

Being and Becoming in Nature: Defining and Measuring Connection to Nature in Young Children

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ABSTRACT

This paper examines the meaning, assessment, and development of connection to nature (C2N) in two- to five-year-old children. It grows out of a Connection to Nature Workshop organized by the University of Florida, Stanford University, the North American Association for Environmental Education, and the Children and Nature Network to evaluate instruments that measure C2N. Defining and measuring C2N in young children emerged as a current research gap. The workshop was followed by the formation of an Expert Advisory Panel on Early Childhood Nature Connection to address this need. Through semi-structured interviews and narrative responses to a survey, panel participants provided insight on early childhood connection to nature and reviewed existing measures of nature connection for this age group. This paper presents a synthesis of panel ideas. One outcome of the analysis was a detailed description of C2N, highlighting the importance of both quantity and quality of time in nature. Quality time in nature includes opportunities for self-directed exploration, multisensory engagement with nature places, the presence of animals, and the supportive influence of peers and adults. Research implications include recommendations for mixed-method assessment strategies for young children as well as the importance of access to nature for all children.

Keywords: biophilia; connectedness to nature; early childhood, measurement

This paper examines the meaning, assessment, and development of connection to nature (C2N) in two- to five-year-old children. Most research that systematically investigates people's connection with nature involves adults or school-age children and adolescents (Restall & Conrad, 2015; Tam, 2013; Zylstra, Knight, Esler & Le Grange, 2014). Early childhood, however, is a formative period when children learn basic patterns of relationship with the world around them and an understanding of the meaning and value of things in the context of their families and societies (Pramling Samuelsson & Kaga, 2008). Therefore, it is important to consider how connection with nature begins to develop in these early years. Nature preschools, nature kindergartens, and the "greening" of early childhood school grounds and curricula are proliferating, and many of these programs identify connecting young children with nature as a core part of their mission (Sobel, 2016). Therefore, there is a need to understand how to identify and assess nature connection in this age group.

The notion of early childhood as an important period for connecting with nature is based on young children's "heightened susceptibility to acquiring understandings and concepts which impact on the individual's life-long attitudes, understandings, and skills" (Wilson, 1996, p. 121). Early childhood is a unique time when children are forming meaningful relationships with their parents, grandparents, caretakers, teachers¹, siblings, and peers, learning language, constructing a sense of identity, building physical skills, acquiring a sense of agency, and exploring their environment. A rich literature of children's relations with the more-than-human world supports the idea that connecting with nature is important for children's current experience—or *being*—in addition to its contributions to the future adults that they will *become* (Rautio & Jokinen, 2015; Taylor, 2013). Sebba (1991) notes that children "experience the natural environment in a deep and direct manner, not as a background for events, but rather, as a factor and stimulator" (p. 395). Among adults, connecting with nature in childhood is associated with later habits of care for the environment, and children who express greater connection also express greater environmental concern (Chawla, in press). Therefore, we argue for an age-specific conversation on early childhood connection to nature that explores both being and becoming through voices in child psychology, sustainability science, environmental education, and related fields.

Reviews of nature connection across the lifespan indicate that it is a multidimensional construct that includes emotions, behaviors and cognition, but there is no single consensus definition (Beery & Wolf-Watz, 2014). Beery and Wolf-Watz (2014) describe an "environmental connectedness perspective" that includes a broad collection of ideas that describe an affective, cognitive, and physical human relationship with nature by using terms such as affinity, biophilia, commitment, ecological self, identity, inclusion, relatedness, and sensitivity. These ideas emphasize direct experience of nature and physical, emotional, and cognitive outcomes as well as provide a useful starting point for consideration of C2N in early childhood. However, rather than assuming that this perspective derived from research with adults and adolescents directly applies to early childhood, this paper strives to freshly examine characteristics of C2N in two- to five-year-old children.

PURPOSE

This paper grows out of a workshop to evaluate approaches for assessing C2N in both children and adults, followed by the formation of an Expert Advisory Panel on Early Childhood Nature Connection with the goal of collectively reviewing existing measures of nature connection for two- to five-year-olds and benefitting from expert insights on the development of nature connection during this period. Several panel members emphasized the importance of building on fundamental research in early childhood development for these years when children are undergoing rapid growth and change in their physical, social, emotional, and cognitive capacities. Within this context, panel members discussed the meaning of C2N for two- to five-year-old children and how it develops. This paper draws on the authors' engagement in workshop discussions, collaboration with the Expert Advisory Panel, and reading of relevant literature to explore the following questions:

1. How is C2N defined when it applies to two- to five-year-old children?
2. How does C2N develop during this period?
3. How is C2N best measured in children this age?

The following section describes the methods followed during the C2N assessment workshop and collaboration with the Expert Advisory Panel. Further sections review the meaning of C2N for two- to five-year-old children, key considerations in young children's being and becoming in relationship with the natural world, and C2N assessment approaches for these ages. In conclusion, this paper discusses key themes that emerged from the Expert Advisory Panel's reflections and suggests implications for future research and practice.

¹ The term "influential adults" will be used in this paper to refer generally to parents, families, caretakers, and teachers.

METHODS

Workshop

In 2018, the Pisces Foundation funded faculty and staff affiliated with the University of Florida, Stanford University, the North American Association for Environmental Education, and the Children and Nature Network to evaluate instruments that measure C2N in children and adults, with the goal of creating an online *Practitioner Guide to Assessing Connection to Nature* (Salazar, Kunkle, & Monroe, 2020). In October 2018, eight members of these organizations joined 14 researchers and educators in a two-day Connection to Nature Workshop in Spokane, Washington to review strengths and weaknesses of existing tools and research approaches, and select measures for inclusion in the guide. Participants considered how different groups may need different tools to appropriately measure C2N, based on age, culture, and program context.

It became apparent that C2N in two- to five-year-old children has received much less attention than nature relationships in later childhood, adolescence and adulthood, when people are capable of responding to long interviews and written questionnaires. For example, in advance of the workshop, participants received summaries and links to 26 papers on C2N and associated assessment tools, as well as three reviews of this literature: only two of the assessment papers involved preschool children, and the literature reviews failed to consider C2N during these early years. For this reason, the first and second authors of this paper, who were participants in the workshop, offered to investigate approaches to the assessment of C2N in this age group and make recommendations for the guide. This paper's third author joined this effort, based on his background in working with young children in nature settings and his interest in research on this topic.

Identification of Assessment Tools for Two- to Five-Year-Old Children

In preparation for the Connection to Nature Workshop, faculty and research assistants affiliated with the University of Florida conducted a literature search for peer-reviewed articles and book chapters that introduced original C2N assessment tools. The search began with the research library developed by the Children and Nature Network and the Ebsco database. As each article or book was identified, it was used in a citation index search to find additional papers and books introducing new or modified tools. In total, 46 relevant publications were identified, which produced 23 tools that are freely available for reuse. This list was complemented by any paper that explored non-survey forms of assessment, such as games or photography. This process produced two studies that assess C2N in preschool or kindergarten children, by Elliot, Ten Eycke, Chan, and Müller (2014) and Rice and Torquati (2013). During the workshop, this paper's authors suggested the addition of a third study by Giusti, Barthel, and Marcus (2014). After the workshop, a fourth study was published and added (Sobko, Jia, & Brown, 2018).

The authors created individual tables to guide the review of these four studies. Each table summarized the study aims, how C2N was defined as a construct and its different dimensions, the steps followed to create the measure, and the samples used to pilot and apply it. Less detailed summaries of each study are condensed into Table 1 of this paper. As the Table 1 shows, Sobko et al. (2018), Giusti et al. (2014), and Rice and Torquati (2013) created quantitative assessment tools, whereas Elliot et al. (2014) constructed a quantitative tool along with ethnographic documentation of how children relate to nature.

Table 1

Measurement approaches to assessing connection to nature in two- to five-year-old children

Article	Construct name and dimensions	Measurement approach	Sample
Elliot et. al. (2014)	Ecological awareness: <ul style="list-style-type: none"> • nature relatedness • environmentally responsible behavior 	1. Child interview via board game: <ul style="list-style-type: none"> • 4 items on nature v. non-nature activity preferences • 6 items on environmental behaviors 2. Ethnographic observation of children's behavior in nature	43 kindergarten children on Vancouver Island, British Columbia: <ul style="list-style-type: none"> • 21 in nature kindergarten • 22 in conventional kindergarten
Giusti et. al. (2014)	Affinity with the biosphere: <ul style="list-style-type: none"> • emotional affinity • cognitive affinity • attitudinal affinity 	Child interview via image-based board game: <ul style="list-style-type: none"> • 14 items for emotional affinity • 21 items for cognitive affinity • 6 items for attitudinal affinity 	27 five-year-old children in preschools in Stockholm: <ul style="list-style-type: none"> • 11 children with nature-rich routines • 16 children with nature-deficit routines
Rice & Torquati (2013)	Biophilia: <ul style="list-style-type: none"> • preference for being outdoors • enjoyment of sensorial aspects of nature • curiosity about nature • interacting with nature 	11-item interview using puppets: <ul style="list-style-type: none"> • one puppet represents the "more biophilic" child • the other puppet represents the "less biophilic" child • the participating child is asked, "which one is more like you?" 	114 children in 10 early childhood programs equally distributed between Nebraska and California: <ul style="list-style-type: none"> • 6 programs had an outdoor play space with natural elements • 4 programs did not have outdoor play space with natural elements
Sobko et. al. (2018)	Connectedness to Nature Index-Parents as Proxy for Preschool Children: <ul style="list-style-type: none"> • enjoyment of nature • empathy for nature • responsibility toward nature • awareness of nature 	Two studies conducted: <ul style="list-style-type: none"> • Study 1: Piloting and adapting a 20-item index for parents to fill out for their preschool children • Study 2: Large scale evaluation of the new tool and testing its convergent validity 	Two studies conducted: <ul style="list-style-type: none"> • Study 1: Randomly chosen parents of 31 two- to four-year-old children (mean age = 2.16). * Families lived in apartment buildings without front or back yards, as is typical in Hong Kong • Study 2: 299 families with two- to five-year-old children <p>*ages verified by T. Sobko, personal communication</p>

Collaboration with an Expert Advisory Panel

Nine researchers and practitioners who have studied two- to five-year-old children were invited to join an Expert Advisory Panel on Early Childhood Nature Connection. Panel members agreed to share general reflections about the meaning of C2N in early childhood and its development, evaluate existing assessment tools and approaches, and discuss promising research directions. Together, the panel represented the fields of education, child development, conservation, and sustainability science. Four members were creators of existing C2N assessments for young children, two had designed tools to measure empathy in young children, and two had designed C2N assessments with older children. Two were involved in a nature preschool and two were connected with university lab preschools which included nature settings. Panel members provided an international perspective, as they worked in the United States, Canada, Sweden, and Taiwan. Six had experience with racially and ethnically diverse children, who together came from a mix of professional, working-class and low-income backgrounds, primarily from urban or suburban areas; whereas three worked almost exclusively with children from white middle-class families.² (For panel members' names and affiliations, see the Acknowledgments).

Advisory Panel members (hereafter "participants") were sent the full summary tables of measures to assess C2N in young children and associated publications (as identified in Table 1). They received a list of open-ended questions that asked for their evaluation of the strengths and limitations of the four quantitative tools and the ethnographic documentation, as well as their general reflections about C2N in two- to five-year-old children. Specifically, they answered the following questions:

1. For two- to five-year-old children, what ages have you worked with or studied?
2. Based on your experience, how should "nature connection" be defined in early childhood?
3. What pivotal experiences mark the development of nature connection in early childhood?
4. How do children express nature connection at this age?
5. Are indicators of nature connection context dependent?
6. Briefly share your assessment of each of the four studies that measured nature connection in young children.

Six participants chose to return written responses and three responded through phone interviews that were recorded, transcribed, and returned for corrections and revisions. All of the participants agreed to share their responses with each other. Because three of the quantitative tools and the ethnographic documentation were produced by members of the panel, people were critiquing each other's work. For this reason, the collected responses were sent back to participants without names.

Analysis of Interview Responses

The opening interview question about participants' work and research with young children required a simple summary of the information. To identify the topics that participants covered in their responses to questions 2 through 5 about the definition, development, expression, and contexts of C2N in young children, this paper's authors began with a process of descriptive coding (Miles & Huberman, 1994; Saldaña, 2009). Each author began by coding individually. We then created a document that aligned our three coding columns beside the panel responses. From this synthesis, we generated a list of all the codes used, grouped under common topics. In addition to showing considerable overlap in terms of the topics identified, this list revealed a few topics suggested by individual participants. Through correspondence and a Skype conversation, we agreed on common terms for each topic and a final list of topics. For the next step of thematic analysis (Saldaña, 2009), we agreed on how to cluster topics together under common themes. This final list of themes was then arranged in an outline, which structures the presentation of Results below.

² Participants described the diversity of children that they worked with in a separate follow-up email, apart from the survey questions.

The authors also coded participant evaluations of the four assessment tools and ethnographic documentation. Six participants reviewed these approaches separately, whereas one made general comments about the collection as a whole. Due to time constraints, two limited themselves to reflecting about lessons learned during the construction and application of assessment approaches that they created. The final section under Results summarizes these evaluations and presents the contributions that emerged from this process for the *Practitioner Guide to Assessing Connection to Nature* (Salazar et al., 2020).

As we reviewed participants' responses, we highlighted their comments and questions about aspects of early childhood nature connection that remain uncertain or unsettled, and we added questions of our own. These comments and questions inform this paper's concluding discussion. They suggest productive directions for future research to understand C2N in young children.

RESULTS

This section summarizes key themes from responses to the questions posed to participants, including their review of C2N measurement approaches for two- to five-year-olds. Participants' responses to the initial question about the ages they studied and served showed that they all brought a depth and breadth of professional experience. Most had designed or used C2N assessments with children (or assessments for the related construct of empathy). All nine participants provided details of extensive research, teaching, and parenting experience. Consider the following responses from two participants: "I have worked at a preschool lab school for over 20 years as an administrator and researcher." And, "I have worked with two- to five-year-olds, in our university lab school and as a mother with my own children." The following results share participants' reflections regarding the definition and meaning of C2N in young children, its development, and approaches to assess it.

The Definition and Meaning of C2N in Two- to Five-Year-Old Children

Participants provided a rich list of key characteristics of C2N in two- to five-year-old children (outlined in Figure 1). The special qualities of this age group was one theme that resonated among participants. Further, C2N was seen as a multidimensional construct that is place-based, associated with child choice, and closely aligned with empathy. One participant, however, expressed caution about the idea of *connecting to nature*, "The term [C2N] itself suggests a separation from nature in a sense. We have to start seeing it through an indigenous worldview...We *are* nature. We are part of the natural world." This observation highlights a paradox in using the term C2N: is disconnection even possible if humans are a part of nature?

Special qualities of very young children. At the very foundation of this study is the idea that early childhood is a special time in a child's relationship with nature. One participant captured this idea by referencing related research by Keeler (2008, p. 39):

Children form an up close and personal relationship with the world and they experience the outdoors in a different way than we adults do. While it is true that they are literally closer to the ground than we are, our vantage points differ in deeper and more important ways. Children are tuned in to the magic of life in ways that too many of us have tuned out. They are firmly living in the present moment and can focus on small, intimate places that we adults take for granted.

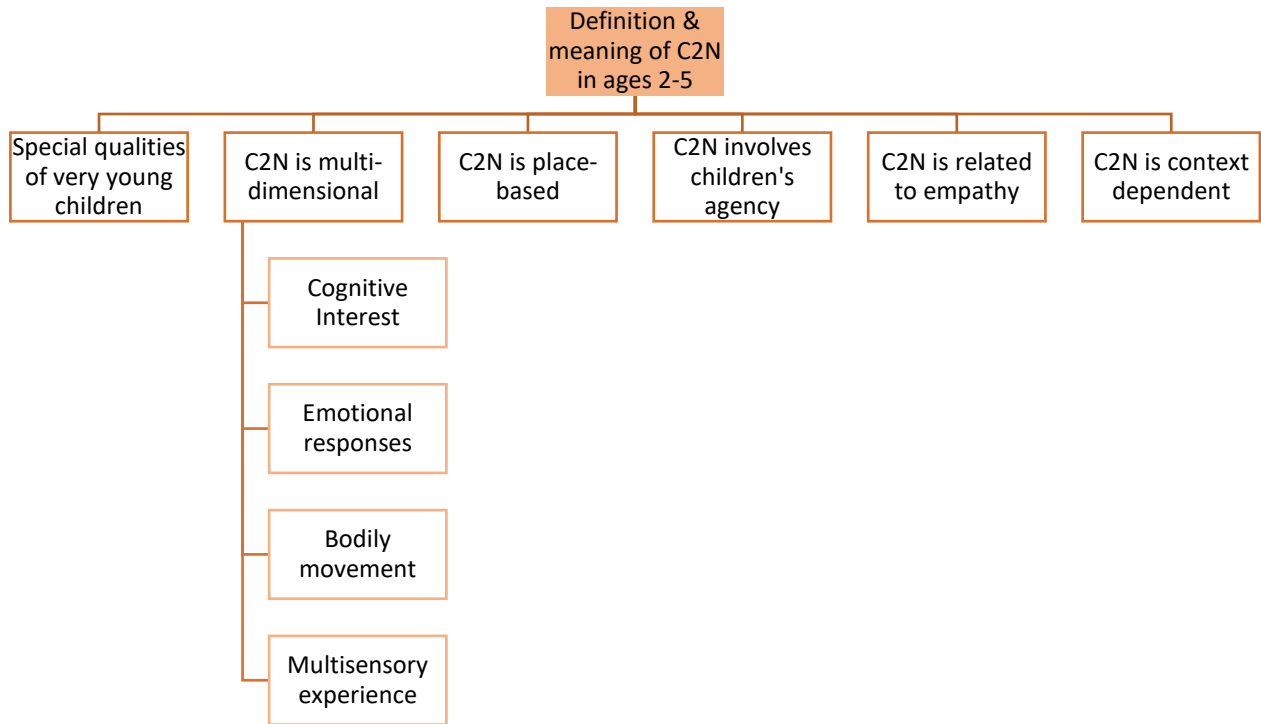


Figure 1: Components of the definition and meaning of C2N in two- to five-year-old children

Another participant captured the feeling that young children may connect to nature in a special way, based on her reflections of interactions with children, such as this shared experience:

I began to see how the children saw things as really alive. Or they would express things in ways that made me look again. One day it was cloudy and then there would be some blue sky. And one child turned to me and said, “The sky is waving at us!” You could say, “Oh, that is perfectly charming,” but in a way it was personal. Or when it was pouring with rain and we were walking down the path, and the rain was uncovering a stone in the path, a big boulder. One of the children said, “Oh, that rock is growing!” They were ways of looking at the world that made me look at the world differently.

This particular participant reflected on whether she, as an adult, has forgotten how to connect with nature in the ways she observes children connecting.

Two- to five-year-old children are in the early phases of a developing self-identity (Harter, 1999). Without a stable sense of “self” versus “other,” they are limited in their ability to process the idea of being “part of nature.” A participant who defined C2N as “the extent to which one sees oneself as a part of nature” suggested that precursors of this understanding may exist in two- to five-year-olds; but she cautioned that we cannot ask young children directly whether they consider themselves part of nature, unlike the way that measures for adults assess C2N. Another participant agreed: “In light of preschoolers having limited understanding about thinking and introspection and often unaware of their ongoing thought activities, and still growing in their ability to sort out and

internalize information and ideas, I am not sure that they could have the cognitive awareness of being or not being part of nature.”

Another participant considered the special way in which we learn about young children: “Kids may not be able to talk about their feelings, but we can observe their behaviors.” For this reason, many participants emphasized the value of observation. Consider these responses from one participant reflecting on parenting, and another reflecting on research methods. “She could not talk too much at that time, but through observation, I could tell her reactions were different in nature and man-made environments.” And, “The role of inductive participatory observations and ethnographic methods is therefore central to understanding how children express nature connection at this age.” Detailed observations can provide clues to special ways that children see and relate with nature.

C2N is multidimensional. All nine of the participants identified C2N as an emergent property of relationships between mind, body, culture, and environment. They discussed cognitive, affective, and behavioral dimensions of C2N, with themes that included cognitive interest, emotional responses to nature, bodily movement, contact with animals, and multisensory experience.

Cognitive interest. Eight participants described cognitive interest as an expression of C2N in early childhood. They noted children’s curiosity about natural objects, interest in spending time in nature, exploring and investigating natural phenomena, and interest in learning about animals, such as catching bugs and observing them. The focus of their comments was on interest and curiosity, not knowledge. Although curiosity can involve emotions like excitement, one participant cautioned, “Interest needs to be kept separate from enjoyment.” She used the example of children who may show an interest in books about animals while not enjoying actual interactions out in nature.

Emotional responses. Seven participants noted affective or emotional dimensions of connectedness to nature. They identified enjoyment of nature, play in nature, displays of excitement, and comfort in natural settings as expressions of emotional bonds with nature. One participant described the state of being emotionally relaxed in nature as another way that young children express C2N. Citing the ethnographic work of Elliot et al. (2014, p. 114) a participant observed that, “Children have the ability to find their way to a love of nature, of being outdoors, of moving their bodies in a generous fashion.”

Bodily movement. Six participants included bodily movement as an expression of C2N in young children, in terms of free physical interaction with nature. They noted that feeling comfortable in natural spaces cannot be seen in isolation from bodily sensations, and children pursue their curiosity about nature during active physical exploration. Consider the importance of free movement in this description of a child by one of the participants:

One little boy never, ever, sat still when they would go and sit in their spot. Usually by spring they could stay there for 10 minutes, 15 minutes. But when he was in his spot, he would climb on a log and jump, and climb on a log and jump. He could never sit still. But he could find more salamanders than anybody I ever knew. I don’t know how he found the salamanders. Every day he would come and he would show them to me. One day I thought, I have seen more salamanders in this hour than I probably have seen before. He seemed to have a sense of where to look. And that connection he had. He could connect with salamanders. He knew where to find them.

Another participant observed young children’s desire to be in physical contact with animals: “When we went to the river, kids do not just observe the fish. They want to catch the fish because having something in their hands and observing these moving animals in their hands is more fun.” This same participant described collecting and touching living creatures and plants as “how kids express their connection and love for nature.”

Multisensory experience. Five participants highlighted multisensory experiences in their descriptions of C2N. For example, consider this description: A child “exhibits curiosity, experiments with objects, plays with natural loose parts, engages in sensory experiences with plants and animals (sees, hears, touch, smell, pets, etc.)” Relatedly, another participant defined C2N as “kids’ experiences and reactions to any natural element. Natural elements can

be defined as visible (trees, flowers, animals) and invisible elements (sounds, smells, winds)." This definition points directly to a rich multisensory focus.

C2N is place-based. Four participants discussed the role of place in shaping C2N. One participant noted that children's nature experiences happen in actual places, places that help us get beyond the abstract conceptualization of "nature." As already stated, one participant quoted Keeler (2009, p. 39) to the effect that young children are "firmly living in the present moment and can focus on small, intimate places that we adults take for granted."

The importance of place is evident in one participant's description of children's explorations and behavior, which included their repeatedly checking on an anthill over the course of an entire year, "They would pass the anthill and think about it—if there weren't any ants out, or why the ants were really busy." This person noted that the same children talked about "my forest," not in a possessive manner, but rather in a way that indicated belonging to the place. Another participant observed that children's responses to nature reflect their level of familiarity and ease in specific places: "I have observed urban preschoolers become frightened of woods on field trips."

C2N involves children's agency. Six participants discussed the importance of children's free action and free choice, in the sense of the ability to choose time and activity in nature and nature experiences. One described free action experiences as those "where children pursue their own interests and curiosities, thereby learning their own capacities and boundaries; these experiences are unstructured and child-directed." Another defined C2N as "an affinity for the natural world with freely chosen personal elections to be in a nature-rich environment." It is evident in "child-driven" behaviors such as "gravitating toward natural phenomena," "preference for being in nature," and "requests to access nature spaces."

C2N is related to empathy. Four participants discussed empathy in their description of C2N. One person observed young children's concerned response to dead animals in nature as evidence of empathy at work. She did not limit empathy, however, to children's interactions with animals, but also noted that it became part of how children related to one another when they were out in nature. Consider her comment: "When they were outside in the forest, they were a lot less competitive with each other. I have seen that they tried to beat each other as they ran across the school field to the playground but in the forest they helped each other climb the log or get higher in the tree."

A participant who had been measuring both biophilia, or attraction to nature, and empathy in young children proposed that the relationship between empathy and C2N is not yet understood. "Empathy might be a different but highly related construct. I think you could make a cogent argument for empathy giving rise to biophilia or biophilia giving rise to empathy, or having them develop interdependently."

C2N is context dependent. When participants were asked whether indicators of nature are context dependent, six of the seven who answered this question said "yes," that measures of C2N need to be sensitive to the context of young children's experience. According to one participant who was emphatic about this point, "The belief that nature connection is a universal and decontextualized indicator is a product of the deductive methodology so far used to construct psychometric measurements." He noted that children's connection with nature "is embodied and so are significant nature situations"; therefore, C2N needs to be contextualized in both culture and space.

Another participant illustrated this point by noting differences in the nature experiences of urban and rural children. For her daughters in rural Asia, nature meant a landscape of paddy fields and mountains, whereas going to urban parks would be the most common form of nature connection in Asian cities, along with storytelling and TV shows about nature. Similarly, another participant observed that C2N is relative "in the realm of familiarity and understanding of the world," giving the example that urban preschoolers might be afraid of woods but comfortable with the nature they find in "dirty, gravelly plant spaces next to a building."

Whether C2N itself is a relative or universal construct is a deeper question. That fact that it is place-based indicates that it must be contextualized, but the key characteristics of C2N that have been discussed in this section appear to apply across cultures. One participant noted that if people define nature objectively through common elements like soil, leaves, water, wood and live animals, then C2N is universal in the sense of feelings for these things; but to the

degree that people define nature subjectively and their behavior varies in different contexts, indicators to measure C2N need to be context dependent.

The Development of C2N in Two- to Five-Year-Old Children

Participants identified important ways that C2N is nurtured and fostered in two- to five-year-old children. Not surprisingly, qualities that define C2N appear again in people's discussion of experiences that promote its development. This section highlights key themes that contribute to the development of C2N during the ages of two to five. It specifically identifies the following themes: the role of sociocultural influences, positive time in nature, and interaction with animals (see Figure 2).

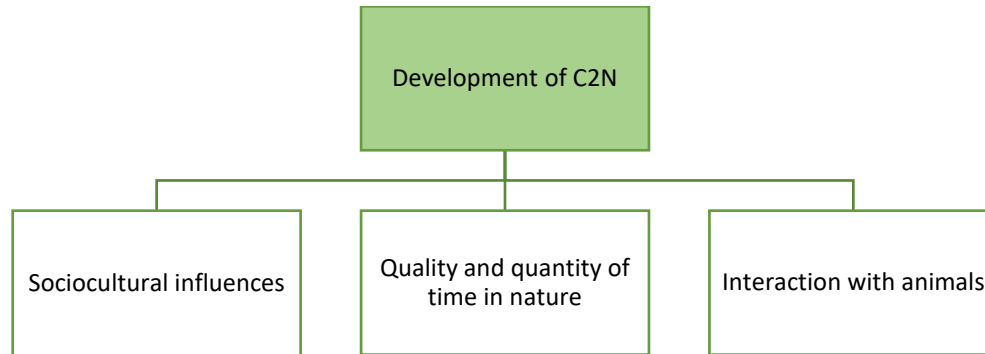


Figure 2: Thematic components of the development of C2N in two- to five-year-old children

Sociocultural influences. Six of the nine participants emphasized the sociocultural context of young children's experience of nature. Other people play multiple roles in mediating young children's relations with nature. They act as gatekeepers who control access to nature. They either direct attention to natural phenomena, or suggest that elements of nature are unimportant. They communicate their own emotions and preferences. They either encourage children to value nature as part of their emerging identity, or identify themselves as separate from nature.

Parents are the first gatekeepers to nature experiences. As one participant stated, "Parents' perceptions of nature and preferences regarding outdoor settings matter." Another participant observed that, "Kids cannot go to natural environments by themselves in early childhood; therefore, parents play a very important role to shape kids' connection to nature." A third placed families in larger cultural contexts, noting that the role of culture is evident in "property rights that define access to natural environments, existing codes of conduct in natural areas, or a sense of belonging to a social group that promotes nature-ameliorating rather than nature-degrading actions." It influences everything from "what surrounding mentors and social norms allow children to do in natural areas, to which recipients of empathy, care, and concern are worth paying attention to." Influential adults also communicate their interests and feelings in nature. One participant quoted Chawla and Derr (2012, p. 529) to the effect that others can direct children to either value nature or avoid it: "Children learn what other people around them consider worth noticing and how they appraise it, and they find their own spontaneous interests either encouraged, reprimanded, or ignored."

As young children form a sense of self, their experiences in nature may become part of their identity through social interaction. A participant referred to the expectancy value model of motivation of Eccles and Wigfield (2002) to note that "social interactions within cultural contexts influence not only how children directly experience the world, but also how they integrate the values they are developing into their identity. Thus, parents become an important influencing factor on the extent to which children value nature experiences and identify with nature." While these examples show how sociocultural experiences can support C2N, one participant noted that they can also weaken

C2N over the lifespan: “Children are probably open to things that because of our socialization we are no longer open to.” In some settings, sociocultural influences may conflict or overshadow C2N.

Quality and quantity of time in nature. Participants referred to the importance of repeated access to nature experiences, given that “kids’ connection to nature develops over time.” Similarly, another participant highlighted the importance of repetition, noting that children “needed that time of going outside every day to the same spots.” Another participant commented that, “The development of children’s relationships with the environment is influenced not just by frequency of time in nature, but also by qualities of the places they encounter and the social contexts of their experiences.” One person associated quantity and quality with the idea of “authentic elements,” proposing that, “Children with exposure to more authentic elements of nature (soil, leaves, water, wood, live animals) would technically be considered more connected to nature than ones who have less exposure to authentic elements of nature.” Another person suggested that although the link between time in nature and C2N “is not a straightforward nor simple relationship,” when children have little or no contact with nature, it can be seen as a process of socialization by which they come to see themselves as separate from the natural world.

Six people highlighted the role of influential adults in providing opportunities for young children to enjoy *positive* nature experiences. One suggested that, “Parents’ and kids’ common positive natural experiences mark the development of nature connection in early childhood.” Parents communicate pleasure and happiness in nature, for example, by “smiling at a 3 year-old while she is playing in the mud” and sharing wonder. One participant noted that C2N is nurtured by, “Experience in a natural setting that is directed by an enthusiastic nature lover/animal lover; transfer of excitement; being with nature is reinforced as a preferred behavior.” As another participant described, “When parents let kids’ bare feet touch the land and enjoy the feeling with kids, kids will be happy to do that next time.” According to another participant, shared positive experiences are central to the development of C2N. These statements that combine time, place, and sociocultural experiences highlight an over-arching theme from our findings: namely that children’s C2N is a function of a tangle of factors.

Interaction with animals. In reviewing ways that young children express C2N, their affiliation with animals has already been described; nevertheless, it is important to underscore how it also relates to the development of C2N. Seven participants believed that experiences with other species are an important condition for fostering C2N. Their examples highlight children’s interactions with a variety of animals, including insects, birds, fish, salamanders, and farm animals. In her role as a parent, one participant commented on how animals figured strongly into her children’s developing C2N. She noted her two daughters’ “interest in observing animals and feeding animals, so they always want us to bring them to a farm because they can feed animals.” She told about her three-year-old’s stopping in front of a cow, very close to it, looking at it for some time, and asking, “Mom, can I stay for a little longer? I like her, she is so pretty.” This incident illustrates the importance of building on young children’s affinity for animals through opportunities for significant interactions. Another participant observed the salience of animals in children’s imaginations, as demonstrated by “fairy tales set in nature and populated by animal characters.” Although participants mentioned interactions with animals most frequently, they also talked about children’s eager engagement with trees, flowers, other plants, water, earth, and rocks.

Participants most often described the contribution of animals to the development of C2N in terms of children’s curiosity, interest, and empathy, but the reality of exploration also included potential mistreatment. As one person observed, “And that didn’t mean that worms didn’t go in pockets and get mistreated at times.” This same participant told a story that showed how empathy for animals sometimes leads children into ethical dilemmas. When a forest kindergarten class was visiting a local stream one day, one child found a dead shrimp floating on the surface.

And they worried about it. So the next day they discussed about that. Should they go in the stream? The shrimp was dead and maybe they killed the shrimp and they shouldn’t go in. You know, a discussion about what the ethics should be. It was very interesting to hear them talk about it, and how maybe they should walk around the edge and maybe they shouldn’t go in. Of course, when they got to the stream, everybody rushed in. But still they had the discussion and had felt concern about that, about what they should do. I thought, “Oh, how like all of us! We know we should do better, but when that water sparkles in front of you, it is too big a temptation.

Although the children could not resist the water, the incident generated ethical awareness and moral reasoning. As the observer noted, "We would all like to have thinking citizens like that."

Assessing and Measuring C2N in Two- To Five-Year-Old Children

In the process of reflecting upon the assessment of C2N in 2 through 5 year olds, research participants encouraged mixed methods, noting strengths and limitations in both qualitative and quantitative approaches (see Figure 3). For quantitative measures, they recommended a playful, game-like format. They also noted the value of gathering information from more than one source, such as teachers and parents in addition to children directly.

Advantages of mixed methods. Seven of the nine participants noted that qualitative and quantitative methods complement each other. Four spoke to the importance of beginning with observations and open-ended interviews as a foundation for constructing quantitative measures. The Biophilia Interview created by Rice and Torquati (2013), for example, was derived from many years of watching the authors' own young children and children in a university lab preschool interact with nature. Another participant who led the quantitative side of an assessment realized that when he followed children into their forest classroom, "The few times that I was out with the kids, I really got a better understanding of what was going on.... If you follow them and look at what they do." Another person observed that Sobko et al. (2018) were able to create a C2N index that reflected young children's experiences in the urban core of Hong Kong because they interviewed parents about how children encountered nature in this setting.

Qualitative methods. Eight out of nine panel members emphasized the importance of qualitative methods in assessing C2N in young children. They described the value of observations, photography, interviews, focus groups with parents, and informal conversations with children, parents, and teachers. One person stated that these approaches are essential given that "children in early childhood . . . have limiting possibilities to express themselves or focus in rigorous surveying." He pointed out that the observations recorded by Elliot et al. (2014) revealed the social side of C2N, which is missing in psychometric measures. He concluded that, "The role of inductive participatory observations and ethnographic methods is therefore central to understanding how children express nature connection at this age."

Four participants noted that, despite benefits, open-ended qualitative approaches can have limitations. "It is difficult to aggregate this type of data," one participant said, "and there may be issues with reliability." Another person argued that when people want policy makers to invest money in opportunities like forest kindergartens and preschools, "you cannot come just with anecdotes." He continued:

And then you have to have studies where you have a clear operationalization of your construct, with a connection with the behavior that occurs. You need to have inter-rater reliability. You need to have video cameras to record your observations. And then you can come up with numbers and compare them. It is qualitative, but at the same time you have numbers at the end. I think that would be useful but it is very resource intensive. You need a lot of money to do this.

Two other people also recommended translating informal observations into a matrix of observational items that trained evaluators can record and analyze reliably.

The participant who led the ethnographic documentation reported in Elliot et al. (2014) explained the importance of using multiple qualitative methods to understand young children's relations with nature. She found that photographs and video clips complement field notes, showing aspects of children's experience that may get missed during the rapid flow of outdoor activities. Talking with teachers, along with conversations and focus groups with parents, helped her see the children through other eyes, and placed the limited time covered by her observations in the wider context of their lives. When she was outdoors, she sometimes asked children questions to clarify what they were doing or thinking. In this case, "It helped that I developed a relationship with the children. They knew who I was and they would share things with me. That made a big difference."

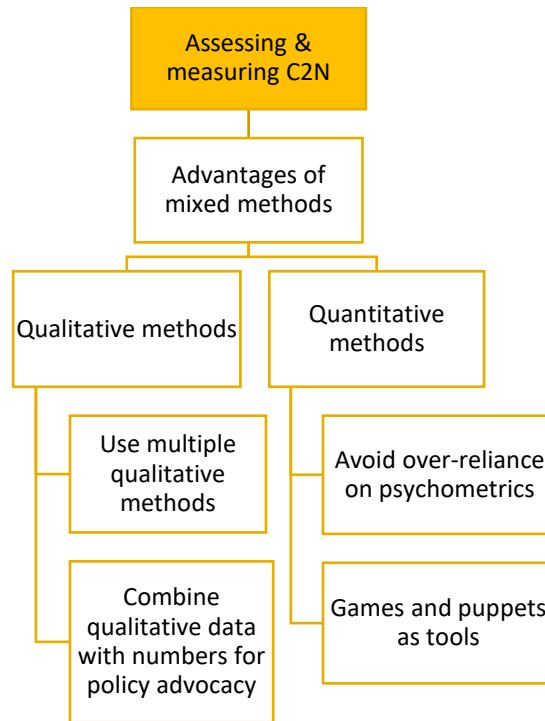


Figure 3: Themes related to assessing and measuring C2N in two- to five-year-old children

Quantitative methods. Two participants cautioned that an over-reliance on psychometric measurements can lead to a narrow definition of C2N that fails to represent the fullness of children’s experience. In this case, according to one person, “What researchers believe to constitute children’s connection with nature is what academics have so far assessed in children. This has created a situation in which what *can* be measured becomes what children’s connection to nature *is*.” Relatedly, another participant observed that as she was reviewing the quantitative measures of C2N in two- to five-year-old children, “I am struggling a bit here as it seems we are almost trying to define and operationalize from an assessment (or at least that is what I find myself doing in the review, versus starting with an established nominal definition in the context of young children and seeing if the measurements at hand align and are valid.)” The same participant expressed reservations about forcing young children to choose between preferences for nature versus built settings or manufactured objects. To measure nature relatedness, for example, the board game used by Elliot et al. (2014) asks children whether they prefer to play outside or watch TV inside, or play with dolls and toy trucks or sticks and leaves. She suggested that young children can enjoy play in nature *and* indoors, or play with sticks and leaves *and* a toy truck, yet still feel affinity with nature.

Six participants agreed that games, puppets and pictures are appropriate means to measure C2N in young children. These strategies are engaging and they can present children with simple choices. A participant who used the Biophilia Interview with puppets, for example, found that children enjoyed it and “wanted to ‘play it’ again and again.” Research participants also appreciated the playful approach in the board game used by Elliot et al. (2014) and children’s selection of images in the study by Giusti et al. (2014).

Contributions to the C2N Guide

A key outcome of our dialogue with Advisory Panel participants was agreement to include two C2N measures for young children in the *Practitioner Guide to Assessing Connection to Nature* (Salazar et al., 2020): the Biophilia Interview created by Rice & Torquati (2013) and the qualitative measures that Elliot et al. (2014) used to document C2N in a forest kindergarten. This selection offered complementary quantitative and qualitative approaches. Several

people were concerned that other measures covered more than C2N. The board game used by Elliot et al. (2014), for example, was designed to assess pro-environmental behaviors as well as nature relatedness; but three participants argued that stewardship behaviors represent a different construct than C2N. Similarly, two participants proposed that empathy and knowledge about human/nature interdependence—which are dimensions of the Giusti et al. (2014) measure of affinity with the biosphere—form distinct constructs. The same issue applied to the index created by Sobko et al. (2018), which includes items related to empathy and responsibility toward nature. Although participants appreciated the way that Sobko and her colleagues carefully adapted their measure to the conditions of Hong Kong’s urban core, some cautioned that parents provide only one limited perspective on young children’s C2N. For the purpose of this project, they wanted to focus on measures used with children.

The Biophilia Interview is based on Wilson’s (1984) biophilia hypothesis, which emphasizes interest, curiosity and desire to engage with nature. The interview playfully involves two gender neutral puppets who express different orientations to nature. With a boy, for example, an evaluator animates one puppet, saying, “This boy likes to splash in puddles”— and then animates the second puppet, saying, “This boy doesn’t like to splash in puddles . . . Which one is more like you?” The child indicates the puppet that is like himself. With a girl, the puppet’s gender changes, and the evaluator says, for example: “This girl likes to dig for worms”/ “This girl doesn’t like to dig for worms.” The final biophilia score is a sum of the child’s responses to 11 statements. Researchers have used it successfully with three- to five-year-old children, from different ethnic backgrounds and countries (Ahmetoglu, 2019; Rice & Torquati, 2013).

As described above, the documentation of nature relatedness (Elliot et al., 2014) uses field notes, photography and videos taken during observations of young children in nature. In addition to recording what children and adults do together outdoors, it captures children’s stories, questions and ideas about nature. Conversations with influential adults provide insights into children’s nature experiences beyond the observation periods. These descriptive records show how a program functions and how children’s relationship with nature develops over time.

DISCUSSION

This research has attempted to address three key questions about C2N in the context of early childhood study and practice: how is it defined, how does it develop, and how can it be measured? The dialogue about young children’s C2N that we have shared in this paper expanded our understanding by showing that quantity and quality of time in nature matters, *and* many factors condition the quality of children’s time outdoors, including opportunities for self-directed exploration, the places children encounter, the presence of animals, and sociocultural influences of peers and adults. We have also explored the assets young children bring for relating with nature. This is an important discourse to highlight, since people often note the limitations of young minds and bodies.

We have learned that connection to nature in two- to five-year-old children involves freely chosen personal elections to interact with nature. This interaction may take many forms, including bodily movement in nature, the investigation of nature phenomena, place exploration, and free play. During this period of rapid growth and change, young children’s curiosity, interest, and desire to move and explore in nature is coupled with sociocultural learning, given young children’s dependency on adults.

According to the perspectives shared in this paper, early childhood from two to five years deserves a distinct place in the literature on nature connection. In some respects, the experiences described here overlap with definitions and discussions of C2N in research with adults and older children. Reviews of this larger literature by Restall and Conrad (2015), Tam (2013), Zylstra et al. (2014) and Beery and Wolf-Watz (2014) indicate that C2N is multidimensional; and this is also the case for young children. Advisory Panel participants observed emotional, behavioral, and cognitive dimensions of C2N in two- to five-year-olds, but they also noted that young children often express these dimensions in distinctive ways. This section discusses the following characteristics of C2N at this age and their implications for environmental education: young children’s ways of perceiving the world, the importance of interest and self-direction in their encounters with nature, and the body as their pathway for relating with nature. Together, these characteristics indicate the centrality of embodiment and place in young children’s relationships with nature.

Reflections on C2N in the Early Years and Implications for Environmental Education

Young children's ways of perceiving the world. A few Advisory Panel participants observed that young children sometimes see the world in ways that are qualitatively different from adults. They sense the magic of life, and sometimes talk about things like rocks and clouds as alive. While they are beginning to develop their self-identity, they do not draw hard lines between "self" and "other." Two participants suggested that these may be positive capacities, and that when adults are socialized to forget these possibilities, they may lose significant ways of connecting with nature.

These remarks are consistent with a multidisciplinary re-evaluation of "magical thinking," "animism," "anthropomorphism" and inclusion in nature that is currently underway (Harvey, 2013). Magical thinking—or the belief that events can happen that defy conventional causality—includes animism, which endows inanimate elements like stones, clouds, wind and rivers with consciousness and agency (Rosengren & French, 2013). Anthropomorphism attributes human characteristics to non-human things, such as believing that a tree can feel pain (Gebhard, Nevers & Billmann-Mahecha, 2003). In nineteenth century anthropology, these beliefs were associated with primitive colonized cultures in contrast to the scientific rationality of colonizing nations (Rosengren & French, 2013); and in the early 20th century, Piaget (1929) claimed that this is how young children think, gradually giving way to scientific thinking around age 12. Since the beginning of the 21st century, this deficit view of indigenous cultures and early childhood has been challenged on several fronts.

New studies indicate that magical beliefs may peak between ages three to six, but they remain common in older children and adults (Bolton, Dearsley, Madronal-Luque & Baron-Cohen, 2002; Woolley, 1997). Although young children may be more likely to perceive the world in animated ways, they are not unique in this respect. Young children are also more capable than deficit models of development assume. They are actively figuring out the world, which requires experience regarding what is possible and not possible. By age two, young children can distinguish real and pretend events, and during ages three to six, they are more likely to use conventional causal principles to explain events rather than magic (Rosengren & French, 2013).

At the same time, the natural sciences are changing, as new discoveries show interdependence and communication in everything from microbes to trees, earthworms to elephants, ocean currents to weather patterns: inspiring ideas about "vital materialism" (Bennett, 2010), "enchanted animism" (Merewether, 2019) and "enlightened anthropomorphism" (Gebhard et al., 2003). These ideas call for the field of child development to shift from a focus on a solely human world, to seeing children's becoming as a "becoming with" symbiotic communities of species and lively matter like rocks and clouds (Merewether, 2019, p. 237). Rather than rejecting young children's perspectives, educators can value them as ways of entering into relationship with nature, and gradually introduce the language of science to deepen understanding of the interconnectedness of all things (Gebhard et al., 2003).

The body as a pathway to connection. This research has highlighted the role of the body in C2N. Children live their lives in nature through sensory experience and bodily movement. As noted by Kontra et al. (2012), "Theories of embodiment provide a structure within which we can investigate the mechanisms underlying action's impact on cognitive changes occurring throughout the lifetime" (p. 731). For example, Beery and Jørgensen (2016) looked at how young children's bodily experiences of nature provide important learning opportunities that support biodiversity understanding. They considered how being in nature provided for direct experiences of biodiversity and connecting with nature. They observed, for example, that "the transformation of sticks, stones, cones, and shells to different purposes were a part of creative processes that have implications for learning" (p. 10). Similarly, participants in this current study used examples that emphasized embodied movement as children's means to connect with nature, such as the participant who noted that "the ability of feeling comfortable in natural spaces cannot be seen in isolation from bodily sensations."

Interest and self-direction. The theme of self-direction and child control in connecting with nature ran through our dialogue with Advisory Panel participants. When children freely engage with nature through movement and all their senses, then opportunities for C2N to develop increase. Our results indicate that connectedness is, in part, dependent upon whether or not children have opportunities to explore nature on their own terms, interest driven

and unstructured. This finding is in line with best practices outlined in *Guidelines for Excellence: Early Childhood Environmental Education Programs* (NAAEE, 2010). Guideline 2.3, titled “child-directed and inquiry-based” (p. 21), highlights the importance of opportunities for children to follow their own interests in regard to nature exploration and inquiry.

Strengths and Limitations of this Research

We noted the expertise and experience of our participants. Their willingness to dive into our questions about the meaning, development and measurement of C2N in young children made this paper possible, and their reflections draw on many years of observation, practice and research. Everyone shared an eager interest in understanding C2N in very young children and moving research with this age group forward.

Nonetheless, our Expert Advisory Panel was small in number, limited to people who were doing research on early childhood C2N or empathy for animals, and not representative of the large and diverse field of early childhood educators and researchers. Further, despite our efforts to be consistent in the questions we asked, we allowed participants to respond either in writing or via telephone interviews. These different data collection strategies, combined with our semi-structured approach, may have given participants differing opportunities to elaborate their responses. It was also our hope to nest this dialogue on C2N in early childhood development research. While we have noted some references to the broader field of child development research, this topic deserves a deeper dive than we had space to achieve in this paper. This paper opens a conversation which we hope other early childhood educators and researchers will continue.

Directions for Future Research

Adapt methods to contexts. When measuring how young children relate with nature, it is important to understand what nature means within the cultural context of the children we study and ourselves as researchers and educators. For example, Sobko et. al. (2018) adapted the Connection to Nature Index of Cheng & Monroe (2014) to be age-appropriate. However, it did not fit cultural understandings of nature in Hong Kong, and therefore the authors adjusted the scale to fit the parents’ and children’s urban experience. In this way, the measurement of nature is context dependent. Researchers and educators carry the responsibility of ensuring that multiple ways of knowing and connecting with nature are recognized and valued in research and practice. Culturally mismatched scales can not only inaccurately measure a child’s C2N, but also value certain cultural understandings over others.

Just as participants in this study argued that it is important to consider context, they advocated in favor of mixed methods to better capture understanding of C2N. Our results indicate that a combination of qualitative and quantitative approaches can describe special qualities of very young children and specific features of their cultures and the places they encounter, and address complexities of measuring C2N at this age. Our findings are supported by a recent review of early childhood research by Corr, et al. (2020). While their review focused on early childhood special education research, their conclusion that mixed methods may mitigate many of the challenges of working with young children rings true here. Two challenges, for example, are the special qualities of early learners and their limited ability to express themselves verbally.

Keep different constructs separate. Moving forward, research will benefit from greater agreement about the characteristics that define C2N in two- to five-year-olds. This paper represents an attempt to create clarity around this construct. Most participants distinguished C2N from general knowledge about nature and responsible behaviors toward nature. Keeping each of these distinct constructs separate will make it possible to explore whether C2N, knowledge, and responsible behaviors are related, and if so, how. Similarly, although connection with nature and empathy for living things in nature appear to be closely related, there is a value in distinguishing them in order to investigate how one may affect the other and how they may develop together.

Teachers as researchers. Empowering teachers to be researchers, collaborators, data collectors, and authors on C2N publications is important for successfully garnering a holistic view of young children’s relationship with nature. This idea is evident in one participant’s response: “It was really good to talk with the teachers, because I found they

offered me another perspective on what happened, or they could tell me about what happened the following day.” Also, Guisti et al. (2014) asked teachers to conduct their board game interview, which provided a comfortable situation for the children. As these examples show, teachers are already serving as collaborators and sources of knowledge for both qualitative and quantitative measures of C2N in early childhood.

The practice of practitioners as researchers is firmly established in early childhood research. Elm and Nordqvist (2019), for example, demonstrate how teachers can be incorporated as researchers to investigate sustainable development. Through action research and other methods, scholars should seek partnerships with teachers. Teachers should also be encouraged and trained to conduct their own studies into C2N, using tools such as the biophilia puppet interview and ethnographic documentation described here. Teachers have a rich skill set for collecting observational data, which they are continually sharing in assessments and communication with parents. Many early childhood centers already use the Desired Results Developmental Profile (DRDP) assessment tool to track preschooler’s development on 56 measures, including “sense of place,” “knowledge of the natural world” and “ecology”(California Department of Education, 2013). Partnering with teachers in C2N research may unlock new insights into children’s C2N and enhance our ability to foster it.

CONCLUSION

In closing, this research suggests two additional points to consider: the contribution of young children to a sustainable future, and the importance of access to nature. One of our participants reflected on the purpose of connecting young children to nature. In her evaluation of the measurement tools, she questioned different perspectives on early childhood education for sustainability:

Could a child like to play with a doll and with sticks? I think yes. . . . I think this also points to a distinction regarding varying perspectives as to what is the contribution of young children to a more sustainable future – is it involvement in environmental behaviors? Some say yes, and I think we see that reflected in the instruments. Others say no – there are other contributions – empathy, compassion, conflict resolution, curiosity . . . and I think then that those views trickle into our thinking about what it means to be connected to nature.

True to the findings of our research, we posit that early childhood environmental education should encourage a combination of these outcomes. A focus on environmental behaviors for a sustainable future emphasizes young children’s *becoming* as they learn adult roles. Experiences like empathy and curiosity in nature—including the full range of experiences described in this paper—are states of *being* that enrich life in the moment, with the capacity to motivate children to continue to seek out nature as they grow. Through early experiences in nature, children may begin to feel part of the natural world before they know how to express this in words. From this beginning comes awareness that, as part of the natural world, they have a responsibility to care for nature and one another.

The importance of embodied encounters with nature in early childhood points to a second consideration: the necessity of ensuring that all children have access to nature. Our participants discussed access in many different ways, from the local level of access to direct physical interaction with animals, for example, to the broad context of property rights and legal access to natural spaces. And beyond proximate access, how do we consider the role of economic access, to enable children to find nature regardless of family income? What about physical access for bodies with differing abilities, and access regardless of whether children live in rural areas, suburbs or cities? Given the dependency of young children, influential adults need to bring nature to the places where they live, learn and play and take them out into nature. We must remember, however, that making nature accessible involves a range of decisions beyond parents’ and teachers’ control. Ultimately, it requires that political, economic and environmental decisions at every level of society make connecting children with nature a high priority.

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