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Publisher: Routledge

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Applied Environmental Education & Communication

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/ueec20>

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Published online: 14 Apr 2015.



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To cite this article: Nicole M. Ardoin, Kelly Biedenweg & Kathleen O'Connor (2015) Evaluation in Residential Environmental Education: An Applied Literature Review of Intermediary Outcomes, Applied Environmental Education & Communication, 14:1, 43-56, DOI: [10.1080/1533015X.2015.1013225](https://doi.org/10.1080/1533015X.2015.1013225)

To link to this article: <http://dx.doi.org/10.1080/1533015X.2015.1013225>

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Evaluation in Residential Environmental Education: An Applied Literature Review of Intermediary Outcomes

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Residential environmental education aims to enhance proenvironmental attitudes, knowledge, and behaviors, as well as attain outcomes related to personal and interpersonal skills. Although these outcomes may not be evident for months or even years afterward, few program evaluations investigate how the experience and context affect intended outcomes during the process of environmental education (EE). This time lag contributes to what has been called the “black box” or the lack of understanding of what occurs during the program itself. This article presents an applied literature review that explores intermediary indicators and outcomes for residential EE and suggests novel approaches for evaluating their attainment.

INTRODUCTION

Program evaluations in environmental education (EE) often attempt to measure cognitive, affective, and behavioral outcomes (Feder, Shouse, Lewenstein, & Bell, 2009; Zint, 2013), with an ultimate interest in better under-

standing the influence of these programs in the short, medium, and long term. Yet, although some EE outcomes, such as knowledge, may be relatively straightforward to measure, other outcomes, particularly those in the behavioral and affective realms—such as critical thinking, mindfulness, and hope, among others—are challenging to characterize, difficult to directly observe (Camargo & Shavelson, 2009), may require intermediary steps to achieve (Webler & Tuler, 2002), and may come to fruition long after the participant has left the program (Carleton-Hug & Hug, 2010). Thus, nontraditional approaches to evaluation are of interest in approaching these more challenging-to-characterize outcomes.

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Intermediary outcomes represent steps along the way toward attaining ultimate outcomes, helping make progress toward more formalized or directly intended outcomes (Webler & Tuler, 2002). Intermediary outcomes differ from what is commonly called formative assessment, however, which focuses primarily on the extent to which a program is “working” for participants by measuring activities and the attainment of overall intended outcomes (Patton, 2002). Although the two might overlap at times, intermediary outcomes primarily represent steps or stages along the path to human behavior change or other transformative, longer-term experiences that may transcend the specific program or intervention itself. The intermediary outcomes particularly relevant to informal environmental education experiences may include concepts such as interest (e.g., Barron, 2006; Hidi & Renninger, 2006), engagement (e.g., Ardoin et al., 2014), and trust (e.g., Almers, 2013), and frameworks for approaching socioscientific issues (e.g., Gresch, Hasselhorn, & Bøgeholz, 2013; Sadler, 2009) are increasingly documenting the importance of such intermediaries for achieving overall outcomes. Development of situational interest, for example, may influence a participant’s long-term interest in the topic, thus linking the intermediary outcome (situational interest in science/environment) with longer-term, desired outcomes (sustained interest in science, including career choice in the field; Azevedo, 2011; Barron, 2006; Renninger & Hidi, 2011). Similarly, the opportunity to share different interpretations of knowledge can lead to a greater commitment to engaging in new behaviors (Keen, Brown, & Dyball, 2005; Schusler, Decker, & Pfeffer, 2003). These frameworks provide clues as to what types of student reactions and pedagogy may appropriately enhance intermediary outcomes.

Measuring intermediary outcomes may provide a promising avenue to document progress toward a program’s ultimately desired outcomes. The focus on activities taking place, development of interpersonal rela-

tionships, and other processes that occur during program implementation may be important indicators of how, why, and for whom a particular program works in a certain way (Ardoin et al., 2014; Ewert, 1983). Yet, the affective and process-oriented nature of intermediary outcomes can make them difficult to conceptualize; they can be ephemeral, subjective, and problematic to measure. Consequently, they may not be represented formally or accurately within a program model or evaluation. While these variables can be challenging to characterize and may deviate from the traditional output or outcome orientation, they may also be among the most insightful aspects to evaluate.

Residential Environmental Education: Peering Into the “Black Box”

Ewert (1983) expressed concern about the “black box” of program design and evaluation, suggesting that, while at times we might have a sense that a particular outdoor education intervention “works,” we are less sure of the mechanisms—the *how* and *why*. Similarly, EE program evaluations have been critiqued for a reliance on outcomes evaluation, employing primarily preprogram and postprogram surveys and interviews (Carleton-Hug & Hug, 2010; Zint, 2013), which may not adequately characterize more nuanced and in-process experiences. Current trends in evaluation practice, such as developmental evaluation (e.g., Patton, 2011), process evaluation (e.g., Devine et al., 2012), and implementation evaluation (e.g., Mainieri & Anderson, 2014) are reorienting toward more refined measurement. They provide tools for considering procedural components of programs that can facilitate intended outcomes, thereby indirectly recognizing that it is critical to measure intermediary elements of program implementation to better understand programs. These changes are occurring across academic fields, although EE has yet to

fully explore the opportunities presented by these alternative, emergent evaluation models (Carleton-Hug & Hug, 2010).

The limited approaches used in EE evaluation are not a new concern (cf, McKenzie, 2000; Zint, 2013), and a handful of peer-reviewed papers suggest innovative ways to integrate intermediary outcomes into EE evaluation. Farnham and Mutrie (1997), for example, measured the intermediary outcomes of group cohesion, tension/anxiety levels, and physical self-perception using surveys, staff interviews, and teaching sheets. Similarly, Neill and Heubeck (1997) used the Adolescent Coping Scale to explore how outdoor education programs influence coping strategies, an intermediary outcome for improved mental health and the intended outcomes of personal growth. These and similar studies, however, were conducted in the context of research rather than evaluation (e.g., Rickinson et al., 2004), and thus have not been duplicated in practice for program evaluation and development.

Although intermediary outcomes and measurement tools are critical to understanding any EE setting, this review focuses on residential EE because of the somewhat unique affordances of the immersive, multiday experiences that set them apart. Similar to other EE programs, residential EE often follows outcomes described in the classic Tbilisi Declaration: environmentally related awareness, knowledge, attitudes, skills, and citizen action participation (UNESCO, 1980). Unlike basic EE programming, however, residential EE often includes additional emphasis on social and personal development (Bourke, Buskist, & Herron, 2014; Dettman-Easler & Pease, 1996; Stern, Powell, & Ardoin, 2011).

This article is intended to initiate discussion of ways that evaluation of residential EE can draw on diverse evaluation tools to better explore outcomes that occur while progressing toward ultimate intended EE outcomes. First, we review the intended outcomes of residential EE programs; second, we present trends in residential EE evaluation and research; third, we suggest potential avenues for innovation in

measuring intermediary concepts based on literature from multiple fields. Finally, we discuss the perceived relevance of these potential measures to residential EE practitioners. And although we focus on residential EE, we believe these findings can inform evaluation in other EE contexts as typical program evaluation structures and protocols may also benefit from consideration of intermediary outcomes as well as new evaluation approaches (e.g., Ernst, Monroe, & Simmons, 2009; Zint, 2013).

METHODS

For this applied literature review, we first examined intended outcomes from residential EE programs across the United States and internationally. We identified programs and their Web sites using a variety of online directories including Raincloud (<http://guide.raincloudpub.com>), the American Camp Association (www.acacamps.org), and the Association of Nature Center Administrators (<http://www.natctr.org/>), the University of Michigan's My Environmental Education Evaluation Resource Assistant (MEERA) Web site (meera.snre.umich.edu), and Wikipedia's site for Nature Centers (http://en.wikipedia.org/wiki/List_of_nature_centers_in_the_United_States). We conducted Internet searches using the Google search engine with the search terms of "residential environmental education" and "national association + environmental education." Additionally, we used different Google domains (employing relevant English, Spanish, and Portuguese search terms) particular to specified countries including Argentina, Australia, Brazil, Canada, Chile, Germany, Honduras, India, Ireland, Mexico, New Zealand, Spain, and the United Kingdom.

Once on a program's Web site, we looked for stated goals, outcomes, mission statements, and philosophies to extract intended outcomes. From an initial list of 460 residential

EE programs identified, we narrowed to a list that included only those programs with a functional Web site; at least one overnight stay; programming that emphasized environmentally related knowledge, dispositions, competencies, and/or skills; and language about their mission, goals, or intended outcomes on their Web site. Two researchers coded the remaining 206 programs' intended outcomes through an iterative, inductive process to discern metacategories of program objectives—both intermediary and ultimate. Our intention in this step was not to fully understand each of the 206 programs, but rather to gain a broad grasp of desired outcomes.

The second step was to explore how residential EE centers are evaluating their outcomes. We conducted a literature review of 37 evaluation reports of residential EE programs and peer-reviewed articles related to residential EE. We identified evaluation reports and manuscripts using the search term “residential environmental education” within journals focused on EE, science education, and museum studies; dissertation abstracts; gray literature found on University of Michigan's MEERA portal; and on Google Scholar. Finally, we conducted a snowball sample request of evaluation reports from six professional environmental education evaluators. We tallied the reported outcomes, indicators, and tools used in studies specifically focused on evaluating residential EE. As with the intended outcomes, our goal was to gain an understanding of the trends in measures and tools rather than to conduct a comprehensive analysis of all residential EE evaluations.

After the review of objectives for and methods used in residential EE evaluation, we sought innovative indicators and methods for measuring intermediary outcomes in peer-reviewed journal articles. We considered “innovative indicators” to be those outside of the typical environmental attitudes, values, knowledge, and behaviors described in the introduction; we considered “innovative methods” to be those that went beyond immediate preprogram and postprogram survey and

interview approaches most common in residential EE, as discussed. With these parameters, our search included an array of fields outside of the residential EE space, including nonresidential EE, science education, interpretation, museum studies, and program evaluation. We then looked to non-EE fields in which such evaluation measures may be present, including public health, nonprofit development, organizational development, and business. We reviewed abstracts from 34 journals over the past 5 years and noted outcomes, indicators, or measurement tools that seemed particularly interesting and relevant for residential EE. Our criteria specifically focused on whether the outcome, indicator, or tool could elucidate measures for intermediary steps toward the overall residential EE program objectives found in the prior review.

Finally, we interviewed 12 residential EE educators (8 women; 4 men) to learn about methods they currently use or might consider using to measure intermediary steps toward environmental learning, behavior, and personal development. Interviewees' experiences ranged from entry-level educators to program coordinators. Interviews were open ended, lasted approximately 1 hr, and included: (a) a description of our overall research methods and our interests in intermediary outcomes; (b) an invitation to share how they currently measure intermediary outcomes and which ones they would like to see measured; and (c) an assessment of the practicality of our derived list of innovative methods for measuring intermediary, process-related outcomes. We thematically analyzed these interview data using NVivo 7, a qualitative data software package.

Findings: Outcomes and Methods in Residential EE Evaluation

Of the 206 residential EE programs we reviewed, 90.8% were based in the United States and 9.2% were based in Canada, New Zealand, Australia, Chile, Honduras, Brazil, India,

Ireland, the UK, and Spain. The low percentage of international sites included in our review is partly because we found that the majority of environmental education taking place outside the United States occurs in schools and day-use centers, rather than in residential settings. The lack of Web-based directories for non-U.S. environmental education sites also limited our search.

Outcomes of Interest

Intended outcomes were coded into: environmental and science awareness and knowledge; environmental and science attitudes; social skills; personal development; environmental and science skills and behaviors; cognitive skills; community building; and participation (Fig. 1).

The most commonly cited outcomes generally matched the international goals for EE of environmental awareness, attitudes, behaviors, skills, and citizen participation (UNESCO, 1980). In addition, however, the residential EE programs often described an intention to promote personal development, social skills, and community development, which many Web sites described as pathways to influencing participants' overall level of environmental citizenship. Maine's Tanglewood 4H Camp and Learning Center, for example, indicates that they teach "values of teamwork, leadership, respect, and a love of the natural world—preparing our young people to be tomorrow's responsible citizens and community leaders" (<http://umaine.edu/tanglewood/>).

These general categories of intended outcomes are reported in a similar review that surveyed 114 directors of residential EE centers (Bourke, 2011). Respondents were asked to select from lists of potential programmatic focus areas and expected outcomes for residential EE programs. Directors described their curricula as being focused on: science (97%), personal growth (30.4%), social studies (21.4%), recreation (14.3%), creative expression (5.4%), and agriculture (2.7%). Intended outcomes included changes in environmentally related

knowledge and behavior (36% respondents) and changes in attitudes (30.4% respondents). The relative frequency of these outcomes is similar to our findings, although the closed-ended nature of the questions may have limited the extent to which other intended outcomes were reported.

In most of the 37 evaluation reports and manuscripts we reviewed, the measured outcomes aligned with those documented in our Web site search. Two evaluation reports did not align easily with our predefined intended outcomes. The Headlands Institute¹ conducted an empowerment evaluation using class observations and field science educator surveys to measure transference, defined as "when students connect their Headlands Institute experiences and acquired skills back to their lives at home" (Meiris, 2010). We consider transference an intermediary outcome related to the adoption of environmental awareness, attitudes, behaviors, and, even, social skills. A second study (Duffin, Becker-Klein, Plumb, & PEER Associates, 2007), used student and educator interviews to consider how cultural context affects program processes and results. We consider this an inquiry into the "fit" of the program's context and process to the overall programmatic goals. Transference and fit are both examples of how residential EE can explore intermediary outcomes to improve a program's potential to reach overall intended outcomes.

Evaluation Methods Used in Residential EE Programs

The majority of outcomes found in the 37 evaluation reports and manuscripts were measured using surveys, interviews, and, occasionally, participant observation (See Table 1). The surveys and interviews were most frequently conducted using a posttest only design, although some studies reported using a pretest/posttest design (e.g., Harding, 1997) or including a delayed posttest (e.g., Stern, Powell, & Ardoin, 2008;

¹Now NatureBridge at Golden Gate.

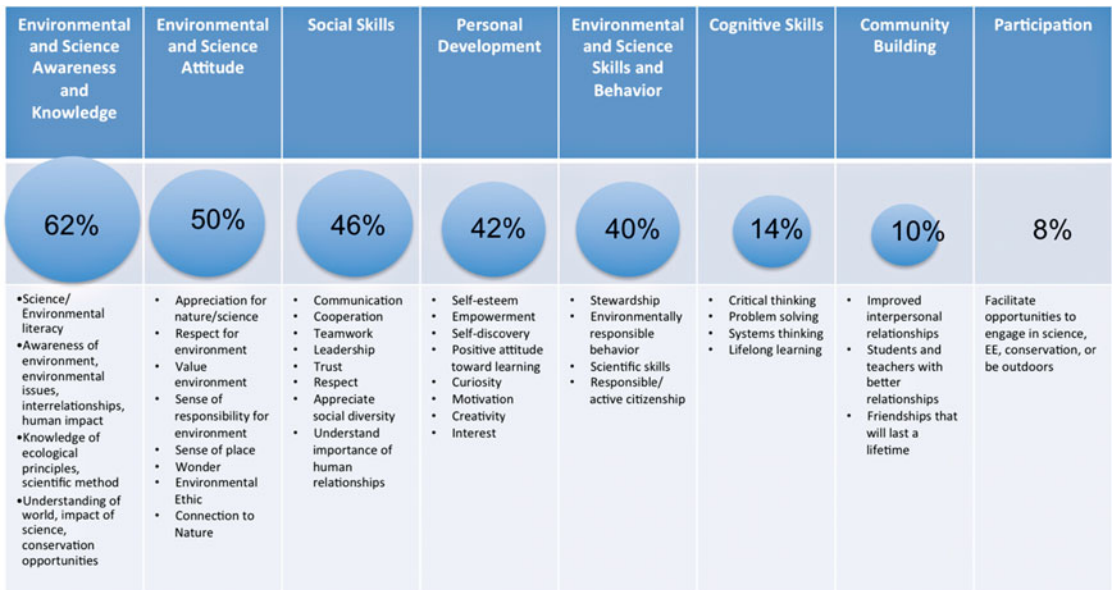


Fig. 1. Intended outcomes of residential environmental education programs as described on program Web sites

Stern et al., 2011). In addition to collecting data from the students, some studies and evaluations included classroom teachers and parents in their research to understand teachers' motivation for bringing students to a residential EE program (Schartner, 2000; Smith-Sebasto, 2007), which aspects of a program teachers found most impactful for their students (e.g., Ballantyne & Packer, 2008), teachers' thoughts on the efficacy of a program (e.g., PEER Associates, 2009), or what changes parents saw in their children after a residential EE experience (e.g., Dettman-Easler & Pease, 1999; Dresner & Gill, 1994).

Although most of the reviewed studies relied on standard data collection and analysis tools, we found some interesting attempts to understand students' experiences, including cognitive mapping, ethnography, personal meaning making, and social mapping. Kearney (2009) used the conceptual content cognitive mapping tool (3CM) to guide students through a process of generating ideas about what constitutes a healthy environment and sorting these ideas into categories, thereby assessing students' conceptual knowledge about healthy

environments at two points during their stay at a residential EE program. In another example, James and Bixler (2008) conducted an ethnographic study of one class's 3-day residential EE experience to understand students' lived experiences in the program. In addition to participant observation and interviews, they administered Modified Personal Meaning Making (PMM) and Five Field Map (FFM) instruments to understand students' meaningful learning and their social worlds, respectively. These two studies offer promising methods for measuring intermediary outcomes of residential EE.

New Directions for Evaluation: Looking to Other Fields

After reviewing the current state of residential EE evaluation, we sought inspiration from related academic fields in terms of outcomes and methods. First, we present potential concepts with regard to intermediary outcomes; then we summarize the perspectives of EE educators, including their feasibility and interest.

Table 1
Indicators of intended outcomes and measurement tools used in residential environmental education

Indicators	Measurement tools
Environmental knowledge and awareness	
Science knowledge & understanding	Test of understanding (AIR, 2005)
Environmental knowledge	Clicker questionnaire (Kearney, 2009) Cognitive mapping (3CM) (Kearney, 2009)
Interconnectedness	Observation protocol (Schneider & Atkin, 1999)
Ecological knowledge	Test of knowledge (Harding, 1997)
Environmental attitudes	
Environmental attitudes	Children's Attitude Toward the Environment Scale (CATES) (Harding, 1997; Smith-Sebasto & Semrau, 2004) Survey (Cheng, Monroe, & Gordon, 2008; Kearney, 2009) Children's Environmental Response Inventory (CERI) (Smith-Sebasto & Cavern, 2006)
Learning for sustainability	Interview with Env Learning Outcomes Survey (ELOS) attitude question (Ballantyne & Packer, 2008)
Sense of place	Observation protocol (Schneider & Atkin, 1999)
Positive attitude toward wildlife	Survey (Dettman-Easler & Pease, 1999) Parent interviews (Dettman-Easler & Pease, 1999)
Connection with nature	Survey (Stern, Powell, & Ardoin, 2008)
Environmental engagement	Open ended questionnaire (PEER, 2009)
Environmental skills and behaviors	
Sustainability skills	Interview with ELOS knowledge and behavior questions (Ballantyne & Packer, 2008)
Environmental stewardship & responsibility	Survey (Stern, Powell, & Ardoin, 2008; PEER, 2009, 2010; AIR, 2005) Phone surveys 6 and 12 months post (Burns, Chandra & Lara-Cinisomo, 2011) Observation protocol (Schneider & Atkins, 1999) Environmental Responsibility Index (Stern, Powell, & Ardoin, 2011)
Cognitive skills	
Problem solving	Survey (PEER, 2009)
Social Skills	
Social skills	Scales for cooperation, conflict resolution, & leadership (AIR, 2005)
Leadership	Survey (PEER, 2009, 2010) Life Effectiveness Questionnaire (LEQ-H) (McLeod & Allen-Craig, 2003) LEQ-I (Stenger, 2001) Questionnaire & interview analyzed using Rickinson et al. (2004) frame (Amos & Reiss, 2012) Character development and leadership index (Stern, Powell, & Ardoin, 2011)
Personal development	
Personal skills	Scale for self-esteem (AIR, 2005)
Character development	Character development and leadership index (Stern, Powell, & Ardoin, 2011)
Interest in learning and discovery	Interest in learning and discovery scale (Stern, Powell, & Ardoin, 2008)
Attitude toward school	Attitudes toward learning and school scale (Kearney, 2009)
Personal development (e.g., leadership, self-esteem, cooperation)	Survey (PEER, 2010)
Academic engagement	Teacher survey (PEER, 2009)
Community building	
Social skills	Scale for relationship with teacher (AIR, 2005)

(Continued on next page)

Table 1
Indicators of intended outcomes and measurement tools used in residential environmental education (Continued)

Indicators	Measurement tools
Academic improvement Teacher practices	Student and educator interviews (Duffin et al., 2007)
Participation Perception of environmental education experience	3-item open-ended questionnaire (Smith-Sebasto & Obenchain, 2009; Smith-Sebasto & Walker, 2005)
Lived experience in residential environmental education program	Ethnography, including Personal Meaning Making and Five Field Map tools (James & Bixler, 2008)
Engagement	Observation tool (Ballantyne & Packer, 2008)

Intermediary Outcomes: Opportunities for EE Evaluation

Our review of evaluation and research outside of residential EE revealed that programs are measuring intermediary outcomes that the field of EE has demonstrated or hypothesized to result in learning and motivating proenvironmental behavior, thus representing potentially promising avenues for residential EE evaluation (see Table 2). We categorized these concepts into cognitive, affective, and personal and social development outcomes for the sake of organization, although many can fit into any or all of the three groupings provided.

The same literature review revealed promising methods for measuring these outcomes in residential EE. From the organizational development literature we found two frameworks for approaching evaluation that could provide important contributions to residential EE evaluation. Developmental evaluation recommends a continuous, inductive evaluation process to improve programs that are complex and may not have clearly defined goals (Patton, 2011). In doing so, evaluators can learn much about the intermediary factors that contribute to any perceived success. Similarly, systems analysis has been adopted by some organizational evaluators in both the design and interpretation of evaluation results (e.g., Wasserman, 2010), thus ensuring consideration of the fuller picture of what may contribute to outcomes of interest. In

Table 2
Promising intermediary outcomes for residential EE derived from review of non-EE literature

Outcome type	Intermediary outcomes
Personal and social development	Identity Affiliation Trust Self-efficacy Affective integration (the degree to which participants think they have quality interpersonal relationships) Cognitive integration (the degree to which participants have learned to understand others' interpretive frameworks) Collectivism Collective psychological ownership Relational development Interconnectedness*
Cognitive	Mindfulness Critical thinking Decrease uncertainties Knowledge translation Worldviews and perspectives about nature Knowledge transference*
Affective	Engagement Interest Motivation Passion Emotion Thriving (vitality + learning) Environmental concern (fear and care) Flow Curiosity* Stewardship*

*Outcomes generated by the residential environmental education practitioners during interviews.

Table 3
Diverse measurement tools for intermediary outcomes

Evaluation frameworks	Innovative tools
Developmental evaluation	Appreciative inquiry (e.g., Patton, 2011)
Systems analysis	Using systems perspective for evaluation design and interpretation (e.g., Wasserman, 2010)
Measurer	Measurement tools
Educator-elicited data	<p>Reflective journaling</p> <ul style="list-style-type: none"> –Poetry –Draw and write (e.g., Draw-an-Environment Test Rubric or Draw yourself) (e.g., Kalvaitis & Monhardt, 2012; Mosely, Desjean-Perrotta, & Utley, 2010; Strife, 2012) <p>Use of technology</p> <ul style="list-style-type: none"> –Video booth with chalkboard (Simon, 2012) –Blogs (e.g., Denskus, 2012) –Video diaries (e.g., Roberts, 2011) –Podcast (participants produce podcast on topic related to program) –Online wiki (TCC Group, 2011) –Crowd-sourced web photos/videos (participants contribute to online repository of photos and/or videos) –Digital storytelling (e.g., Johnston, 2008) –Photo-elicitation (e.g., Smith, Steel, & Gidlow, 2010) <p>Concept mapping</p> <ul style="list-style-type: none"> –Q sort (e.g., Sostrin, 2009) –Complexity mapping (e.g., Sostrin, 2009) –Cognitive mapping (e.g., Kelly et al., 2007) –Journey mapping (e.g., Crunkilton, 2009) –3CM (e.g., Kearney, 2009) –Personal Meaning Making tool (PMM) – concept map (e.g., James & Bixler, 2008) –Five Field Map tool (FFM)—who kids learn from (e.g., James & Bixler, 2008) –Card sort (e.g., Gyllenhaal, 2002; Serrell & Associates, 2001) <p>Activity-based</p> <ul style="list-style-type: none"> –Forced choice (students physically move to location that demonstrates correspondence with their response to a question) –Station rotation (discussion, action, drawing stations) (Khalil, 2011) –Physical placement based on level of affect (e.g., excitement, interest, concern) –Emoticon necklaces/cards (Khalil, 2011) –Circle or cross out preferences (Khalil, 2011) <p>Prompted time series</p> <ul style="list-style-type: none"> –3 × per day use of journal (e.g., Niessen et al., 2012) –Experience sampling method (pager) (e.g., Tobias & Inauen, 2010) <p>Open-ended questions</p> <ul style="list-style-type: none"> –What more would you like to learn? –Your three snapshots you'll take home
Observer protocols	<p>Observation protocol for videography</p> <p>Engagement observation tool (Barriault & Pearson, 2010)</p> <p>Observation of question-asking</p> <p>Observation of physical positions</p>

addition to innovative frameworks, we also discovered techniques for capturing data on intermediary outcomes. Specific tools included student-generated information, such as reflective journals or one of many uses of technology; observation protocols; conceptual

mapping exercises; various survey and interview methods such as prompted time-series responses, photolanguage, peer evaluations, and ethnographic vignettes; and participatory evaluations led by students, educators, or adult chaperones. Table 3 presents a diverse list

of tools from EE and other fields, each with potential for measuring several intermediary outcomes. We found the primary differences in the tools to be who elicits the data (the educator or an observer) and the general type of tool it employed (i.e., technology vs. journaling).

Feasibility of New Approaches: Field Educator Interviews

We presented these concepts and measurement tools to residential EE educators for feedback on their potential utility for understanding intermediary outcomes in their programs. Educators expressed interest in several of the new targets to measure, including: critical thinking; engagement in general and with the environment, in particular; environmental concern; mindfulness; trust; identity; worldviews and perspectives about nature; cognitive integration; relational development; and interest. In addition to providing opinions on the usefulness of proposed affective and intermediary outcomes from the literature, educators added several outcomes to our list. (See outcomes marked with an asterisk in Table 2.)²

Educators also expressed support for several of the innovative methods to capture these intermediary outcomes. Specifically, educators suggested that concept maps and journaling prompts would fit well within existing programs as they are already used as educational or communication tools. The use of iPads and cameras was less widely supported; some field educators believed the use of technology detracts from the unique opportunity to be connected only to nature, while others were curious about creative opportunities to leverage technology for embedded assessment uses. Several educators and staff posited that online focus groups, student-led research, and peer evaluations were

among the least promising methods as they would either require excessive effort on the educator's part or detract from program learning objectives.

Overall, educators expressed that the most beneficial methods would be those that create robust, quantifiable data for sharing with both internal and external stakeholders interested in the intermediary and overall outcomes of the programs (e.g., educators, program managers, parents, teachers, school administrators, board members, and funders, among others). They indicated interest in learning how to improve the rigor of evaluation data through techniques such as randomizing data collection processes to avoid data collection that is skewed toward opportune moments or particularly eager students. Educators expressed that experience sampling and randomly selecting students—two options discussed during the interview—were both feasible and potentially engaging ways of addressing this need.

We also explored how to build evaluation of these intermediary concepts into residential EE programs, as most methods would need to be complementary with EE activities and, thus, embedded in the programs. Because environmental education is built upon experiential learning pedagogies, which follow an iterative cycle of learning, processing, and reflecting on information, some of the evaluative methods can also function as educational tools. Conceptual mapping, for example, provides evaluation data while also offering students an opportunity to integrate their thinking into a visual format. Several educators also commented that informal assessment is already built into many of their programs through direct, but informal, observation throughout the day. However, they lack methods for systematically documenting and analyzing the data so that the data can serve as a basis for assessment and evaluation.

A final component of the interviews was identifying potential evaluators, because some tools require onsite observations as well as additional support with evaluation design, implementation, and/or data analysis. Most

²Although some of the intermediary outcomes described in Table 2 are relevant to residential EE (e.g., trust, critical thinking, interest), particularly because of the emphasis on interpersonal and intrapersonal skills, we did not find evidence of these being evaluated consistently within or across programs.

residential EE programs have school teachers, chaperones, or environmental educators as part of their regular learning network. Several interviewees suggested that it may be ideal to capitalize on the expertise of these education professionals by asking them to actively participate in the evaluation process by, for example, using a standardized protocol to collect observational data while on site or helping develop rubrics for data analysis.

CONCLUSION

This review examines residential EE evaluation with the intention of proposing new avenues for intermediary outcomes that result in ultimate outcomes. Many of these intermediary outcomes are challenging to characterize and measure, requiring special methods, metrics, and techniques, and needing more than a posttest-only survey to adequately capture the nuanced experience. Yet, our findings suggest that the majority of research and evaluation in residential EE focuses on testing the postexperience presence of overall intended outcomes. Although this follows common program evaluation practices, we believe that understanding the richness and depth of the field experience during residential EE will allow adaptation of content and methods to enable more effective achievement of outcomes. Therefore, we see the opportunity for more research into these intermediary outcomes and related evaluation techniques.

We hope to encourage further dialogue by presenting outcomes and measurement tools from diverse fields that can be applied for this purpose. As with all evaluations, users should be careful to select outcomes and tools that are age appropriate; fit their program's budget, staffing, time, and setting; and match their evaluation or research questions and needs. Although we present evaluation outcomes and methods separately as they have been

implemented, they can be combined and modified with other outcomes and methods to match a program's evaluation needs. Also important is determining whether the outcome or tool is most appropriately used before and after, during, or simply after program implementation, as well as at distinct intervals (e.g., once a year) or continuously.

By identifying and measuring aspects of programs that lead to overall intended outcomes, program developers may better be able to enhance their success. Although we focused on residential EE because of the opportunity to observe and influence intermediary outcomes over several days and during the course of the program itself, the concepts and metrics discussed are also relevant in other types of EE programs. The convergence of desired outcomes within the field suggests an opportunity to work collaboratively across settings to achieve, over time, enhanced environmental knowledge, skills, and behaviors across a range of audiences, for the benefit of society and the environment, now and in the future.

ACKNOWLEDGMENTS

We appreciate thoughtful feedback from reviewers and colleagues, especially Maria DiGiano, Rachele Gould, and Kathayoon Khalil. We appreciate the input of field science educators and education directors at the NatureBridge campuses, who participated in this study, as well as NatureBridge administrators, who provided overall guidance.

FUNDING

We are grateful to the Gordon and Betty Moore Foundation for their financial support of this and related research.

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