.

However, there are many challenges of long-term evaluation. First, there is the difficulty of keeping track of participants in our mobile society. This means that long-term evaluation requires more time and personnel, which makes it more expensive. It can be difficult to keep staff and funders engaged while waiting for the results of the evaluation. Also, it is time consuming to develop methods and means for partnering with outside/third parties to assist with long-term outcome measurement.

Perhaps one of the greatest limitations to overcome for long-term evaluation is validity of the data. For example, there is the problem of intervening variables (Liddicoat and Krasny, 2013). Over the course of time, many experiences could contribute to behavior or attitude changes. It is unlikely that a single event of any duration can be pinpointed as the source of behavioral change years later. Bixler and Vadala noted that factors such as education, work, other people, and exposure to pollution were cited as influential to participants in explaining current attitudes and beliefs (cited in Liddicoat and Krasny, 2013). On top of that, participants who did not enjoy an experience might not be willing to participate in an evaluation of that experience. If they do participate, they may report responses that they see as socially desirable, or as something they feel the reviewer wants to hear. Additionally, memory varies from person to person in length and in accuracy;

what one participant remembers for years might be lost to another after a few months.

Liddicoat (2013) has summarized and critiqued data from many long-term environmental education studies. Her work examined findings about program outcomes using significant life experiences, retrospective interviews, and participant memories. Many significant life experience studies are theoretical, but are increasingly supported by empirical research. Retrospective program evaluation, which relies on participant memories, can communicate what the participants retained; further studies in this area might lessen some of the ambiguity about the causes of behavior or attitude change over time (Liddicoat and Krasny, 2013).

Methods and instruments

Determining whether to use short-term or long-term outcome measurement should occur early in the process of program and evaluation planning. Simmons (2004) points out that chances to administer pre-tests or to collect initial information can be lost if thorough planning does not take place.

Short-term outcomes are generally used to help quantify knowledge and/or skills gained, such as understanding about non-point source pollution or how to set up a Leave No Trace campsite. Short-term outcomes may also include behavior or attitude changes that might occur following an experience. For example, participants might use a bicycle for transportation or feel more comfortable outdoors. Short-term outcomes can often be measured by existing staff with some training and can often be incorporated into a program. Specific outcome examples, along with several possible measurement tools, are shown in the Table 1.

Long-term outcomes are generally used to help measure environmental literacy, including long-term attitudes, behaviors, or actions. Long-term outcomes usually have impacts that extend beyond the individual to the local or regional community, the environment, or even global impacts. It is important to realize the limitations

Table 1. Selected short-term environmental education outcomes with possible measurement methods.

Component of environmental literacy	Example short-term environmental education outcomes	Possible measurement methods
Knowledge	Local ecological community	• Pre/post-test, using the same questions
	Where food comes from	• Verbal quiz, using show of hands or thumbs-up, thumbs down
	Criteria for determining stream health	• Ticket out the door—participants answer a prompt on a slip of paper and hand it in as they leave
Skills	Think critically	• Mind mapping—participants individually complete a mind map; can edit with the group to delete misinformation or add new information
	Identify and remove invasive plants	• Surveys
Attitudes	Interest in science class	• Participant interviews
	Enthusiasm for a field trip	• “Voting” by putting a token in a box
Behaviors	Help with a citizen science program	• Social media, such as Facebook or Instagram (unstructured, but can have unexpected results)
	Recycling or composting	• Snapshot assessment (see the case study below)
	Stop using plastic bottled water	• Participant observation

and difficulties of long-term outcome measurement, as stated in the section above. Long-term outcome measurement often requires expertise beyond that of a typical non-formal or informal education organization. Specific outcome examples, along with several possible measurement tools, are shown in the Table 2.

Table 2. Selected long-term environmental education outcomes with possible measurement methods.

Component of environmental literacy	Example long-term environmental education outcomes	Possible measurement methods
Knowledge	Natural resource issues	• Surveys
	Naturalist skills	• Participant interviews
	Criteria for determining stream health	• Snapshot assessment (see the case study)
Skills	Responsible voting	• Significant Life Experience studies
	Ecosystem restoration	• Retrospective interviews about specific events
	Ability to analyze information	• Participant memory studies
Attitudes	Pursue a science career	• Mapping general trends such as numbers of science major graduates/career choices
	Nurture enjoyment of public land in others	
Behaviors	Become a citizen scientist	
	Lead recycling or composting program	
	Minimize dependence on fossil fuels	

Case study: Snapshot assessment

Written by Cyril May (CJ May), based upon the final report completed by Amanda Armour, Ruth Ditlman and Melissa Ivins, graduate students at Yale who worked on the program during the 2010–2011 academic year.

Snapshot assessment was used to measure short-term and long-term effects of recycling education, and to accompany related community-based social marketing. Yale Recycling developed the Snapshot Assessment method for determining the efficacy of its efforts to use community-based social marketing in increasing participation by faculty, staff and students in on-campus recycling programs. The method provides a relatively solid set of metrics for recycling behavior that may be utilized for both short and long-term assessment.

Snapshot Assessment had been used by Yale's recycling coordinator for years in an effort to make recycling education into more of a game or contest. CJ May, Yale's recycling coordinator, looked into trash and recycling bins within specific departments and graded each based upon the percentage of correct material inside. For example, a trash bin would receive a grade of 75% if twenty-five percent of what was visible with a glance was inappropriate to the bin i.e. recyclable. Likewise, a recycling bin containing 60% recyclables and 40% trash would receive a grade of 60%. Increments were recorded at 5% intervals. This informal snapshot methodology allowed Yale Recycling to track the performance of the printing office bin-by-bin over a year, marking its slow progress toward 90% in both trash and recycling bins. Most importantly, it allowed Yale Recycling to see which of its methods for improving participation were effective. In the case of the printing office, promise of a large pizza party (reward) provoked staff members into policing one another's performance (creation of a norm).

In 2011, Yale Recycling formalized this method as Snapshot Assessment in its 5 Days for Recycling program, an effort to measure the effectiveness of community-based social marketing in increasing participation. This advanced version utilized digital photographs, taken several times each week after the departure of departmental staff. The Yale Recycling team member photographed the contents

of individually tagged public and workstation bins (Photo 1). The bins were given grades by another member of the team who coded the photos after they were uploaded to a shared site. Yale Recycling performed several assessments each week for several weeks before the 5 Days for Recycling program, during the week of the program, and for several weeks after the program. Although the community-based social marketing efforts were not successful in resulting in post-program behavior change, the Snapshot Assessment was successful in providing bin-by-bin information on these effects or lack thereof.



Photo 1. Yale researchers took photos of the contents of trash and recycling bins then graded them by percent correctly sorted.

Snapshot Assessment could be considered for use by recycling educators and other educators involved in programs in which participant behavior changes can be observed in physical evidence, e.g., sorted trash and recyclables. An additional advantage is that Snapshot Assessment may be re-initiated long after a program of education to determine long term effects. Another advantage is that this last

evolution of Snapshot Assessment allowed for the tracking of participation bin-by-bin. For desk-side recycling and trash bins, this assessment can provide a look at the behavior of specific individuals over months or years, which provides a tremendous opportunity for measuring effects of environmental education on a specific behavior.

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6. Measuring pro-environmental behavioral change

Susan Meyers, Alison Paul and Maria Carolina Pulido

What are pro-environmental behaviors?

Changing behaviors is an important aspect of many environmental education programs. Behavior change refers to altering the voluntary actions of an individual or a community. It is closely related to, but distinct from, creating awareness, instilling knowledge or altering attitudes.

Common pro-environmental behaviors that environmental education programs aim to change or impact include (Evaluation glossary, n.d.):

- Lifestyle behaviors such as riding the bus, recycling, connecting with nature in an urban environment, or conserving water or energy;
- Volunteer behaviors such as participating in local park restoration project or citizen science monitoring;
- Civic behaviors such as voting in elections;
- Consumer behaviors such as buying organic produce or recycled products;
- Advocacy behaviors such as boycotting an environmentally unfriendly business.

What are the barriers to behavior change and the strategies to overcome these barriers?

The table below (McKenzie-Mohr, 2011) lists possible barriers or reasons that a person would resist or be inclined not to change their behavior. It also suggests some strategies that may be employed to effect behavior change by overcoming these barriers based on community social marketing.

Table 1. Behavior barriers.

Barriers to behavior change	Appropriate strategies to overcome barriers
Lack of motivation	Commitment, social norms, incentives
Forget to act	Prompts
Lack of social pressure	Social norms
Lack of knowledge	Communication, social diffusion
Structural barriers, such as cost, location.	Convenience

The strategies listed in Table 1 are further defined by the following examples:

- **Commitment or good intentions to act:** signing recycle pledge cards, posting photographs of those making a commitment to keep dogs on a leash along a beach trail to protect nesting birds, asking homeowners when they expect to complete weather stripping and for permission to call back to help them troubleshoot any problems;
- **Communication or creating effective messages:** presenting information that is vivid, concrete and personal such as describing the amount of waste produced annually by Californians as “enough to fill a two-lane highway, ten feet deep from Oregon to Mexico;”
- **Convenience or making it easy to act:** providing and/or installing energy efficiency or water saving devices, initiating free curbside recycling services;

- **Incentives or enhancing motivation to act:** charging for the use of plastic shopping bags at the checkout, providing rebates for home energy retrofits, deposit refunds for glass bottles;
- **Prompts or remembering to act:** posting “Turn me off before leaving this room” signs on light switches, labeling lids which indicate which recyclables go in which container;
- **Social diffusion or speeding adoption:** distributing different colored armbands to students based on the distance walked or biked to school, asking residents who grass cycle to speak to their neighbors and friends about this sustainable behavior;
- **Social norms or building community support:** publicly communicating the percentage of community members who comply with water restrictions, attaching gas mileage bumper stickers to fuel efficient cars, comparing the energy usage of one consumer to his neighbors on a monthly billing statement.

The effectiveness of these strategies can be assessed by evaluating changes in behavior. For example, the volume of office paper recycling can be assessed before and after providing recycling bins showing the difference after the “convenience” removed the “barrier.”

How can behavior change be measured?

When designing an evaluation plan, establish the desired outcomes of the program and determine what is measureable (Table 2). Some additional factors to consider when assessing behavior are its frequency, duration, and intensity.

Table 2. Behavioral change measures.

How behavior change is measured	What is being measured	Examples of measure, or measuring tools
Self-reported	The intention to act	<ul style="list-style-type: none"> • Survey • Pledge • Interview
Observation	A prelude to the desired action	<ul style="list-style-type: none"> • Number of individuals voluntarily participating in an informational program such as composting or stream monitoring
Self-reported	The action itself	<ul style="list-style-type: none"> • Surveys • Interviews
Observation	The action itself	<ul style="list-style-type: none"> • Number of individuals participating in an exchange program trading existing incandescent bulbs for compact fluorescent lamps • Number of individuals filing rebates for water saving or energy efficient devices • Increase in volume of curbside recycling • Number of individuals voluntarily participating in a stream restoration project
Observation	The result of the action	<ul style="list-style-type: none"> • Decrease in average kilowatt-hours on monthly energy bill • Comparisons of pro-environmental behavior between program participants and non-participants, or between before and after a program (Todd et al., 2012) • Increased macroinvertebrate diversity in stream

Example: Georgia Adopt-A-Stream

This example was chosen because it shows that a twenty-year-old citizen science program, though successful, can use evaluation tools and social marketing strategies to assess and address the barriers to pro-environmental behavior change. The program's goals are to increase public awareness of the State's nonpoint source pollution and water quality issues, to provide citizens with the tools and training to evaluate and protect their local waterways, to encourage partnerships between citizens and their local government, and to collect quality baseline water quality data. Varying levels of involvement are possible from simple stream habitat visual surveys to chemical, macroinvertebrate, or bacterial monitoring (Photo 1). Those who attend and pass QA/QC tests are considered quality data collectors for one year and can post their data online at www.GeorgiaAdoptAStream.org once they adopt a stream.

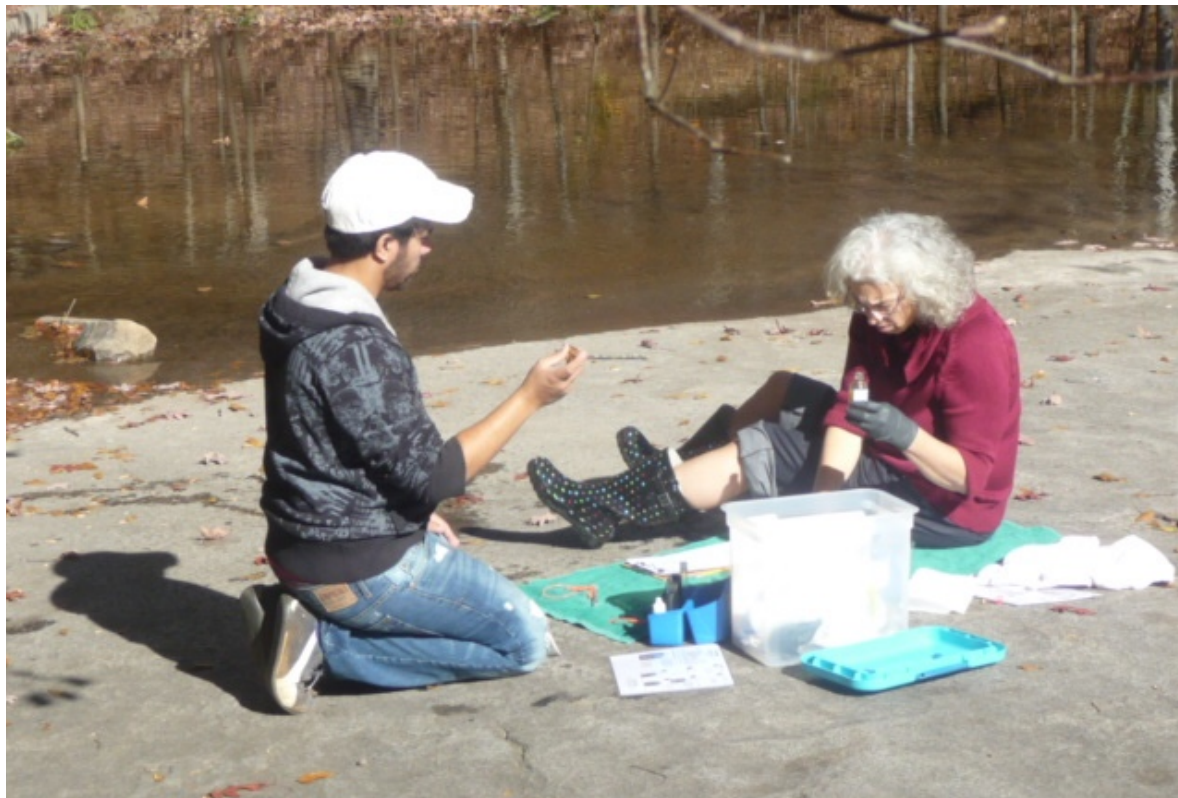


Photo 1. Two volunteers test the stream waters inside Stone Mountain Park, GA.

It has been relatively easy to track both individual participation and total numbers of trained data collectors, sites adopted, trainings offered, and monitoring events by the data entered on the website. These pro-environmental behaviors are great indicators that the program has been effective in reaching several of its goals. The concern has been with those individuals who attended a training but did not take the next step of adopting a stream. Participation in the training was certainly a prelude to the desired change of behavior, but why were these participants not continuing to the next stage?

A pre-survey at every workshop was started this year to find out why participants attend, and if age, gender, employment, or other factors determine the audience. The next step is to follow up with participants at one, three, and six-month intervals with an e-mail survey to assess their needs. Do they need more information, a source for testing equipment, a safe and convenient location to monitor? What are the barriers? Would incentives or the opportunity to hear about the successes of others encourage stream adoption? In what ways does the program need to be adjusted? Although in the initial stages of collecting data, the process and subsequent changes will be shared with all participants, building the commitment and ownership that are vital to the program.

Case study: Increasing hotel towel reuse

This case study describes how a social norm tool was used to increase towel reuse by hotel guests (Goldstein et al., 2008). Over the study period, three different messages were used with hotel guests:

- a. **Environmental protection:** You can show your respect for nature and help save the environment by reusing your towels during your stay.
- b. **Descriptive norm:** Join your fellow guests in helping save the environment. Almost 75% of guests who are asked to participate in our new resource savings program do help by using their towels more than once.
- c. **Room specific descriptive norm:** Join your fellow guests in helping save the environment. Almost 75% of the guests who stayed in this room who are

asked to participate in our new resource savings program do help by using their towels more than once.

After each of these messages was used, the percentage of guests choosing to reuse their towels was calculated, revealing that 37% of guests reused towels with the standard environmental protection message. The descriptive norm message increased the percentage of guests choosing to reuse their towels to 44%. With the room specific descriptive norm, 49% of the guests chose to reuse their towels. Combining communication and social norms where people could easily equate themselves to other guests and perceive the desired behavior was the most effective strategy.

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7. How to know when we don't know

Bob Coulter

One of the great challenges the staff of any educational program face is to know the program's impact on participants. How do we know it's "working?" For that matter, just what does "working" look like? This challenge is particularly acute for environmental education programs, in that many of our goals are less amenable to purely objective measures. While we can assert with some confidence whether a student knows basic multiplication facts or knows how to punctuate a sentence correctly, just what is the threshold for counting someone as environmentally committed? How do we rate someone's civic character? Even if we can get some index of measures that serve as a proxy for these constructs, how do we tease out the marginal contribution of our program in the mix of each participant's life experiences before and after our programs? As we seek to define and measure outcomes, we need to acknowledge that we usually don't have substantial amounts of interaction with our school partners or other program participants. Instead, we work intermittently at best with teachers and students, with 3 or 4 experiences spread across a school year counting as a sustained effort. Hence, our work is often just a small portion of participants' total life experience.

Combining these challenges, we end up with a real evaluation conundrum: We certainly know some things from observations, and perhaps we gather some data with overt tools like focus groups, surveys, and the like. But we still have a lot of holes in the picture that we need to fill if we are to understand our programs and how well they achieve the goals we set for them. As Shapiro and Biber (1972) note in their consideration of the challenges of knowing what works in education, "one treads a rough path between knowledge and opinion. Certain facts seem well substantiated, many are open to question, others remain an article of faith" (p. 61). Just how do we connect the dots? One tool that is useful in

addressing this gap between what we would like to know and what we actually do know is abductive reasoning, or more colloquially as "inference to the best explanation."

As a thought tool, abductive reasoning is the less known cousin of deductive and inductive reasoning. Deductive reasoning is frequently captured in logical syllogisms such as:

1. All cats have whiskers
2. Peach is a cat
3. [Therefore] Peach has whiskers

Inductive reasoning is very common in science, where ongoing collection of evidence supports a generalization until contrary evidence is unearthed. For example, the classic case of observing a group of swans might lead to the conclusion that all swans are white. This works for a while, until the observer encounters a black swan, at which point the conclusion needs to be revised. In many ways abductive reasoning is similar to inductive reasoning, with the critical difference that in abductive reasoning there is often a dearth of evidence. Hence colloquial terms are often used, such as inference, guess, or even "best shot." The key here is to develop the capacity to reason from limited information, which is often the case as we evaluate programs on the fly.

Applied to a simple case, we can see abductive reasoning at work. If you look outside in the morning and see that the sidewalk is wet, it's a pretty good bet that it rained last night. Do you know this for sure? Perhaps not, but it's a more likely explanation than aliens watering the pavement. If you know that your building

custodian washes down the sidewalk every Tuesday morning (and today happens to be Tuesday), you might have an even more plausible hypothesis to explain the wet pavement. This simple vignette is meant simply to illustrate the process of reasoning in an ad hoc sort of way that fills in the gaps to the best of our ability and helps us to arrive at a hypothesis—or “a presumptive inference” as C.S. Peirce has called it (Eco and Sebok, 1983). More than just a hunch, the key to a good abductive inference is that it has a reasonable warrant of evidence behind it. From there, can we discern the best explanation, in terms of being the one most supported by the evidence and being generally useful in making future explanations? These are hallmarks of good abductive reasoning.

How can I avoid simply concluding what I want to conclude?

Working from limited information can certainly lead to what amounts to a confirmatory bias, where we draw conclusions that support our pre-conceptions. To avoid this, we need to keep our own theorizing in check until we have sufficient evidence. As Sherlock Holmes noted, “it is a capital mistake to theorize in advance of the facts.” In practice, drawing interpretive conclusions requires an ongoing interplay of what we observe and what sense we make of it, followed perhaps by iterative modifications based on new evidence or more refined interpretations of the evidence before us. Pure objectivity is challenging, and a goal that is likely to be approximated more than fully achieved. Still, we need to develop an evaluation mindset that lets us continuously process what is happening in our programs.

John Stuart Mill offers a couple of tests that we can use to check ourselves against inadvertent bias. First, there is his Method of Agreement where, as Lipton (1991) describes it, if we can identify “only one antecedent that is shared by all the observed instances of an effect, we infer that it is a cause” (p. 18). Complementing this is Mills’ Method of Difference. Again quoting Lipton, “[w]hen we find that there is only one prior difference between a situation where the effect occurs and an otherwise similar situation where it does not, we infer that the antecedent that

is only present in the case of the effect is a cause” (p. 18). When used regularly to guide our work, Mills’ Methods of Agreement and Difference can provide check points to ensure that the data supports where our interpretations are taking us. The key is to be certain we are using all of the evidence available to us, and not just that which supports our preferred inference.

How can I use abductive reasoning in evaluating programs?

Given limited space, I will highlight one example from my work at the Litzsinger Road Ecology Center, a field site managed by the Missouri Botanical Garden. A key program evaluation question for us is: To what extent is the teacher a variable in the kids’ experiences? It’s not uncommon when we work with large schools for there to be multiple classes in each grade. For one of the schools we work with, there are four second-grade classes. We normally require all of the teachers starting a partnership with us to participate in a three-day planning workshop. In this case, three of the four teachers were willing to do this; the other just couldn’t get her head around outdoor study. Given school administrative concerns about kids at a given grade level having nominally the same experiences no matter who the teacher is, our choice was to take all or none of the classes. We went for all of them, including the hesitant one. Back to the original question, extended a bit: What is the impact on kids of a teacher who is manifestly passive toward outdoor study, even if the kids are nominally participating in the same program as their peers in other classes? Evidence before us was based on about six to eight hours of observations made by a mix of staff and volunteers who worked with the kids. Staff were consistent throughout; volunteers worked with classes as their episodic schedules allowed. Kids observed included the class led by the non-participating teacher and her three participating colleagues.

Collectively, the staff and volunteers observed noticeable differences among classes in the kids’ level of interest in ecology, observation skills, and ability to go beyond simple recitation of textbook terms and concepts. Teasing this out with the help of Mill’s Tests for Agreement and Difference (described above), there are a

number of points of agreement in the kids' experience: They all have veteran homeroom teachers, and in the aggregate enjoy similar home lives and live in the same neighborhoods. We also observed that for the most part the kids had basic skills and capacities typical of kids that age, and picked up over time that most had the relative lack of free outdoor exploration experience typical of modern suburban kids. These common features helped us to create a program for their needs, somewhat different from what we might create for a school where the kids had more outdoor experience and/or more previous experience on site with us. Points of difference between classes devolved primarily to members of the class with the teacher who didn't go outdoors as willingly as her peers. (This reasoning assumes an otherwise random assignment of kids among the classes at that grade level.)

You may be saying that this is somewhat intuitive, but this is where it gets interesting from the standpoint of program evaluation and subsequent policy-making. Dig more deeply into the teacher variable: Is the real difference in the kids' experience emerging from the teacher's lack of workshop participation, or is it the deeper issue of the teacher's discomfort with being outside which manifests itself in the non-participation in the workshop and her not taking the kids outdoors. There are two logical chains here that need to be considered:

1. She wasn't trained by us in how to work effectively with her kids outside; ergo, if we or someone else could train her, she'd do better. Many environmental education programs operate on this "train and go forth" model.
2. Her not going to the workshop and not leading the kids in meaningful outdoor work reflects a deeper role identity that doesn't encompass field study. Change, if it were to happen, would require a deeper shift in personal and professional identity. In other words, she can't just be workshopped to a new level of practice.

In terms of program evaluation, if we were to go with option #1 as the explanation, it would affirm the value of the orientation workshop, and uphold the value of the participation requirement. Option #2 suggests a more cautious view on our part of

the value of the workshop. In practice, it recognizes that there are things we just can't train past, and even if we have nominal compliance with the workshop requirement, we can't expect it to serve as a magic elixir. Based on the totality of evidence available to us—our observations, discussions with all of the teachers in the grade level, and our experiences with other teachers (who have and who have not participated in the workshop)—we've gone with option #2. We still hold the orientation workshop and reward participation among new teachers with scheduling priority, but it has given us a more measured level of support for the role of the workshop as a professional development experience. The rationale for this policy decision is buttressed by examples counter to the one shared here where teachers have missed the orientation workshop but have gone on to develop quite good projects.



Photo 1. We often support students in taking action in the community. Are we building civic character that will extend beyond their time with us? How do we know?



Photo 2. Enjoyment and camaraderie are important parts of learning. How can we consider these hard-to-measure factors in evaluating our programs?

Where is the value in using abductive reasoning?

I can see two primary benefits in actively developing and working from inferential hypotheses:

1. Giving us working hypotheses that are good enough to let us proceed with the work at hand, without needing to subject every issue to full analysis. Practically speaking, we don't have time or resources to measure and document everything, yet we have to act with our best understandings. If we can get to the point of routinely applying Mills' tests to guard against defaulting to biases that confirm what we want to believe, we can move forward with a reasonable degree of empirical certainty.

2. Articulating tentative ideas that—if time and resources permit—could be trussed up for more substantive analysis. If what you are seeing is particularly interesting, or if having more firmly established knowledge is essential for making decisions, then the conclusions that were arrived at abductively may help in forging hypotheses for more extensive research. Given limits of time and resources, these formally investigated issues will only be a subset of what we might be interested in “knowing.”

While formal program evaluation is a powerful tool, it is also important to hone our skills in making evidence-based inferences. With careful observation and a commitment to iterative reflection, we can fill in gaps in our understanding and craft more effective program designs.

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8. Measuring education outcomes as a tool in regulatory compliance

Leah Saffian and Colleen Spencer

The U.S. Environmental Protection Agency (EPA) and each state's environmental agency is tasked with regulatory oversight to assure federal and state environmental protection laws are followed. Local governments and the private sector develop plans and implement programs to improve and protect environmental conditions within their jurisdiction and adhere to these regulatory requirements. Programs include: stormwater management and pollution prevention, water conservation, drought contingency, groundwater reduction, or those to improve water quality such as watershed management and source water protection or total maximum daily load implementation plans. Most plans include some form of environmental education for staff, employees, contractors, and the citizens of the community.

The education component can prove to be highly beneficial to achieving the required purpose of a regulatory plan. Citizens knowledgeable on current regulatory issues are more likely to back local programs designed to improve local environmental conditions addressed in the plan; making community education and involvement essential to successful implementation. Just as important is the planned ongoing evaluation of the plan's education programs.

This chapter looks at the importance of and suggests approaches to planning and evaluating the education component of regulatory plans as a measure of not only the plan's educational goals, but also as an indicator of the education component's impact on changing the environmental culture of the community. In addition, examples of potential partnerships with other entities are suggested to accomplish common environmental education goals.

Regulatory plans are developed and funded locally to meet the specific requirements defined by law and enforced by regulating authorities: EPA, state environmental agencies, or regional and county entities. The local community defines the goals of their plans and decides how best to implement programs based on suggested best management practices.

As with each goal in a regulatory plan, the evaluation of education programs and goals within the plan is critical to measuring a plan's overall cultural and environmental impact. Aspects of environmental education related to regulatory plans should attempt to:

- Connect citizens to the issues addressed in the regulatory plan;
- Empower them with knowledge;
- Solicit an investment in solutions to meet the plan's environmental goals; and
- Embolden stewardship to transform the community's environmental culture related to the the plan's target issues (Figure 1).

For example, if a goal of a stormwater plan is to reduce nutrient pollutants entering waters of the state from neighborhood run-off, educating residents and lawn maintenance companies on the importance of reduced fertilizer use and proper disposal of yard trimmings would be a goal of the stormwater plan's education component. So how do we measure success of this education program?

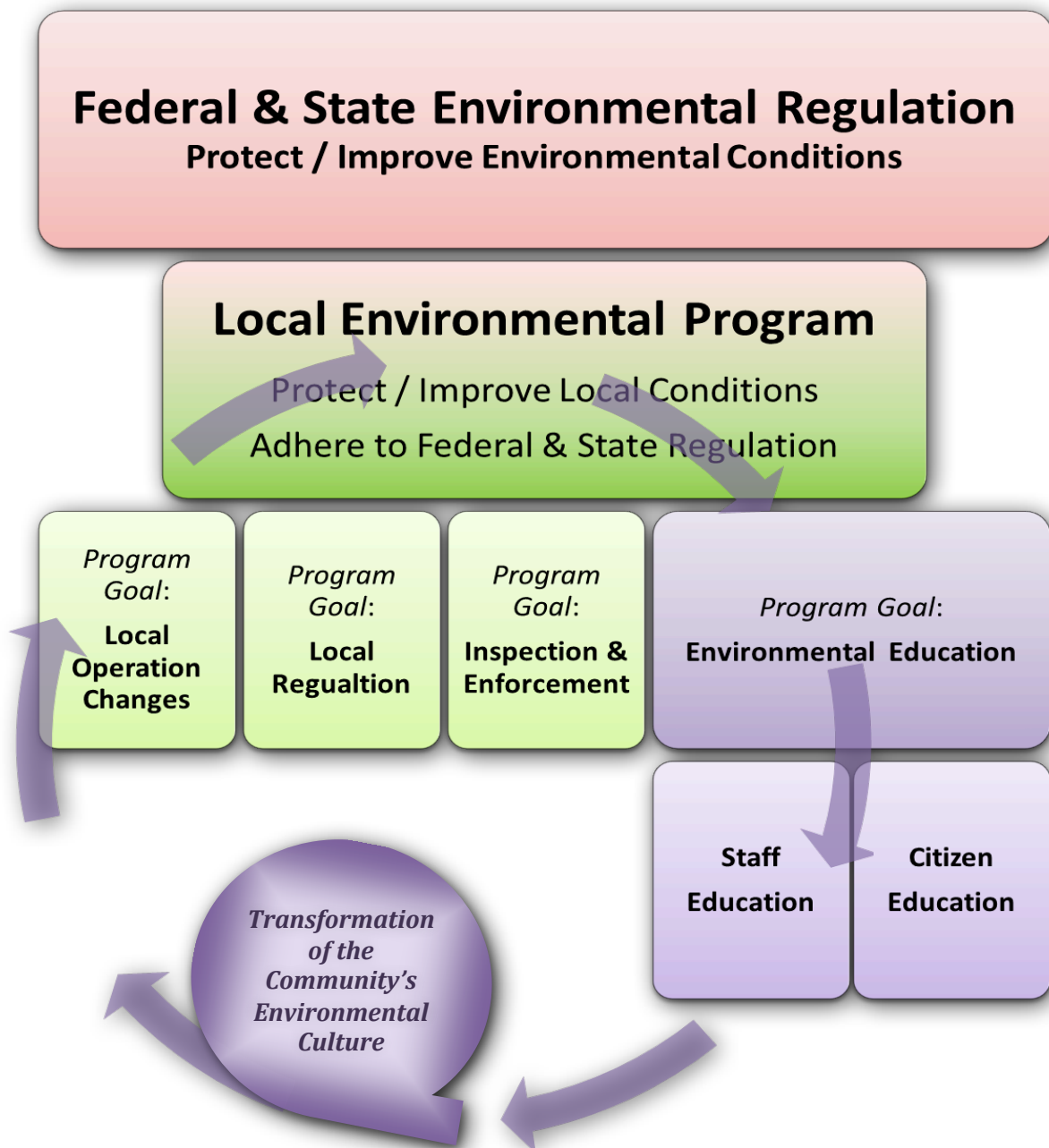


Figure 1. Community's environmental culture transformation.

The EPA's manual, Measurable Goals Guidance for Phase II Small MS4s (see EPA Manual) suggests measuring efforts quantitatively by the number of students, participants, businesses, pamphlets, brochures, workshops, etc. This tells the story of the plan administrator's efforts which may satisfy regulatory requirements, but to truly measure the impact of our education efforts, we must dig deeper and develop evaluation tools that measure qualitatively what has happened as a result

of our education efforts; how knowledge has changed individual attitudes and community culture. Such evaluation would measure the outcome of our efforts: for example, a residents making a conscience decision to reduce fertilizer application after attending a neighborhood landscaping workshop. Measuring this type of response gives us a better picture of the success of the stormwater education program's landscaping workshops. Patton describes this qualitative evaluation method of telling "the program's story by capturing and communicating the participants' stories" (Patton, 2002). This evidence of success is what plan administrators should pursue. Coupled with water quality sampling data showing reduced nutrient loads, qualitative evaluation demonstrates that our landscaping workshops are a viable tool to connect citizens to stormwater issues and empower them to be part of the solution to improve water quality while also meeting regulatory requirements.

So what should be the approach to environmental education in regulatory plans? While regulatory plans are often viewed as a burdensome financial demand on a community, partnerships with other governmental and non-governmental organizations that offer educational or environmental programming may be a win-win to accomplishing mutual environmental education goals. This brings about not only a change in an individuals' action related to the environment but also change in the community's environmental culture. Trust and social connections among a community's many diverse audiences can change environmental norms, establishments and regulations, and create a community attentive to environmental stewardship and community-based natural resources management.

A city water department's conservation team joining forces with the county agricultural extension service to bring university research-based landscape irrigation practices, plant material recommendations, and rainwater harvesting techniques to the local community during neighborhood landscape workshops is an example of a mutually beneficial partnership. The environmental education outcome, changing outdoor water use practices to conserve water, is a goal of both organizations. Evaluation tools may include pre and post workshop surveys to measure the knowledge gained and each participant's intention to act, and a

retrospective survey mailed to participants six months later to determine behavioral intention, actual action, and improvements in water conservation.

The stormwater plan administrator is teaming with local youth groups to mark storm drains and distribute pollution prevention information to neighbors. This partnership engages youth to convey the environmental message to residents in their community. The evaluation of this project uses the number of storm drains marked and pollution prevention information distributed; and involves surveying participants before and after the event, a visual assessment of litter and debris in the neighborhood's stormwater collection system before and a month after marking, and illicit discharge reports before and after the marking event.

Partnering with the local Keep America Beautiful affiliate, the city's water conservation and source water protection messages can be carried to middle schools through a jointly funded environmental education entertainer. A segment of the performance includes how to use the shower timer that is given to each student after the presentation. To determine outcome of this environmental education program, teachers are asked to have students illustrate or write about what they will do to help the community conserve water and protect our water ways. The number of students attending and timers distributed is recorded.

Logic models as illustrated in NOAA's "Designing Evaluation for Education Projects" (Simmons, 2004) are a useful tool to use during development of the education program and corresponding evaluation methods to define mutually desired short and long term outcomes. Many resources on developing outcome based measurement tools can be found throughout this publication. Non-governmental organizations like North American Association for Environmental Education (NAAEE) and the U.S. Green Building Council (LEED buildings) can also be resources for guidelines and regulations to apply to education program and evaluation development.

Environmental education influences change. Assuring a regulatory plan's education efforts is beneficial to improving a community's environmental

conditions can only be determined through in-depth planning and corresponding planned, well implemented evaluation techniques. Regulatory plan development that includes outcome based environmental education and utilizes measurement tools to measure outcomes strengthens the regulatory plan and the community's environmental culture which, in turn, supports accomplishing the goals of the regulatory plan.

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9. Integrating outcome measurement into environmental education programming

Michelle Eckman and Marti Copeland

Like all educators, environmental educators are challenged by time and money to create and implement meaningful, outcome-driven evaluations. In this chapter, we seek approaches and techniques to measure the impact of our programs that are at once informative, cost-effective, realistic, and efficient.

One attractive solution to the limitations of time and money is to integrate measurement tools into our actual programs. Here we explore various approaches to Within-Program Evaluation, including but not limited to:

- **Drawings**—i.e., students draw their interpretations of nature before and after their experiences, “what does a scientist look like?,” linked concept circles, or concept maps;
- **Rubrics/“scorecards”** – for school teacher or chaperone to fill out during program;
- **Interviews**—students respond to established questions asked by staff or fellow students;
- **Videos**—a staff of educators review videos of programs and fill out a rubric for “lightbulb” or “teachable” moments; students create videos to demonstrate cognitive or emotional outcomes;
- **Models**—i.e., students invent a “water treatment product” to clean pond water, students build a complete “habitat” with found materials.

Typically, evaluations seek to enumerate or quantify the impact of a treatment, in this case, an environmental education program. We highlight some means of quantitative Within-Program Evaluation, but many of these methods are qualitative measures of student understanding. The benefit of qualitative

measures is that they can also elucidate student attitude toward learning or the concept and where problems may exist in their understanding—all of which provide a great deal more information to the evaluator than a quantitative measure alone (McLean et al., 2003).

Drawings, concept maps, semantic webs

Student artwork, drawings and other visual representations can be used as a measurement instrument during environmental education programs. Drawings may show a shift in values or a change in intended behavior as a result of an environmental education experience (Thomson et al., 2005.).

Semantic webs are visual representations that demonstrate an understanding of the meaning of words or terms. Schusler (2013) reported one program’s use of semantic webs as a means to evaluate student understanding of reptiles and amphibians before and after a herpetology program. Students were specifically told they were not being graded, but that the information they depicted would be used to help the program staff teach the program better. Students were instructed to draw the word “herpetology” in a circle in the middle of the page and then draw related words in other circles around the herpetology circle. In general, students had fewer words in circles before the program, and more word circles after, including more relevant words. This tool can generate a mix of qualitative and quantitative data (Figure 1).

Concept maps also consist of a main theme word or term written in a central circle, and then supporting and related terms drawn in circles around the central

theme. Concepts are then linked together with lines connecting between circles. Students who have a more in-depth understanding of a topic will have more circles and lines connecting related concepts. Again, concept maps can be used for a mixed measure of qualitative and quantitative results.

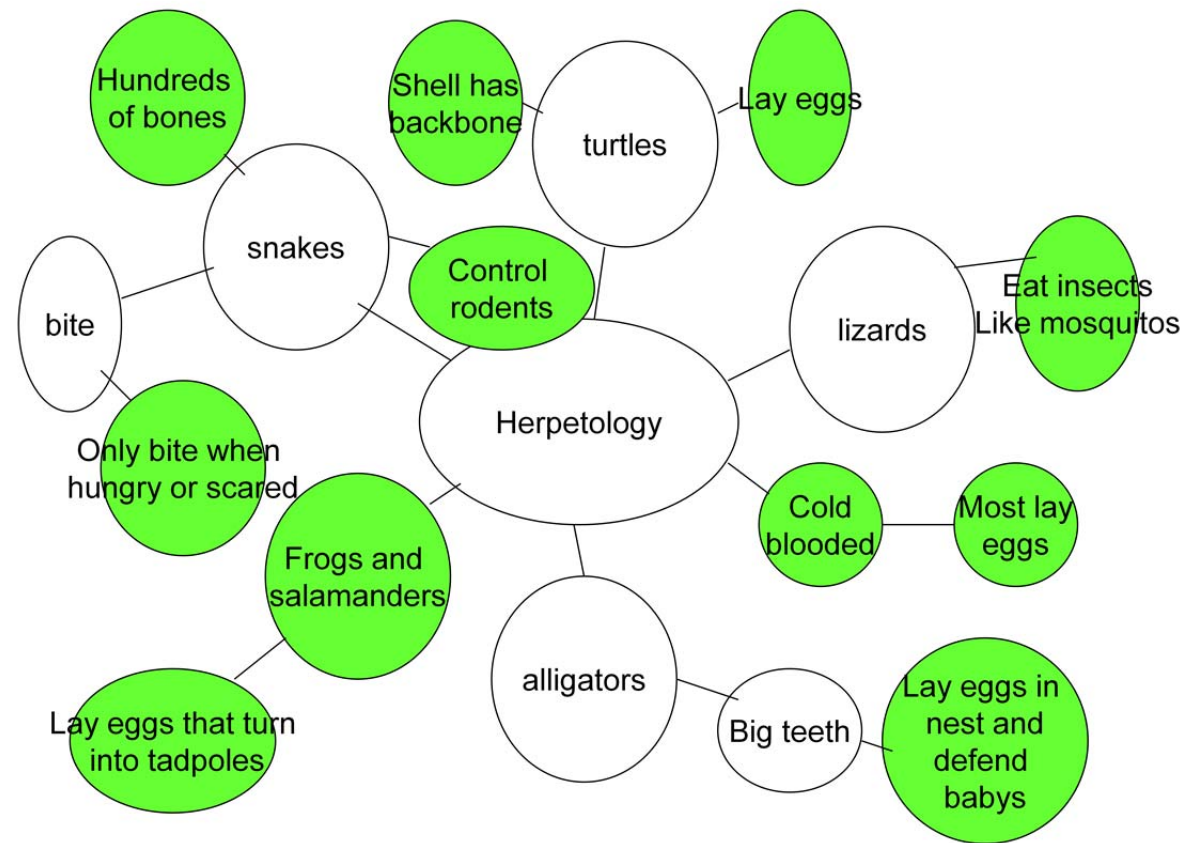


Figure 1. An example of semantic web. The green circles represent additions after the program. The diagram is created by Renee S. Morrison, Jacksonville State University Field Schools' Learning Station.

A study completed at a residential outdoor education program in Texas utilized students' pre- and post-experience drawings of nature to show a shift in values. Many pre-experience drawings showed symbols of nature, such as a sun, tree, sky above and grass below. The post-experience drawings showed more specific detail, including bark texture, leaves, and specific animals relating to their outdoor experience. This demonstrated that students gained a deeper understanding of the features of the ecosystem and possibly the relationship between organisms and their environment.

Drawings can also be used to show cognitive understanding and attitudes. One such technique is the Draw-A-Scientist Test (Chambers, 1983). This approach has been used for decades, and was recently implemented at an Audubon Center in Dallas County, Texas. Audubon educators asked each participant to draw a scientist during the introduction to their nature-based school field trip. As research has shown to be the case for nearly the past 100 years, students at the Audubon Center routinely drew a person in a lab coat at a table with a container of bubbling liquid. Often, the person had crazy hair (like Albert Einstein) and eye-glasses. These drawings were useful to the instructors for understanding the students' existing ideas about science. A possible extension would be to ask students to add to their drawings at the end of the program. Drawings could then be analyzed for change in perception as a result of the program.

There are also examples outside of the field of environmental education where drawings have been found to be meaningful evaluation tools. McLean et al. (2003) asked medical students to draw pictures as they imagined themselves to be upon entering their medical program, and another picture of themselves 10 months after starting the program. Students were given the option of using color, etc. Evaluators used the drawings to determine if there was a positive, disparaging or neutral change in how the students perceived themselves.

Rubrics / scorecards

The Connecticut Audubon Society (CAS) developed rubrics for use in their Science in Nature program. These rubrics or "scorecards" are used by classroom teachers and chaperones to track the number of times each student could properly identify and describe various ecosystem processes during their program. At the Connecticut Audubon Society (CAS), rubrics were created for classroom teachers and chaperones to use to track the number of times each student could properly identify and describe various ecosystem processes (Table 1, Table 2). Each CAS teacher-naturalist provides the rubric to the school teacher or chaperone at the beginning of the program and explains how to utilize the rubric.

At the end of the program, the school representative returns the rubric to CAS for evaluation purposes.

Table 1. Rubric.

Keyword	Pro development		Anti development	
	# uses	# times used in proper context	# uses	# times used in proper context
Soil compaction				
Soil moisture				
Biodiversity				
Food web				
Urbanization				
Economy				
Jobs				
Interdependence				
Nitrogen cycle				
Soil quality				
Topsoil				
Erosion				

Table 2. Earth process scorecard.

Earth process scorecard				
Student name	Weathering	Erosion	Deposition	Total

In CAS's Science in Nature Rock & Soil Ecology program for 5th grade students, one of the major foci of the program is on the impact of weathering, erosion and deposition on our landscape and ultimately on the ecosystem as a whole (Photo 1). Students are given points for every time they can properly identify and explain evidence of weathering, erosion or deposition. Students with the most points win a prize, which is not revealed until the end of the program. At the end of the program, students with the most points win the prize of knowledge. Educators could opt to give prizes of healthy snacks or a sustainable, environmentally-friendly item.



Photo 1. 5th grade student collecting soil data during CAS's Science in Nature's Rock & Soil ecology program.

Similarly, in the Science in Nature Rock & Soil Ecology program for middle schools, students participate in a mock city hall debate where one half of the students must argue in support of a development of a coastal open space that is

home to an endangered bird species while the other half must argue against the development. Each group is given a list of keywords that they must incorporate into their arguments, including terms like “soil compaction” and “biodiversity.” Again, school teachers and chaperones are given rubrics with the keywords listed. The group that properly uses the most keywords in the course of their argument “wins” the debate.

Interviews and direct observations

The interview process could be a useful measurement tool for many environmental educators. “As a method of inquiry, interviewing is most consistent with peoples’ ability to make meaning through language” (Seidman, 2006). Interviewing allows the researcher to put the participant’s thinking or behavior in context so that it can be better understood (Seidman, 2006). Interview questions that are open-ended generate an opportunity for participants to construct meaning but also may require the interviewer to have training in interview skills, such as proper phrasing and re-phrasing of questions, asking follow-up questions, and not interrupting. Many researchers choose to conduct one-on-one interviews and spend hours transcribing them, but that may not be a realistic option for environmental programs that are limited by time or money. In that case, educators may consider including the following Within-Program options.

A Station Rotation (Khalil and O’Connor, 2012) allows the educator to create questions and place them with a leader at various stations. Students travel to one or more stations, where they are prompted by the leader to answer a question, and then their answers are recorded by the leader. In addition, interviewing students in small groups may encourage them to speak more openly (Monroe 2001).

For younger students, the Smileys Activity (Khalil and O’Connor, 2012) can assess feelings or attitudes. Each student has or makes a set of notecards showing one of each of the following emotions: happiness, sadness/anger, and neutrality. Students are periodically asked to show the card that best represents their feeling

about a subject, and student responses can be tallied, perhaps by another instructor, for future analysis. Follow-up questions may help the educator understand why a student feels a certain way.

Direct observations of what students learned in the course of environmental education programs can be valuable means of measuring the outcomes of a program. Direct observation can take the form of students presenting or discussing what they learned in the course of their program, witnessing how they dispose of their waste during snack or lunch periods, or simply reading the data they record during their program (Schusler, 2013).

Videos

Videos can show after the program what may have been missed during the program. Whether evaluating the quality of instruction or the demonstrated interest of participants, videos are useful for a wide range of assessments. For a stationary program, a video camera can be placed on a tripod and left alone during the program. For a program that moves locations, an extra helper would be necessary for operating the camera. Also, it is important to note that several types of research require the signed consent of the participants and/or legal guardians, particularly audiotaped or videotaped interviews.

The Dallas Zoo once offered a week-long summer camp for middle-school students geared toward the use of video and digital media in nature. The final projects presented at the end of the week were promotional or informational videos about the Dallas Zoo. Such videos can demonstrate the knowledge gained through a program and serve as an assessment of whether the cognitive goals of the program were achieved.

Similar to drawings or photographs, student-made videos may also offer insight into their attitudes and feelings toward nature. A photo evaluation shared by Khalil and O’Connor (2012) could be modified to apply to video. In this evaluation, students are asked to photograph (or create a video about) things in nature that they find beautiful, interesting, or some other qualification chosen by the

instructor. The recordings could be narrated by the students and used by the instructors to inform them about the students' feelings or attitudes.

Models

Having students create, design, or build a model or tool can elucidate the knowledge gained throughout the course of the program, as well as allow the students to engage in higher-order thinking and apply their learning to addressing an environmental issue. This is also a way to integrate STEM (science, technology, engineering and math) principles into a program, making the program more attractive to schools and potential funders.

At a park-based program in Georgia focusing on habitats, K-1 students learned about the components of habitats: food, water, shelter, space. The plight of animals, such as the loss of habitat, was explained as well as their previous existence in the area. Children were asked to then gather natural materials and build a house (shelter) and provide the other components of habitat (food, water, and space). At the end of the program, a "tour of homes" was given allowing each child to explain and show how they provided habitat for an animal. Although parents did help the children with the gathering and construction, children gave the tour of the home they built.

In the Waters to the Sea™ Program developed by the National Audubon Society and Hamline University (<http://cgee.hamline.edu/WTTS-Trinity>), students are given "dirty" pond water and are tasked with creating, designing and testing a tool that will clean the water to a potable (drinkable) state. Students are provided with or are asked to collect various natural materials to create their "water treatment tool" in a soda bottle. This project is best implemented as a summative activity after a study of the ecosystem services of wetlands. Students who effectively learned about the contributions of the plants and soils in filtering and absorbing water should be able to incorporate those elements into their design.

Strengths and limitations

It is important to recognize the strengths and limitations of the approach of Within-Program Evaluation. One consideration is that students are already highly "tested." Implementing a measurement tool, such as a survey or questionnaire, within an environmental education program, can feel unnatural and take away from the program experience. Other measurement tools, such as drawings, rubrics or videos, may collect useful data without subtracting from the students' experiences. In the case of a drawing, the activity could even add to the program experience.

A limitation of Within-Program Evaluation is the length of time an evaluation may take. Some programs are quite short in duration, and a lengthy evaluation, such as an interview or model, would not be a realistic solution. The best solution would be an evaluation that is seamlessly integrated into the program curriculum.

Another limitation is that data only reflect short-term or immediate impact. This could be useful for measuring some cognitive or knowledge-based outcomes. However, many providers of environmental education are seeking to show long-term impact, and certainly the future of our planet rests on widespread, long-term behavior change. Is it enough to show that environmental education programs are having a short-term impact?

By incorporating outcome measurement into an environmental education curriculum, program providers are sure to have data that can be used to improve the program and/or communicate to stakeholders the value of the program. In the ever-present challenge of outcome measurement, the ideas listed above can offer solutions that guarantee a set of useful and informative data.

Resources

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10. What have students learned that is not on the test?

Janell Simpson and Susan Meyers

The intent of this chapter is to provide tools to the classroom teacher to document the impact of a formal environmental education program on the environmental literacy of students. Although standardized testing provides an objective view of skills and knowledge, integration of data from an evaluation tool will provide a more complete assessment—not only of the individual student learning, but also a larger picture of the classroom learning environment that nurtures the whole student.

Measuring environmental education outcomes is a step forward from anecdotes to reliable measures of student growth. A measurement tool that evaluates student attitudes about the environment will help the teacher design a formal program that includes practical ways that an individual can make a difference based on newly-developed environmental literacy. The tools offered seek to quantify environmental literacy both as observed by the classroom teacher and as self-reported by the student. Standardized testing may provide an effective assessment of knowledge and competencies detailed in a curriculum. However, competencies, knowledge, and dispositions should be expressed in behaviors; and environmentally responsible behavior is the ultimate expression of environmental literacy.

Environmental literacy

An environmentally literate person is someone who, both individually and together with others, makes informed decisions concerning the environment; is willing to act on these decisions to improve the well-being of other individuals,

societies, and the global environment; and participates in civic life. Those who are environmentally literate possess, to varying degrees:

- The knowledge and understanding of a wide range of environmental concepts, problems, and issues;
- A set of cognitive and affective dispositions;
- A set of cognitive skills and abilities; and
- The appropriate behavioral strategies to apply such knowledge and understanding in order to make sound and effective decisions in a range of environmental contexts.

This definition treats the primary elements of environmental literacy—the cognitive (knowledge and skills), affective, and behavioral components—as both interactive and developmental in nature. That is, individuals develop along a continuum of literacy over time—they are not either environmentally literate or illiterate.

There are four interrelated components of environmental literacy: knowledge, dispositions, competencies, and environmentally responsible behavior, all of which are expressed in particular contexts. Competencies are clusters of skills and abilities that may be called upon and expressed for a specific purpose. Measurement of competencies is the primary objective in large-scale assessments. They include the capacity to:

- Identify environmental issues;
- Ask relevant questions;
- Analyze environmental issues;

- Investigate environmental issues;
- Evaluate and make personal judgments about environmental issues;
- Use evidence and knowledge to defend positions and resolve issues; and
- Create and evaluate plans to resolve environmental issues.

The expression of a competency is influenced by prior knowledge and dispositions (Hollweg, 2011).



Photo 1. Student enjoys birdwatching in City Park, New Orleans, Louisiana with binoculars provided through Donors Choose. This class participates in a coastal restoration project in partnership with City Park and Coastal Roots of Louisiana State University.

Measurement tools

The teacher rating tool (Table 1) can be personalized for different groups. It seeks to quantify both practices, such as recycling and gardening, and connections to larger issues, such as global warming.

Table 1. Teacher rating tool for measuring environmental literacy (adapted from Murphy, 2011).

Environmental attitude	Rarely	Sometimes	Almost always	Consistently
Student demonstrates appreciation for natural environment.				
Student volunteers for activities such as recycling, gardening, or composting.				
Student initiates conversations about current events centered on environmental issues.				
Student uses classroom learning to support opinions about environmental issues.				

Other types of measurement tools to consider include: informal interviews, journal entries written in response to a prompt, surveys, pre- and post-tests, and student projects. Several Likert scale surveys are available examining student connection to nature, sense of place, and environmental stewardship (EE Outcome Measurement Tools, 2012). Additional outcomes might be observed in a typical environmental education classroom and could be included in such a tool. Do students actively conserve energy, tend a school garden, or participate in composting? Do students show awareness of environmental connections between current events and classroom discussions? Does the student's artwork show an appreciation of the natural environment? Does the student report family dialog about nutrition or food security or visits to a farmers' market?



Photo 2. Students perform water quality analysis of the Mississippi River in Jefferson, Louisiana, in collaboration with BayouSide Classroom of LUMCON, Louisiana Universities Marine Consortium.

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11. Environmental education outcomes in nature-based programs

Ed Councill and Beth Weigel

Introduction

Nature-based programs are varied and difficult to consider without further definition. For example, nature itself is so broad a term that any attempt to make generalizations about how it describes any or even most environmental education programs is risky. Many of us environmental educators, however, see nature at the core of environmental education. So, for purposes of this chapter, nature will be defined as an outdoor and predominantly non-built venue where outdoor/ environmental education programs can occur.

Programs themselves also are quite varied, even under the environmental education umbrella. Just the 20 contributors to this e-book alone demonstrate this complicating phenomenon. However, an environmental education program offers a description of facts related to the world's physical, ecological, and sustainability interdependencies that include impacts of resource use—so that participants can make personal decisions of behaviors that create consequences for the health of the planet. This definition as used by NAAEE, purposely omits advocacy for any particular outcome or behavior. Previous chapters have already given sufficient attention to the terms environmental education and outcomes. Thus, no further delineation of their meanings is required.

The purpose of this chapter is to discuss outcomes and how to measure them within the context of nature-based programs. Appropriateness of such measurements is related to their purpose, the costs and benefits of the exercise, and the use of data/information reported.

Nature-based programs

Nature-based programs are described in several ways. Depending on one's discipline, experience, and personal choice of environmental education emphasis, they are generally considered to possess the following attributes: (1) they take place outside the classroom in the outdoors; (2) they are more experiential or hands-on learning as opposed to the traditional lecture between a teacher and his/her students; (3) they provide elements of outdoor education like exploration, expedition/adventure contexts, involve nature as a context for explaining interdependency and eco-relationships and human impacts that alter such systems; (4) they are more descriptive rather than prescriptive to avoid dogma and advocacy, and; (5) emphasize problem-solving and group projects that engage collaboration, appreciation for diversity of interests and viewpoints.

Such programs usually target nature as context for its numerous subtexts: habitat, ecosystems, food chain, web-of-life, resource management, air/land/ water quality, climate change, human impacts, sustainability, etc. Each of these is important to share with an incoming generation; so they can make decisions that result in a better and more sustainable world for the ensuing one. This model is usually a presentation of fact-based connections about cause and effect choices, rather than a prescriptive agenda.

Many programs are often content-driven by core standards for environmental literacy. Each has a very important role to play, although sometimes they fall into conventional teaching practices led by adults when commercial or public

institutional facilities are the venue. Conversely, many non-profits are likely to use less traditional methods.

Program variations

Programs typically vary by purpose, venue, participants, and presentation. From zoos, museums, gardens, parks, preserves and refuges, to schools and educational facilities, camps, municipal department outreach, magic shows, and so many other labels for environmental education in both built and natural venues, each has a legitimate claim to the label. But each incurs difficult choices in how outcomes are defined and measured. Program participants from all walks of life also complicate outcome measuring. Such are the realities that impact our efforts to measure the efficacy of environmental education programs.

Internal factors have significant impacts also. These are commonly found in mission statements and organization goals and objectives, the background and life experiences of personnel and management, and strategic considerations. Donor and funding requirements are the most frequently cited examples.

Cultural influences

What distinguishes us from many of the other developed countries whose educational systems are more successful in some respects? Several commonalities are hard to miss: teachers are on par with other professions like physicians, architects, lawyers, and scientists; teachers are better-educated and are allowed latitude to teach in a class, albeit more homogeneous than ours, to individual learning preferences and styles; they are paid well and free from bureaucratized accountability regimes; and they are not fettered with policies that can and often do encourage corruption, like frequent right-answer tests and testing 100% of all students. All of which creates a learning environment that is positive, inspiring, and allows student pursuit of issues of interest.

With countries like Finland, Singapore, and Japan, two cultural differences quickly stand out. They are more homogeneous; and they are more child-centered. Diversity makes the US classes even more cogent with respect to treating students as individual human beings, rather than consumers of facts to be rewarded on how accurately they can be regurgitated at test time. It requires teachers to have more knowledge and training about how to reach different learners. Unfortunately the US attitude and debate over teacher pay is formed more of dogma and politics than the need to equip teachers to teach in a new era where the new norm is diversity and outcomes are based on innovation.

Regional differences also defy a cookie-cutter approach to both how teaching occurs and how outcomes are regarded as an integral part of environmental education programs. For example, faith-based assertions that earth's history is 6,000 years severely limits programs that speak to geological impacts. A comparison of two cases presented below by the authors provides a useful though anecdotal case study.

Two nature-based program examples

(1) Discovery Southeast Alaska (DSE) bases its programs in hands-on learning in nature, natural science, and outdoor education. In school programs, adult and teacher workshops, summer camps, wilderness expeditions, and other programs aim to address the following environmental education outcomes:

- Heighten knowledge of and regard for the lands and waters of Southeast Alaska;
- Awaken natural curiosity and foster joy in nature through inquiry learning;
- Encourage personal connection with the natural world;
- Promote attitudes and actions that reflect positive and respectful relationships with nature;
- Promote personal health through spending time in nature.

(2) kidsGROWkentucky, Inc. (KGK) is a non-profit with a mission to inspire youth, families and teachers to grow and be connected with our world. Its two core goals are: to create a culture of learning that is youth-driven and youth-centered, uses nature as a catalyst for balancing right and left brain thinking, and is fun; and to provide a framework for replicating this model throughout Kentucky and beyond (Photo 1, photo 2). The first is product; the second is process oriented. The program was designed by community youth, parents, educators, and resource management professionals from local, state, and national agencies. The key activities include: (1) adventure experiential field trips that are youth-driven, defined by a consensus of participants through their interests; (2) workshops for creating positive environments for individual learning modalities with collaboration among diverse participants; (3) Community Conversations describing how the program is impacting children and new developments in related education issues; (4) Innovative Brain Days providing right brain exercises that focus on problem-solving, critical thinking, teamwork, and innovation; (5) giving youth a voice in their future through a Children’s Outdoor Bill of Rights followed by implementing a Kentucky Youth Advisory Council established with an Executive Order to assist state agencies to be more youth-friendly in their policies, programs, and projects; and (6) building capacity through donations and grants for all the above.

Matching outcome measures to program objectives

These two programs are quite similarly described through their missions, goals, objectives, and activities. Both KGK and DSE programs are a mixed bag, but predominantly require qualitative means of evaluation. KGK being youth-driven somewhat complicates many quantitative approaches to measures of environmental education outcomes. Sometimes activities pursued have little direct relevancy, such as free play or solitude, or are not even anticipated for advance program participant benchmarking. Yet a few others are less challenging and addressed in a traditional manner. For example, aligning activities to strengthen core content can be given credit for performance improvements. Such is the case in both organizations.



Photo 1. A program participant journaling art and nature (kidsGROWkentucky, Inc).

It is measuring objectives—like engagement, leadership, goal-orientation, problem-solving, initiative, curiosity, critical thinking, creativity, and collaboration—that require a qualitative methodology. Among these are letters from teachers and students, journals, observations by program providers, and portfolios. Often process is better revealed through description or other critical methods, than through numeric products. This is the takeaway from Einstein’s office sign: “Not everything that counts can be counted; and not everything that can be counted counts”. To illustrate, the following email was received after a day trip in a series of monthly outings sponsored through the Kentucky Women’s Foundation to empower women through art and nature.

Email from a Mom about her and her daughter’s experience and outcomes:

“I realized later that my journey on the creek with my daughter that day was a very apt metaphor for my journey though “preteenness” with her as well – complete with anxiety, frustration, fears, laughter, screams, hugs and those blissful, peaceful moments when we were actually paddling together, in the same direction, at the same time –aware that sometimes neither of us really knows what the heck we’re doing or exactly how to navigate these murky

waters and we just have to take a breath and trust one another a little bit more. Makes me chuckle a bit to remember.....a good reminder..... Thank you again.....”



Photo 2. Gravel bar classroom (kidsGROWkentucky, Inc).

While there is no quantitative measurement that can be applied here, a closer examination of this feedback reveals how this program produced the desired environmental outcomes and can be analyzed qualitatively. Here the environmental outcomes can be viewed through a shift in language that maps the conceptual metaphor of a journey onto the how a parent and child make sense out of dealing with “preteeness.” This is demonstrated in the use of language that expresses a sense of direction (goal orientation), synchronicity (collaboration), navigation (problem solving, critical thinking), and dealing with uncertainty and developing trust (leadership)—all important factors in a successful journey.

In each case, over half of KGK and DSE programs have goals, objectives, or activities that use a qualitative evaluation approach. How does one put numbers

on an experiential field trip or a community conversation, or giving students a voice in their future? DSE poses a similar challenge: how does one assess “regard”, “joy”, “connection”, or “respectful relationships”? What about thinking outside the artificial separation of different subject matters?

Email from an alternative school student. Casie’s letter summarizing her class’ November 4, 2010 kidsGROWkentucky field trip. (Sent by email from Bill Webb at the Henry County Center for Educational Options on 11/11/10):

“Thank you Mr. Ed Council for the experience of a life time. On Wednesday, November 3, courtesy of Mr. Council’s Canoe Kentucky, students from Henry County’s Center for Educational Options, along with Dr. Denis Rader and Misty Seitz, from the King Center, took a canoe trip up and down Benson Creek and the Kentucky River in Frankfort. Though we spent just a few hours in this outdoor classroom, we learned so many things...things most of us students had likely read about, but now were actually seeing and experiencing first hand. We paddled through Frank’s Ford, the spot in the river where Frankfort got its name. We learned why the bridges are where they are. We saw the places where influential people made their contributions to Kentucky, the U.S, and the world. We learned about the sociological significance of the singing/ swinging bridge. And from his honored spot in the historic Frankfort Cemetery, high on the hill above us, Daniel Boone watched as we floated by. We identified different types of trees, plants, and wild life. We collected sections of small trees that beaver had gnawed through to make a home. We floated our canoes right onto the dry bed of Benson Creek, just beyond the marina, and studied the fossils that were embedded in those ancient rocks, amazing visual echoes of the many creatures that lived and thrived there thousands of years ago. In the span of three very short hours, we studied history and biology and ecology and sociology and more, all together in the same place at the same time, with no bells to separate them. And it was FUN! At some point, along with his other words of information and wisdom, Mr. Council mentioned that our canoe trip was possible because of a program called “No Child Left Inside.” I don’t know much about this, but if it gives other kids the same opportunity that my classmates and I had to learn things while in the company

of the great outdoors, it is a very worthwhile program. Thank you, again, Mr. Council for this wonderful learning experience. Casie Carnal and the other students at the Center for Educational Options.”

On the other hand, the KGK program has used qualitative methods to evaluate its efficacy in non-environmental education areas like giving an evaluation for staff, safety, interpersonal skills, venue, and appropriateness of the program (see below evaluation form). Note that outcomes to be described by adults (teachers and administrators) are mixed with inputs and are requested for program improvements, especially when it is administered in a way that does not distract from attention to the participants, which are excited with the venue.



Photo 3. Urban youth mix bioassays and fun (kidsGROWkentucky, Inc).

An NCLI Trip Evaluation Form

Evaluations are used to improve the event/program by pointing out areas to be changed or strengthened or eliminated altogether. It is to include the primary teachers, students, parents, administrators, and provider staff and NCLI Team and

KGK members. Your considered comments are most appreciated and will be held in confidence as requested.

PART I: Planning

- Was the trip planned sufficiently (were you comfortably ready)?
- Were safety measures adequate?
- Was there opportunity for student-driven activities and focus?
- Was sufficient attention given to core content requirements?
- Did the session generate positive student engagement?

PART II: Implementation

- Did the schedule meet the needs of the trip activities?
- Were the facilities adequate for meeting group needs?
- Was there sufficient and professional provider staff presence?
- Were there any problems either not dealt with or not dealt with adequately?
- Was there a good learning environment?
- Did the experience relate to the agreed upon agenda?
- Was time organized in a manner to balance specific activities and free play?
- Would other suggestions improve the experience; if so, what?

PART III: Follow up/through

- What degree of follow through was available following this NCLI trip?
- Were there opportunities to cross educate among STEM and other content?
- What changes would allow better attention to this phase?
- Would student and/or teacher right brain learning workshops be helpful?

PART IV: Evaluation

- Is an evaluation a good way to make the experience better?
- Was it more burdensome than necessary; if so how?
- What changes would you recommend?
- With suggested improvements, would you want your students to go again?
- Assess the benefits among students, teachers, administrators, and parents?
- Will you urge a continuation of NCLI next year?

PART IV: Open comments

Add a 1 to 10 number (with 10 as the highest praise) for each applicable item above.

Broader objectives with environmental education as a platform

Some environmental education activists and scholars have fostered a platform to address non-environmental education issues. Richard Louv, Elizabeth Goodenough, and Dennis Rader are contemporary contributors to this approach. Earlier legends like Muir, Leopold, and Audubon who preceded their works often contributed to environmental education. Although homage is paid to the benefits of nature, little mention is given to environmental education as the focus of its legacy, but rather an educational sub-set that advocates personal goal attainment and stewardship for future generations.

Therefore, it is not surprising that the dichotomy between the core being nature added to a larger context to the participant has a significant impact on outcome identification and measurement. For example, content is easy to identify: “Did the experience cover the curriculum’s content?” Likewise, it is easy to establish an outcome based on each content element, and test for one’s ability to either provide the right answer to a question about it, or discuss its meaning in environmental terms. A pre-experience measurement followed by a post-experience one can be a basis for determining the efficacy of the experience.

However, from reading the MEEO class blogs, a large number of us find a pre-experience evaluation dysfunctionally distracting from the euphoria of a non-classroom venue nature creates in most youth. On the other hand, if the program is participant/student-centered where nature becomes secondary as a platform to creating an environment where learning takes place, such a measurement regimen may become inappropriate for larger mission elements like growth as defined by engagement, curiosity, collaboration, goal-orientation, leadership, innovation, initiative, interest, creativity, and problem-solving. Longer term (multi-year)

measures of such engagement, like decreased dropout rates, cooperation on group projects, and other portfolio assessments from a consistent teacher are possible. But in a transient society, it too has shortcomings.

Considerations

How does your program fit? Step one is to determine how does your organization and mission truly address outcomes; and can those outcomes be reasonably measured in the short term, since most programs are participant time-limited. What outcomes are appropriate? Step two is the 800-pound gorilla: how does one state outcomes in a non-advocacy, yet student-centered way that covers most of its purposes? This consideration forces one to determine just who is the beneficiary of this information; and is it worth it? How are outcomes measured? For program improvement purposes, the examples of outcomes mentioned above satisfy this question with little imposition on participants. In fact, asking them is a compliment.

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12. Measuring outcomes in zoo and aquarium programming

Debra Colodner, Marti Copeland and Christina Dembiec

Zoos and aquariums, while having historical roots in conservation and research, have relatively recently begun to embrace their role in education. “It has only been in the last few decades that education has become critical to how zoos and aquariums perceive their role in society” (Ogden and Heimlich, 2009). A recent study of zoo mission statements found that education was mentioned in 131 out of 136 mission statements analyzed (Patrick et al., 2007). Zoos and aquariums emphasize a collection of living animals, and are “some of the only places where people can see live animals from various ecosystems around the world” (Khalil and Ardoin, 2011). As zoos and aquariums lend themselves naturally to environmental education, it is important that we understand the challenges and opportunities unique to these institutions.

Zoo and aquarium educators have a unique opportunity to relate to learners. Many education programs at nature centers focus on the local ecology that can be found right in the participant’s backyard. Education programs at zoos and aquariums commonly have a wide variety of exotic animals from far-away places. On one hand, it can be daunting to teach about environmental issues that are relevant to both the student and the wildlife subject, since they are often from completely different climates, eco-regions, and continents. On the other hand, students, who may be uncomfortable in “nature” and have barriers of fear to overcome before feeling comfortable exploring their nearby woods or park, often show a great excitement and love for such charismatic zoo animals like tigers, elephants, sharks and sea turtles. This excitement may open a door to learning (National Research Council, 2009). Basically, many are coming to the zoo or aquarium already interested in the subject matter and ready to learn. With many zoos and aquariums being located in urban settings, they may provide “one of

the only opportunities to encounter nature” for urban residents (Bruni, Fraser and Schultz, 2008). Because of the high costs and moral obligations of keeping animals in captivity, it is incumbent upon zoos and aquariums to evaluate the value of live animals in reaching their desired educational outcomes (Photo 1).



Photo 1. Preschool program at the Arizona-Sonora Desert Museum. Many zoo programs emphasize building connections with nature via live-animal interactions.

Another difference between zoos/aquariums and other environmental education providers is the casual visitor. A large majority of visitors to zoos and aquariums are attending with family, seeking entertainment, and not attending a specific structured program. Relevant conservation-related concepts can be offered through the graphics or signage at an exhibit, the dialogue during an interpretive Zoo Keeper talk, or other avenues, but reception is dependent on the visitor, their prior knowledge and their motivation for visiting (Cartoon 1). This type of free-choice learning experience means that “visitor experiences as well as the educational impact of the zoo visit may well be extremely varied and, as a consequence, difficult to recognize and measure” (Moss and Esson, 2013).



Cartoon 1. Learners at zoos and in other informal environments each come with their own motivations and prior knowledge (copyright: Arizona-Sonora Desert Museum, used with permission).

While some organizations and institutions may have a singular focus, such as a local native species or recycling or water conservation, or offer school-aged programming, community programming, or consulting services, zoos and

aquariums often are called to do all of these things, for a very wide audience. Zoo and aquarium educators entertain, educate, and deliver programs ranging from 15 minutes to 15 weeks or longer. They reach schools, teachers, parents, community leaders, the special needs community, the very young, and the very old. They are called to influence every single visitor in some form or fashion. Beyond their gates, they reach a global audience through a global network of zoos, aquariums, NGOs, range country partners in conservation, and so much more. The impact could be measured in countless ways. It is almost so intimidating and overwhelming that one would question why they would want to take on such a challenge at all. As an accredited member of the Association of Zoos and Aquariums, they are required to measure outcomes of educational programming. The questions then become, “Which ones?” and “How?”

What is being measured?

Zoos and aquariums are often providing educational programs related to outcomes of knowledge, attitudes and behaviors leading to conservation action (Khalil and Ardoin, 2011). “Until very recently, evaluation and educational research in zoos and aquariums has focused primarily on increasing the cognitive knowledge of visitors, with a lesser focus on changes in attitudes and behavior” (Ogden and Heimlich, 2009). While many zoo and aquarium educators can share anecdotal stories about the impact of their programs on individuals, there is a need for evaluations that measure this impact. By measuring program outcomes, zoos and aquariums can improve the programs offered, as well as demonstrate to the community and stakeholders the effectiveness of their programs. Increased attention to educational planning and evaluation was evident at the recent Association of Zoos and Aquariums (AZA) annual conference in Kansas City (2013). Several institutions shared their processes for defining three types of outcomes (or desired changes in visitors/participants):

- **Behavioral** – Behaviors, skills (“Act”)
- **Cognitive** – Knowledge (“Teach”)
- **Affective** – Feelings, attitudes, values (“Inspire”)

The monitored outcomes need to be: specific, measurable, achievable, relevant, and time-specific. Because of the great variety of interactions zoos have with their audiences, these three classes of outcomes need to be defined for each program, and even for each type of visitor. For example, a parent visiting primarily to facilitate learning for his child will likely exhibit different outcomes than those of the child, or than those of an adult coming primarily for entertainment.

Christina Dembiec, a co-author of this chapter, analyzed mission statements of more than 170 AZA accredited zoos and aquariums to determine if the intended outcomes of a visit to one of these institutions were primarily behavioral, cognitive, affective, or something with a different focus. The larger the word appears in the graphic, the more often it was found in the mission statements (Figure 1). It appears that these institutions are primarily concerned with affective outcomes, such as inspiring their guests. If zoo and aquarium education programs are aligned with their institutions' mission, then finding ways to measure affect is important.

How can zoos and aquariums measure outcomes?

The multi-institution study “Why zoos and aquariums matter” (Falk et al., 2007) assessed the impact of a visit to a zoo or aquarium using various qualitative and quantitative approaches, including questionnaires, tracking studies, personal meaning mapping, and interviews. To measure the outcomes of a particular program offered at an institution, many zoo educators use standard paper surveys, although embedded evaluation methods are being integrated more and more: word maps, engagement ethograms, word walls, photoboosts, and other non-traditional activities. There is also interest in the community about exploring social media more deeply as evaluation tools. With classes requiring registration, contact information, such as an email address, can be used to send a link to an online survey. Certain challenges are inherent in this: if a parent registered a child, will the parent be able to answer questions related to outcomes? Incentives may need to be considered to ensure that online surveys are completed. With programs where time permits, a survey completed in class may provide the best



Figure 1. Word cloud: zoos and aquariums mission statements.

return. This method will rely on the ability of instructors to administer the survey correctly and uniformly for the most reliable results.

Long-term impact

The Holy Grail for environmental education in general, and certainly for zoos and aquariums, is the ability to measure long-term impacts. A scientific assessment of the impact of a zoo or aquarium across a population would be extremely costly and perhaps not possible. The large scale study by Falk et al. (2007) interviewed

84 people one year after their zoo visit and found that people still associated their visit with a conservation-oriented theme. A large majority of visitors (76%) indicated that they believed that zoos and aquariums are invested in conservation and education and that zoos and aquariums play an important role in species preservation and in increasing their visitors' awareness of conservation issues, even one year later. Many zoos and aquariums also have anecdotal data from community members about the impact their experiences had on their lives, in terms of careers, hobbies or charitable giving. With the advent of social media, zoos and aquariums are beginning to eye the activity and content on their networks as a possibly powerful proxy for the long-term impacts of a visit. The desire and need to evaluate the impacts of their institutions is helping to restructure and further focus the educational missions of many zoos.

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13. Resources for environmental education outcome measurement

Gerard Gonzales and Michelle Byron

There is a multitude of resources for measuring outcomes. This chapter highlights and summarizes some of the best available resources, which are divided into the following categories:

- **Where Can I Start:** If you are looking to integrate or improve outcome measurements for your programs and are unsure of where to start, visit this section.
- **I Need a Measurement Tool Now!** If you need to start evaluating programs now, here are some resources that you can copy, edit and use right away.
- **I Want More Background to Develop my Evaluation Tool:** These resources are some of the best at providing background and context for general evaluation and specifically for environmental education and are divided into two sections: Web-based Sources and Print Journals or Books.

(1) Where can I start?

You'll probably want a map to get started: something that accounts for where you are, where you want to go and how you are going to get from here to there. A conventional form of this map is a logic model.

1. If you are looking for extensive information and tools to develop a logic model visit: My Environmental Education Evaluation Resource Assistant (MEERA) <http://meera.snre.umich.edu>, or “Developing a logic model: Teaching and training guide” <http://www.uwex.edu/ces/pdande/evaluation/pdf/lmguidecomplete.pdf>

2. If you would like a simple tool to flesh out your map visit: <http://ecologymap.org>

Guidelines for Excellence

The North American Association for Environmental Education (NAAEE) has produced five sets of guidelines that include indicators, examples and references to lead you in the necessary steps to create programs and/or measure their standards. The guidelines address the following topics:

1. **“Guidelines for the Preparation and Professional Development of Environmental Educators.”** These guidelines are designed to apply to pre-service teacher education courses, environmental education courses across disciplines, and professional development for formal and nonformal educators working with kindergarten through 12th grade students. There are six themes: (1) Environmental Literacy, (2) Foundations of Environmental Education, (3) Professional Responsibilities of the Environmental Educator, (4) Planning and Implementing Environmental Education Programs, (5) Fostering Learning, and (6) Assessment and Evaluation.
2. **“Early Childhood Environmental Education: Guidelines for Excellence.”** This guide is a thorough resource focused on developing environmental education programs for children birth through age 8 with an emphasis on ages 3-6. It is arranged around six Key Characteristics: (1) Program, philosophy, purpose, and development, (2) Developmentally appropriate practices, (3) Play and exploration, (4) Curriculum framework for environmental learning, (5) Places and spaces, and (6) Educator

preparation. There is a formative evaluation tool based on these guidelines available at <http://www.naaee.net/sites/default/files/publications/ECEERS.pdf>

3. **“Nonformal Environmental Education Programs: Guidelines for Excellence.”** This is a very thorough step-by-step instructional guide to creating a program. In simple to understand terms, it leads the reader through a needs assessment, assessment of organizational needs and capacities, determination of program scope and structure, program delivery resources, program quality and appropriateness and evaluation. A self-assessment is included.
4. **“Environmental Education Materials: Guidelines for Excellence.”** This tool helps improve instructional strategies by assessing the quality of environmental education materials for fairness and accuracy, depth, emphasis on skills building, action orientation, instructional soundness and usability.
5. **“Excellence in Environmental Education: Guidelines for Learning (K–12).”** This guide focuses on learner achievement, with 4 strands, or steps toward environmental literacy. The strands are: (1) Questioning, analysis and interpretation skills, (2) Knowledge of environmental processes and systems, (3) Skills for understanding and addressing environmental issues, and (4) Personal and civic responsibility.

In addition, the National Science Foundation “User-friendly Handbook for Program Evaluation” is an in-depth resource written for those receiving grants from the foundation. This book walks the reader through the entire process of evaluating programs, the review of techniques will be valuable as you determine how to measure outcomes. <http://www.nsf.gov/pubs/2002/nsf02057/nsf02057.pdf>

(2) I need a measurement tool now!

If your program is about to begin, or already underway, here are some places to find tested tools to measure outcomes:

MEERA <http://meera.snre.umich.edu/reports-and-case-studies>. Click on the Full Report of a title that is close to your program; measurement tools are in the report, general information as an appendix.

The Place-based Education Evaluation Collaborative has PDF and Word versions of many evaluation tools. Search for programs similar to your own: <http://peecworks.org>

Here is a simple introduction to the logic model: <http://www.umes.edu/cms300uploadedFiles/Logic%20Model%20Training%20II.pdf>

Assessment Tools for Informal Science has a searchable database of tools. Some tools are available for download, some are just reviews: <http://www.pearweb.org/atis>

EE Outcomes Measurement. Several surveys and other tools created by environmental educators in 2012, which can adapted for other programs: <http://civeco.files.wordpress.com/2013/10/2012-meeo-tools.pdf>

These creative evaluation tools will require a little bit of work to tailor to your program, but are fresh ways to evaluate how your program is doing at achieving outcomes.

(3) I want more background to develop my evaluation tool

Web-based sources

Simmons, B. (2004). Designing evaluation for education projects: NOAA Office of Education and Sustainable Development. <http://wateroutreach.uwex.edu/use/documents/NOAAEvalmanualFINAL.pdf>

NSF The 2002 user-Friendly Handbook for Project Evaluation: <http://www.nsf.gov/pubs/2002/nsf02057/start.htm>

A thorough summary of logic models: <http://www.uwex.edu/ces/pdande/evaluation/pdf/lmcourseall.pdf>

The Innovative Network divides the resources available into Advocacy Evaluation, Capacity Building and program evaluations. Ratings and downloads available. <http://www.innonet.org/resources>

The Free Management Library has a wealth of information on all aspects of management; the section on evaluation is particularly helpful if you are looking to perform an organization wide evaluation. The evaluation tools include a section on outcomes based evaluations: <http://managementhelp.org/evaluation/index.htm>

McKenzie-Mohr and Associates provides articles and case studies on behavior change in environmental education at www.cbsm.com

Program evaluation using a logic model is detailed in an easy to follow description <https://www.bja.gov/evaluation/guide/pe4.htm>

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Michelle is an environmental educator for The Horticultural Society of New York and creator of a forest and garden preschool co-op in Manhattan. Before moving from Pennsylvania, she worked for Pocono Environmental Education Center. She is pursuing an MS degree in Natural Resources/Environmental Education and Interpretation at the University of Wisconsin–Stevens Point and has a BS in Liberal Studies (environmental science and paralegal) from Misericordia University in Pennsylvania.

Marti Copeland

Marti is the Director of Education for the Dallas Zoo and Children's Aquarium at Fair Park. She has been an environmental educator since 2001, and she has served as a board member for the Texas Association for Environmental Education since 2007. Before moving to the Dallas Zoo in 2012, she developed and delivered environmental education curriculum and trained environmental educators at the National Audubon Society's Dogwood Canyon Audubon Center in Cedar Hill, Texas, and at Houston I.S.D.'s Outdoor Education Center in Trinity, Texas.

Bob Coulter

Bob is currently the director of the Litzsinger Road Ecology Center, a division of the Missouri Botanical Garden. The Center is home base for a research and development group exploring ways to support place-based education, integration of technology with environmental experiences, and character development. The Center also partners with

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Ed Council

Ed is CEO of kidsGROWkentucky, Inc., an NPO with a mission “to inspire children, families, and teachers to grow and be connected with our world”. Its core programs include experiential field trips in natural venues, community Conversations for public awareness about education in general and environmental education in particular, a governmental initiative to create a children’s cabinet or Youth Advisory Council with an initial effort to advise state agencies to establish more kid-friendly policies, programs, and projects, and workshops for kids, families, and teachers.

Debra Colodner

Debra is the Director of Conservation Education and Science at The Arizona-Sonora Desert Museum in Tucson, AZ, and holds a doctorate in chemical oceanography from MIT and Woods Hole Oceanographic Institution. With over 15 years of environmental education leadership experience, she oversees the Museum’s research and education programs for students of all ages.

Christina Dembiec Christina has worked in the field of environmental education for over 12 years at various nature centers, outdoor learning centers, 4-H centers, and at three zoological institutions accredited by the Association of Zoos and Aquariums. Christina holds a BA in Anthropology, an MSc in Primate Conservation, and is currently the Community Education Manager for the Jacksonville Zoo and Gardens in Florida.

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Gerard Gonzales Gerard has taught environmental education in a variety of settings from beaches, including Malibu and Lake Michigan at Camp Miniwanca to the farm at Hidden Villa in Los Altos Hills, CA to Kidspace Children's Museum. He is currently focusing his efforts on awakening the sense of wonder in his two small children and providing professional development for integrating nature with early childhood in Pasadena, California.

CJ May While serving as Yale University's recycling coordinator for more than two decades, CJ implemented community-based social marketing (CBSM) programs as well as innovative efforts to measure individual participation in the campus recycling program. During this time he also began using stage magic as part of recycling outreach on campus as well as for community education on behalf of the Connecticut Recyclers Coalition. As "Cyril the Sorcerer" and "CJ May-Resourcerer" he continues to provide environmental education through magical performances to children and adults respectively.

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Alison manages youth conservation action and environmental education programs at The Field Museum in Chicago, IL. She has over ten years of experience working in experiential education in the U.S. and Latin American, an MA in Social and Cultural Foundations in Education from DePaul University, and a BS in Environmental Science from Loyola University Chicago.

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Maria is currently an Energy Conservation Program Associate (Watt Watchers Associate) at the Fuel Fund of Maryland, where she is currently providing bilingual energy conservation education to low-income adults in Maryland, developing new curriculum, conducting research on the data analysis for program impact evaluation, and expanding the program. She holds an MS in Civil Engineering with Environmental Engineering emphasis.

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Leah is an Environmental Educator for the Washington County Environmental Affairs Office, based in Fayetteville, Arkansas, which focuses on solid waste management and natural resource conservation. Leah works with school districts to increase waste diversion and reduction, provide

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Grace Segovia

Grace is an Environmental Education Coordinator for the City of Pharr, Texas, managing the recycling center and Stormwater Education Program. Grace has a Bachelor of Arts in Psychology with a Masters of Arts in Cultural Studies of Literature.

Janell Simpson

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Colleen Spencer

Colleen serves the City of Sugar Land community as Water Conservation Manager in the City's Environmental Services Division. She has managed the City's storm water pollution prevention program, Texas Stream Team water quality monitoring program, solid waste and recycling services, groundwater reduction plan, and the Keep Sugar Land Beautiful affiliate. Now she focuses on water education and water conservation planning and programming as it contributes to management of the City's water resources.

Beth Weigel

Beth is the Executive Director of Discovery Southeast, Inc., an NPO whose core mission is “hands-on nature education for southeast Alaskans”. Mission-related activities/ programs include nature discovery experiential field trips for grades 5–7, multiday teacher professional development expeditions, summer camps for kids, ocean literacy, a naturalist-in-residence, bear safety, health and nature programs, and fundraisers.