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Improving Assessments of Connection to Nature: A Participatory Approach

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Experiences in nature benefit humans in a variety of ways, including increasing health and well-being, reducing stress, inspiring creativity, enhancing learning, and fostering environmental stewardship values. These experiences help define the relationship people have with nature which is often correlated with a person's level of environmental concern as well as their engagement in pro-environmental behaviors. A more informed understanding of the ways in which interactions with the natural environment can foster connection to nature requires that we are able to measure our perceived relationship to the environment. Dozens of tools measure people's connection to nature—the strength of those perceived relationships with the natural world. Although the tools have been primarily developed to answer research questions, practitioners are increasingly interested in understanding whether and in what ways their work—in areas including environmental education, urban planning, and park management, for example—influences people's connection to nature. In 2018, we launched a participatory process involving researchers and practitioners in a review of existing connection to nature assessment tools with the intention of identifying tools that would be useful to practitioners, as well as defining needs in research. This paper chronicles the process's outcomes, including a discussion of opportunities for future research.

Keywords: connection to nature, assessment, evaluation, environmental education, values, gap analysis

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INTRODUCTION

Experiences in nature benefit humans in a wide variety of ways. Time spent in nature can enhance health and well-being, reduce stress (Hartig et al., 2014; Kuo, 2015), improve attention, increase happiness (Capaldi et al., 2014), improve educational outcomes (Kuo et al., 2019) and foster environmental stewardship values (Chawla and Derr, 2012; Kellert, 2012). Experiences in nature can also help children develop critical and creative thinking skills and can facilitate social and emotional learning (Chawla, 2015; Kuo et al., 2019). Strong connections to nature are linked to a greater engagement in self-reported pro-environmental behaviors (Whitburn et al., 2019) and may be more important than a background understanding of the issue in driving action (Otto and Pensini, 2017).

The recognition of these benefits and related questions have led to increased scholarship, as well as debate over definitions. Such discussions have explored topics related to what we value in nature (Chan et al., 2016; Hartel et al., 2020), what constitutes nature when discussing "connection to nature" (Evernden and Evernden, 1992), and how that definition varies across cultures. Debates have also explored the definition of connection to nature (Tam, 2013; Ives et al., 2017; Beery et al., 2020), predictors and outcomes of connection to nature (Mayer and Frantz, 2004; Hinds and Sparks, 2008; Mayer et al., 2009; Whitburn et al., 2019), and measurement approaches (Zylstra et al., 2014; Restall and Conrad, 2015).

For the purposes of this project and paper, we define "nature" as an environment in which ecosystem processes are evident, including a spectrum of habitats from a wilderness to an urban garden (Maller et al., 2006; Keniger et al., 2013). "Nature" also includes artifacts from those environments, such as a flower in a window box or a bird flying overhead. Connection to nature is the way people identify with these landscapes and the relationships they form with the elements in those environments (Restall and Conrad, 2015). Connection to nature can be an umbrella term that encompasses different, but related, constructs, including *emotional affinity toward nature*, which can include a person's experiences of awe, love, and concern for nature; *inclusion of nature in self*, which refers to how someone perceives the distinction between self and nature; and *connectedness with nature*, which refers to the extent to which people feel they are a part of nature (Tam, 2013).

Relationships with natural landscapes are not necessarily positive and need not be uniform. Negative experiences in nature may create attitudes of fear or disgust (Bixler and Floyd, 1997; Kellert, 1997) that define a relationship. Wilderness areas often inspire awe, but a backyard can offer an important contemplative respite that creates a different connection to nature. Similarly, utilitarian or extractive activities that involve being outdoors or work with natural resources can result in a strong knowledge base that leads to a positive relationship or an understandable sense of dominion.

Recognizing that many factors may be part of a connection to nature, some elements are likely to be more stable, much like a personality trait, while other elements are mutable to change through interventions or positive experiences in nature (Mayer and Frantz, 2004; Nisbet et al., 2009; Lumber et al., 2017). There also appears to be a typical developmental trajectory, where connection to nature increases in childhood, dips in adolescence, and increases again in adulthood (Beery, 2013; Hughes et al., 2019; Richardson et al., 2019). Effectively assessing connection to nature and the diversity of human relationships with nature is a critical step in understanding the value of nature to humans.

Having the ability to assess connection to nature could be useful to educators, natural area managers, community planners, and others because this concept is both an outcome of experience and learning and a potential indicator of mental health, well-being, and conservation behaviors. Although dozens of tools have been developed to measure connection to nature for research purposes (Tam, 2013; Restall and Conrad, 2015), practitioners are not typically accessing or using these tools. To address this research-practice gap, we undertook a multi-step process that included a participatory workshop with practitioners and researchers. Prior to the workshop we identified commonly used assessment tools and conducted a survey of North American Association for Environmental Education (NAAEE) and Children & Nature Network (C&NN) members to better understand their needs (Monroe et al., n.d.). During the workshop we articulated practitioner needs, identified connection to nature assessment tools that could meet their needs, uncovered gaps and opportunities available for future research, and formed teams to explore ways to improve existing tools and approaches. This paper chronicles the workshop outcomes of the project.

WORKSHOP

The planning team—comprised of representatives from University of Florida, Stanford University, C&NN, and the NAAEE—created a list of 30 researchers in psychology, education, and environmental studies based on publications, conference presentations, and scholarly reputation. We focused on recruiting authors of existing tools that are commonly used to measure connection to nature and on practitioners who have used these tools. In a rolling invitation process to maximize diversity of expertise, focus, research setting, and theoretical orientation, we invited 23 individuals to join the workshop. Due to sabbaticals, administrative duties, or other scheduling/temporal conflicts, 8 people declined the invitation. We halted any further invitations once we reached 15 confirmed participants (excluding the planning team); that final group included five authors of the tools under consideration. We aimed to have a group size that would accommodate large- and small-group interaction, allow for constructive conversation, and support participants in expressing differences of opinion and experience. In the end, 22 people attended the workshop in-person and one attended virtually; three nations were represented (New Zealand, Taiwan, United States).

On October 7 and 8, 2018, in Spokane, Washington, we convened a workshop to address three goals:

1. Goal 1: Articulate practitioner needs and develop consensus around which tools are most appropriate for practitioners to assess connection to nature.
2. Goal 2: Brainstorm about important research questions and needs related to connection to nature measures.
3. Goal 3: Identify research questions that members of the group might address in teams over the following year.

Tool Identification

To identify tools that measure connection to nature, graduate students from the University of Florida (UF) and Stanford conducted a review of the literature by searching for "connection to nature"-related terms in Google Scholar, in university databases (e.g., EBCSOHost), and in the Children & Nature Network Research Library. We then used a snowball-sampling method to search for additional citations and mentions that

may not have surfaced in our original process. Through this process, we identified three synthesis articles (Tam, 2013; Zylstra et al., 2014; Restall and Conrad, 2015) that compared 23 different tools used to measure connection to nature, most of which were identified through our initial literature review. After recognizing that some assessment strategies were not represented in the results of our literature review, we undertook additional efforts to find novel approaches that would complement our set of tools.

Through this process, we selected a total of 26 tools for workshop participants to review. Of those, 88% focused on collecting quantitative data using closed-ended items and measures such as scales. We summarized those 26 tools, including the constructs measured, the tool format, and information on the reliability and validity of the tool, and sent the summaries to participants prior to the workshop.

Workshop Outcome 1: Articulation of Practitioner Needs

During the workshop, participants discussed perceived practitioner needs, recognizing that researchers' needs likely differ from those of on-the-ground practitioners. Researchers address theoretically driven questions with the intention of producing generalizable knowledge that will be applicable beyond a specific program, audience, or context. Practitioners, on the other hand, are typically driven by evaluative questions and are interested in knowing whether, how, and under what conditions a specific program achieves its desired outcomes. We developed a consensus understanding of practitioners' needs (listed below) and used this perspective to narrow our collection of assessment tools.

Tools That Can Generalize Beyond a Small Sample of Participants/Visitors

Although practitioners are less likely to focus on producing generalizable knowledge beyond their own programs, for logistical and practical reasons, they may need to collect data from a small sample of their own visitors or participants and extend these findings to their population of visitors.

Tools That Can Detect Changes Due to Participation in a Program

Practitioners who wish to evaluate a program need to measure differences in key characteristics (e.g., knowledge, attitude, values) at two points in time, before and after a program. As those changes may be small and subtle, tools must be sufficiently sensitive and able to capture changes in "state" characteristics (which may be temporary).

Tools That Are Easy to Administer

Few non-profit and educational organizations and agencies have a large or well-trained staff specifically focused on evaluation or research. Therefore, practitioners need tools that are straightforward and that produce data that are easy to analyze and interpret.

Tools That Are Valid Across Various Audiences, Programs, and Settings

To assess whether and how educational and interpretive programs are meeting their intended goals with their audiences, practitioners need tools that are valid (measure the appropriate concepts and constructs), reliable (do so consistently over time), and stable (remain consistent in varying conditions and with a range of audiences). They also require tools that they can adapt to a range of ecosystems, cultures, programs, and languages. Relatedly, practitioners need to know what changes (e.g., vocabulary, item order) can be made to existing tools without undermining the original validity.

Tools That Are Widely Available

If tools are available only in the peer-reviewed literature or directly from researchers, they are difficult for practitioners to obtain. Without such access, practitioners often create their own evaluation tools, undermining the opportunity for comparable results among programs (Stern et al., 2014).

Workshop Outcome 2: Identifying Appropriate Tools

Workshop participants formed small groups, and each was assigned a subset of similar tools to review in detail. They critically examined the 26 tools using the following criteria:

1. Is the tool measuring connection to nature, or is it measuring other constructs?
2. Are there any other major issues with the tool?
3. Does the published, peer-reviewed literature suggest that the tool is valid and reliable?
4. Does the tool seem that it would be easy for practitioners to adapt and implement? If so, is it likely to return meaningful data that are easy to analyze?

Each group summarized their discussion using large flipchart paper, which all participants reviewed as they added their own comments. After a facilitated discussion on each of the tools, the group assigned each tool to one of two categories: "Remove from further consideration" or "Useful to practitioners to measure connection to nature."

We removed 18 tools because we decided that they primarily measured constructs other than connection to nature or were less useful for any of the above practitioner needs (see **Supplementary Material** for further discussion). This left eight tools that the group thought could be appropriate for practitioners (**Table 1**).

Workshop Outcome 3: Research Projects to Improve Existing Tools

Based on our discussion of the needs of practitioners and the shortcomings of some tools, the workshop motivated and the project supported three small research projects to review and enhance existing assessment tools in the following year. The outcomes of these efforts were made available to practitioners in a guidebook (see **Box 1**).

TABLE 1 | Tools identified as being useful to practitioners to assess connection to nature.

Tool	What does this tool look like?	Intended audience
Biophilia interview, Rice and Torquati (2013)	11-item scale with binary response options conducted as an interview with young children	Early childhood (2–5 years)
Connectedness to nature, Mayer and Frantz (2004)	10-item scale; responses to items are recorded on a 7-point balanced scale, ranging from *strongly disagree* to *strongly agree* 14-item scale; responses to items are recorded on a 5-point balanced scale, ranging from *strongly disagree* to *strongly agree*	Young adolescents (10+ years) and adults Adolescents and adults
Connection to nature index, Cheng and Monroe (2012)	16-item scale; responses to items are recorded on a 5-point balanced scale, ranging from *strongly disagree* to *strongly agree*	Children (8–10 years)
Digital photography and journaling, Ardoin et al. (2014)	Collection of journal entries, photographs, and captions	Children, adolescents, and adults
Environmental identity scale, Clayton (2003)	11-item scale; responses to items are recorded on a 7-point rising scale ranging from *not at all true of me* to *completely true of me*	Adolescents and adults
Inclusion of nature in self scale, Schultz (2002)	1-item pictorial scale with seven response options ranging from complete separation to complete overlap	Children (7+ years), adolescents, and adults
Love and care for nature scale, Perkins (2010)	5-, 10-, and 15-item scales; responses to items are recorded on a 7-point balanced scale ranging from *strongly disagree* to *strongly agree*	Adolescents and adults
Nature relatedness scale, Nisbet et al. (2009)	21-item scale; responses to items are recorded on a 5-point balanced scale ranging from *strongly disagree to strongly agree* 6-item scale; same response options as 21-item version	Adolescents and adults Children, adolescents, and adults

BOX 1 | This workshop was part of the two-year *Connection to Nature Assessment Project*. Another outcome of this project was a *Practitioner Guide to Assessing Connection to Nature*, which features 11 tools and approaches to assessing connection to nature (Salazar et al., 2020). Included are the eight tools that workshop participants identified as being useful to practitioners, plus three tools identified after the workshop that address practitioner needs: the Children's Environmental Perceptions Scale (Larson et al., 2011), Nature Relatedness Observations (Elliot et al., 2014), and interpretation of children's drawings. To make the guide more useful to practitioners, team members engaged over 340 conference attendees in several locations to review draft components and provide input on its development.

Project 1

A team revised the Environmental Identity Scale (Clayton, 2003) to make it more inclusive of urban experiences of nature and to make the language more accessible to individuals with low literacy levels (Salazar et al., 2020). The team tested the revised scale with seven different samples, including high school students in Chicago, United States, adults in Russia, and adults in Peru.

Project 2

A team reviewed the current state of connection to nature assessments for young children (Beery et al., 2020). The team developed a definition of early childhood connection to nature, ensuring that it was inclusive of young children's special qualities and recognizing the importance of children's agency and empathy in defining nature connection. This definition further emphasizes that connection to nature, among young children in particular, is multidimensional, place-based, and context-dependent.

Project 3

Two researchers revised the Connection to Nature Index (CNI) (Cheng and Monroe, 2012) to address three issues with the original scale (Salazar et al., 2020). They revised items to reduce the possibility of leading respondents to only consider positive responses; removed items that reflected behavioral intention; and equalized the number of items measuring each concept. The revised scale measures three concepts related to connection to nature, including enjoyment of nature, empathy for creatures, and sense of oneness with nature. They tested the revised scale for reliability and validity with 90 third-to-fifth-grade students in Taiwan.

Workshop Outcome 4: Future Research Priorities to Address Practitioner Needs

Workshop participants reflected on potential opportunities for future exploration to advance our understanding of connection to nature and the ability of practitioners to use assessment tools. They developed the following suggestions to frame future research in this field.

Define Connection to Nature

This umbrella term should be further clarified, separating the relationship with nature from beliefs, values, attitudes, behaviors, and experiences with and about nature, and exploring how these outcomes are correlated or dependent on each other.

Qualitative Approaches and Tools

There is also a need to develop practitioner-friendly tools for collecting qualitative data. We identified a need for strategies that can deepen our understanding of the processes by which programs impact nature connection among participants.

Embedded Assessments

For practitioners who lead programs, embedded evaluation activities avoid disrupting the program to collect data. Games and art activities were discussed as possible strategies.

Tools That Explore a Range of Nature Connections

Most existing tools explore positive and preservation attitudes toward nature. Tools that explore human-nature relationships associated with utility, livelihood, subsistence, or fear are needed.

Validation of Tools Across Languages, Cultures, and Populations

Practitioners need tools that are useful and appropriate across a wide variety of populations, cultures, and contexts. We recognized several priority populations: those with disabilities who may experience nature differently, those from cultures who may understand nature differently, and those for whom English is not their language of choice. There is also a need to understand whether tools can be adapted to be more culturally responsive, particularly when working in cultures where the human-nature relationship is conceptualized differently.

Changes Due to an Intervention

Practitioners need to know what kinds of programs and experiences foster connection to nature and what program characteristics make the largest difference. Frequency, duration, and opportunities for reflection should be considered. The stability or longevity of change is of particular interest as well, and it would be helpful to test the ability of tools to assess long-term changes. In addition, the impact of vicarious experiences (e.g., videos, virtual experiences, and stories) should be explored.

Further Testing of Tools

Future research could explore how tools perform when tested across multiple contexts and should compare tools to understand whether they are measuring the same concept. How does connection to nature vary from or correlate with sense of place or biophilia? Testing could examine whether rising or balanced scales more effectively and reliably capture change.

Collective Evaluation

Researchers might create a system to collect data from commonly used tools in a variety of contexts to ask and answer more global questions with "big data."

DISCUSSION

Sharing research results with those who can use them is an ongoing challenge for the academic community (Meyers, 2006; Neal et al., 2015). This work may be more difficult when researchers and practitioners do not share the same disciplines, as is the case with psychologists and environmental educators who are interested in connection to nature assessments. Our project, coordinated by researchers in environmental education, helped create bridges among disciplines and identify avenues to reach common ground. By bringing together researchers and practitioners in a participatory learning process we created opportunities for social learning and knowledge production (Wals et al., 2009; Monroe, 2015).

Environmental educators, city planners, and park directors, among others, are increasingly interested in understanding their audiences' connection to nature and in assessing whether, and in what ways, their programs and initiatives influence this connection. Yet while many tools exist to assess connection to nature, their utility to practitioners is limited by their format; their bias toward particular conceptions of nature; their focus on a limited range of audiences and contexts; their availability; and inconsistencies in their reliability, validity, and stability.

Workshop participants were engaged and actively advanced our collective understanding of how the needs of practitioners may not match the interests of researchers or funders. Several of these needs could be expanded in future proposals for new research projects, such as creating and testing qualitative tools and analysis strategies and developing strategies for embedded assessments that can be part of program activities.

Workshop practitioners also discussed ways to advance the concept of connection to nature, such as exploring whether the term connection to nature should encompass the full range of relationships and experiences that people have in the outdoors, the effect of various components of a program, and how different experiences create or sustain a connection to nature. It may be valuable to explore whether the agree/disagree scales are less effective in capturing fine-scale shifts in respondents' perception of their connection to nature and are thus artificially reporting greater stability in traits than is warranted. From a practical perspective, using multiple tools with the same program could help us learn more about how they compare and enhance our understanding of changes due to a program (Giusti, 2019). As youth increasingly engage in electronic media, the question of developing a connection to nature from vicarious experiences becomes more urgent.

The advances that were made in refining existing tools as a part of this project represent the ways researchers can benefit from engaging with practitioners. Small changes to the vocabulary used in a tool can affect how people think about nature. For example, changing "mountain ranges" to "leafy backyards" makes an item more accessible to urban residents. Developing strategies to observe and interview young children enables practitioners to understand their perspectives.

There were also limitations to our project. Participation in the workshop was limited by time, money, language, and our networks. The tools we reviewed were limited to those published in the literature. We did not access gray literature and may have missed existing tools that could also be useful to practitioners.

Future Directions

There is a deep, longstanding interest in understanding the value of nature to humans (Kaplan and Kaplan, 1989; Kellert and Wilson, 1993). Although some tools exist to assess aspects of the human-nature relationship, there are still many gaps in our understanding and many unanswered questions. Interdisciplinary teams of researchers and practitioners can help move this exciting work forward as we explore connection to nature as a part of the critical valuation of nature's contributions to people. Pathways that enhance connections to nature and

outcomes that result from deepening our relationship with nature are examples of concrete actions that may help us achieve goals for conserving and sustainably using nature. By enabling practitioners to conduct valid assessments and program evaluations, we can enhance our collective understanding of connection to nature: how and under what conditions it develops; how it is supported, nurtured and enhanced; and the outcomes and impacts it creates.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

GS was the lead writer. MM, CJ, TB, and NA contributed to the writing process. MM, CJ, and NA organized the workshop. All authors attended the workshop.

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SUPPLEMENTARY MATERIAL

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