

Swedish Early Childhood Educators' Views on Teaching to Promote Connectedness to Nature

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ABSTRACT

Connectedness to nature (C2N) shows a positive relationship with many factors supporting children's health, wellbeing, and development. In addition, C2N has been shown to have a positive relationship with learning about and caring for nature. Despite a long history of outdoor education in early childhood settings in Sweden, C2N is not a concept that early childhood professionals widely use. In this study, we aimed at investigating whether early childhood educators perceived C2N as a valuable idea for their professional efforts. Further, the possible relationship between early science learning and C2N was explored. Specifically, Swedish preschool teachers' view on how natural science teaching as part of the Swedish National Curriculum for Preschool could promote children's connectedness to nature. Teachers from two preschools participated in a connectedness to nature workshop and subsequently reflected on their teaching in a questionnaire and during two follow-up discussions. The data reveals a broad set of content regarding natural science teaching and connectedness to nature in the preschool setting. Results indicate that teachers focus on children's interests, participation, and collaboration in their work with children. Further, results indicate educators perceive their role as someone exploring nature together with children.

Keywords: connectedness to nature, early childhood educators, science education, sustainability

Early childhood is a formative period when children learn basic patterns of relationship with the world around them and understand the meaning and value of things in the context of their families and societies (Pramling Samuelsson & Kaga, 2008). One specific area of interest in early childhood is nature experience and the potential for connectedness to nature. Early childhood has been identified as an important period for connecting with nature based on young children's "heightened susceptibility to acquiring understandings and concepts that impact the individual's life-long attitudes, understandings, and skills" (Wilson, 1996, p. 121). Sebba (1991) notes that children "experience the natural environment deeply and directly, not as a background for events, but rather, as a factor and stimulator" (p. 395). Likewise, Beery et al. (2020) identified a rich mix of factors, not least access and opportunity to nature experience, that help define connectedness to nature. From this general emphasis on the importance of early childhood nature experience is a wealth of literature exploring various aspects of connection, from dimensions of learning (cognitive, affective, and physical) (Ardoin & Bowers, 2020; Chawla, 2015; Christian et al., 2015; Collado and Staats, 2016; McCormick, 2017; Vanaken and Danckaerts, 2018; Kuo et al., 2019; Grzybowski et al., 2020), to place attachment (Beery and Lekies, 2018), to social development (Mygind et al., 2019).

The past twenty years have seen a surge in research and educational and general public interest in the idea and practice of children in nature; for example, consider the growth of local to global organizations such as the Children and Nature Network (2020). 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, 2017). The work of the Children and Nature Network is of direct relevance to this current study given the focus on the convergence between public interest and scientific study in practitioner engagement, i.e., translating the widespread cultural interest and scientific study into support and resources for education professionals (Salazar et al., 2021).

C2N in early childhood has been studied from several perspectives, pathways, and potential relationships. For example, much early childhood connectedness to nature studies have considered the situational contexts that influence connectedness, including type of nature available, frequency of exposure, or activity (Lengieza & Swim, 2021). Other studies have considered the relationship between C2N and affective, physical, and cognitive growth; for example, Sobko et al. (2018) considered the relationship between connection to nature and physical activity (i.e., active playtime). One other relationship of interest in the early childhood connection to nature literature is the reported link between experiences in nature and pro-environmentalism as an adult; for example, Rosa et al. (2018) explored whether nature experiences lead to self-reported pro-environmental behaviors and whether the relationship is mediated by connectedness to nature.

Given this interest to better understand connectedness to nature in early childhood and its application across situational contexts, one aspect of consideration is the crucial role played by early childhood educators in supporting child and nature educational efforts. These teaching and learning efforts are related to environmental and natural science content areas, both part of the Swedish Curriculum for Preschool (Swedish National Agency for Education, 2018). Also related is interest in the role of early childhood educators in strengthening the sustainable development concept that is a part of the Swedish Curriculum. There is ongoing interest in what sustainable development educational efforts should look like in a preschool context (Carr & Plevyak, 2020; Pramling Samuelsson, 2021), and further, the links between C2N and education for sustainability (Årlemalm-Hagsér, 2014).

This article hopes to contribute a broader understanding of C2N, specifically via a greater understanding of the role of preschool educators. The specific research question guiding the study is: How do early childhood educators perceive their role in promoting connectedness to nature for children? In addition, the question of how early childhood educator science teaching could be used to promote connectedness to nature was also explored.

Background

This section will provide a foundation in the Swedish early childhood education context, early childhood C2N, and consider early childhood science education as a possible C2N pathway. Finally, a consideration of the role of early childhood educators in supporting C2N will be presented.

Swedish context

Swedish preschool is a voluntary school form attended by 85% of the country's one-to-five year-olds (Swedish National Agency for Education, 2020). The educational activities of Swedish preschools are regulated by a national curriculum with specific and comprehensive learning goals (Swedish National Agency for Education, 2018). Preschool teachers with a minimum background of an undergraduate university degree are pedagogically responsible for the educational activities within a range of disciplines and life skills, such as science, language, and aesthetics. A defining feature of Swedish preschools is children's learning through play and the promotion of cooperation with others in child-centered inquiry (Jonsson, 2013; Pramling Samuelsson & Asplund Carlsson, 2008). The first kindergartens appeared in Sweden around the year 1900, and since that time, nature has been seen as an essential part of the overall program (Änggård, 2010); the focus was and still is upon nature's multidimensional role, e.g., nature as a topic, nature as a classroom, and nature as play space. In the Nordic nations, the idea that children and nature belong together is strong (Gullestad 1997; Klaar & Öhman, 2014).

Nature as a topic can be noted, for example, in how biology has been part of preschool activities from the start in the 19th century (Thulin, 2016). In the newer versions of the Swedish preschool curriculum, natural science has been expanded to include learning goals from biology to simple chemical processes and physical phenomena (Swedish

National Agency for Education, 1998/2010; 2018). This broadening of natural science is further described in the text of the latest curriculum from 2018; the preschool should provide each child with the conditions to develop an understanding of “relationships in nature and different cycles in nature, and how people, nature, and society affect each other” (Swedish National Agency for Education, 2018, p. 15). Nature as a classroom is explored by Änggård (2010) in her study following an outdoor preschool group over the course of a year. Änggård emphasizes the role of the outdoors as a classroom and a place for free play; for example, she highlights nature as an enchanted world, a fairyland for young children. Further support for nature as a play space, as in a place for free play, can be found in the research literature as well (Åström et al., 2020).

Early childhood connectedness to nature

The broad concept of C2N has been referred to as the “connectedness to nature perspective” by Beery & Wolf-Watz (2014, p.198) to highlight a range of overlapping and deeply related ideas. These ideas originate from multiple disciplines, including biology, environmental education, environmental psychology, and human geography. The concept describes affective, cognitive, and physical human relationships with nature by using terms such as affinity, biophilia, commitment, ecological self, human-nature connection, identity, inclusion, relatedness, sensitivity, and topophilia (Bragg, 1996; Chawla, 1999; Clayton, 2003; Giusti et al., 2018; Ives et al. 2017; Kals et al., 1999; Mayer & Frantz, 2004; Nisbet et al., 2009; Palmer, 1993; Sampson, 2012; Schultz, 2002; Stedman, 2002; Sward & Marcinkowski, 2001; Wilson, 1984). Many of these ideas have been carefully studied and tested using psychometric scales such as the Connection to Nature Scale (Meyer & Frantz, 2004), the Nature Relatedness Scale (Nisbet et al., 2009), and Inclusion of Nature in the Self Scale (Schultz, 2002).

Interest in C2N in early childhood stems partly from research that identifies early childhood nature experience as part of a potential C2N lifespan trajectory (Well & Lekies, 2006). In addition, early childhood C2N studies are intertwined with a wealth of research exploring the benefits of nature experience in the early years (Chawla, 2020). Recent research to explore the unique qualities of early childhood nature experience described early childhood C2N in the following way:

...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” (Beery et al., 2020, p.16).

Specifically, Beery et al. (2020) highlighted six definitional elements of C2N in early childhood, and Chawla (2020) detailed six specific experiences/factors that contribute to C2N in young children (see Table 1).

Table 1
Factors contributing to early childhood connection to nature

From Beery, Chawla, & Levin (2020):	From Chawla (2020):
<ul style="list-style-type: none"> • Special qualities of young children • Cognitive interest • Emotional response • Bodily movement • Multisensory experience • Place-based • Children’s agency • Related to empathy • Context dependent 	<ul style="list-style-type: none"> • Access to nature • Time in nature • Positive engagement with nature • Childhood 5-12 • Sustainable practices • Adults who promote engagement with nature and empathy for living things

Previous research in early childhood C2N supports these elements as critical aspects of C2N, for example, agency (Ärlemalm–Hagsér, 2013); place and context (Beery & Lekies, 2018); multidimensionality (Barrable & Booth, 2020; Beery & Jørgensen, 2016); unique qualities of young children (Ernst & Burcak, 2019).

The growing importance of early childhood C2N is evident in both support for connectedness to nature as a distinct goal in early childhood education (Barrable, 2019), as well as via increased efforts to measure it. As noted in Salazar et al. (2020), having the ability to assess or measure 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 pro-environmental behaviors. In response, many tools have been created to assess connection for research purposes (Restall & Conrad, 2015; Tam, 2013); the wealth of such tools is in part a testament to efforts to create age and or program-oriented relevant measures (Salazar et al., 2020). A 2018 North American Association for Environmental Education workshop set about to review these tools and support the availability of the tools for practitioners. The outcome of the workshop and subsequent follow-up resulted in the creation of a practitioner guide (Salazar et al., 2020). The guide provides a means to assess appropriate strategies, improve existing programs, and better understand the effectiveness of efforts to support connection to nature. The early childhood section of the guide features the Biophilia Interview (Rice & Torquati, 2013) and has been translated into Swedish for use in Swedish early childhood settings (Beery et al., 2020).

C2N and sustainable behavior

An important aspect of C2N is research showing a significant relationship between children's nature experiences/connectedness to nature and behavior. In the literature of environmental education and related fields, terms such as pro-environmental behavior, responsible environmental behavior, stewardship behavior, and sustainability behavior are often used to describe human actions informed by environmental awareness, knowledge, and concern (Barrera-Hernández, 2020; Mullenbach et al., 2019; Sivek & Hungerford, 1990; Steg & Vlek, 2009). For this study, we will use the term sustainability behavior (Barrera-Hernández, 2020), given the focus on early childhood education for sustainability (ECEfS) in the Swedish preschool setting (Engdahl & Ärlemalm-Hagsér, 2014; Borg & Pramling Samuelsson, 2022). This connection to behavior and the idea of a lifelong trajectory are relevant given that C2N in childhood has been described as a pathway for developing lifelong interest, concern, and potential for sustainable behaviors on behalf of nature (Chawla, 2020). For example, Charles et al. (2018) highlight how children's opportunities to connect with nature are important for biodiversity conservation. Another recent example is Giusti's (2019) research with children defining human–nature relationships using relational language such as “systems of meaningful relationships between mind, body, culture, and environment...” (p. 19). He reminds us that these relationships can support or impede efforts toward sustainability. Additionally, Sachs et al. (2020) suggested that people must have positive experiences with nature in childhood to instill pro-environmental attitudes in adulthood. This outcome, coupled with studies showing positive relationships between environmental values and behaviors (e.g., Liu et al., 2020; Rajapaksa et al., 2018), reminds the importance of early childhood nature experience as part of a complex progression.

C2N and early childhood science education

A turn to early childhood science education is also helpful for broadening an early childhood focus on C2N, in part based upon the curiosity of everyday experience of nature as a driving force for both science learning and C2N (Ernst & Burcak, 2019; Kim et al., 2019; Spektor-Levy et al., 2013; Thomashow, 2002). Nature experience and new knowledge about nature do not satiate an individual's curiosity but instead fuels curiosity and nourish it in new and broader directions (Blair, 2009; Lindholm, 2018; Rios & Brewer, 2014). Lindholm (2018) explains this dynamic between wonder between curiosity and wonder in the context of early childhood:

Wondering and curiosity accordingly reflect somewhat different modes of questioning and stimulate exploratory joy from different positions. Curiosity remains in the space of terms, concepts, and causality. Wonder emerges from a wordless experience of something's existence. And, while wonder is more ignited by perception, curiosity is more ignited by reflection (p. 990).

Eshach (2006) argues that children's natural interest in observing and thinking (curiosity and wonder) about nature is one reason to introduce science early in life. Eshach describes science as two types of knowledge: domain-specific (scientific facts about different phenomena) and domain-general knowledge (the scientific process in terms of observations, hypotheses, experiments, and discussions). In a description of emergent science, Siraj-Blatchford et al. (2001) suggest that science in preschool should emphasize the process over facts. Children should be encouraged toward curiosity and wonder, i.e., observe, explore, and discuss the nature around them. Building on this, it can be argued that the two knowledge domains should not be polarized since observations and explorations are inevitably directed towards content that could be explored based on child curiosity.

Role of the teacher

Given the focus of this study on early childhood educators' perception of their role in promoting connectedness to nature for children, and further, their view on how their science teaching fits with connectedness to nature, we turn to environmental and science education literature highlighting the role of the educator. One aspect of the role is the educator's perspective of the child. Children are considered actors in their own lives; thus, the natural science content they meet should be based on direct experience, curiosity, and personal meaning (Thulin, 2011). This child-centered perspective demands a certain level of educator confidence in allowing children to be principal actors in their learning; they need both opportunity and freedom to be in settings that may allow for wonder, curiosity, and the development of a relationship with other living things.

A key variable in whether such freedom to explore nature and natural science phenomena is allowed appears to be educator comfort or confidence. Fridberg et al. (2021) showed how preschool teachers' long-term professional development program improved their confidence in teaching science. Torquati et al. (2013) emphasized providing training experiences in nature that help teachers develop confidence in implementing activities in nature with children. Another aspect of confidence is teacher comfort with the logistics of being outdoors and active with children. Ernst and Tornabene (2012) and Ernst (2014) found that efforts to promote early childhood educator use of outdoor settings should focus on reducing barriers (such as adequate time, safety, and proximate accessibility). Teachers' knowledge of science content is an important prerequisite for children's science learning (Siraj-Blatchford et al., 2002; Yoshikawa, 2013), and limited knowledge is directly linked to teachers' competence and confidence to teach science (Fleer, 2009). Many professionals and pre-professionals describe an uncertainty when teaching natural science, connected to a lack of content knowledge. This anxiety is confirmed by other researchers (Kallery, 2004; Greenfield et al., 2009; Torquati et al., 2013; Fridberg et al., 2018).

Methods

An iterative qualitative research plan exploring the early childhood educator perspectives is presented in this section. The methodological use of in-service training as an arena for this research is motivated by a study supporting the value of teacher in-service as a critical element in early childhood and environmental education contexts to introduce or support quality educational practices (Álvarez-García et al., 2015; Sandberg et al., 2007).

Case study

A case study is based on exploring two collaborating early childhood centers as a bounded system. Concrete, context-dependent, and in-depth knowledge were sought through a series of group interviews and follow-up discussions (Crowe et al., 2011). A case study approach is appropriate in this situation, primarily based on uncertainty regarding the phenomenon, e.g., unique aspects of early childhood sites and programs (Yin, 2009). Nonetheless, it is hoped that the results will be transferable so far as the detail provides an opportunity for the reader to decide if the context and outcomes are appropriate for application to other sites (Blomberg & Volpe, 2019).

3.2 Data collection

Participants in this study were all professional educators (preschool teachers with university training and childcare professionals without university training) from two preschools in the south of Sweden. They were asked to

participate in the study based upon previous participation in a credit-based professional development science education course; participant experience working with natural science in preschool was viewed as a valuable asset in discussions about connectedness to nature. During a digital workplace meeting for both preschools combined, the researchers conducted a workshop on connectedness to nature. The workshop included C2N background, cultural relevance, and research applications. Specifically, a presentation of C2N theories and a review of the benefits of nature experience for young children were presented. Moreover, a review of how nature experience has historically played a prominent role in Swedish early childhood education accompanied this introduction; the Swedish translation for C2N was used (*samhörighet med naturen*) as part of efforts to create a cultural bridge to connectedness. Finally, C2N in early childhood/early childhood education research and a review of the recent development of practitioner-friendly applications of C2N measurement tools were also presented. For example, the adapted (translated for language and culture) Biophilia Interview tool (Rice & Torquati, 2013) was presented as a way in which early childhood educators in Sweden could explore C2N with their students if it fit with practitioner interests and early childhood education context.

The C2N concept presentation was followed by discussions in breakout rooms in Zoom for each work team; there was a total of eight work teams consisting of 3-to 4 preschool teachers/childcare professionals in each room. The discussions were guided by a written questionnaire: What opportunities do we see in our teaching to promote connectedness to nature for children? The preschool educators were asked to give concrete examples for the questions, and they were asked to discuss both broadly and concerning natural science and the didactic questions What? How? and Where? The reason for this was two-fold. First, Swedish preschool teachers often use planning documents where What? How? and Why? are central focal points about a planned activity; they are therefore familiar terms for use in reflection. Since Why? was already determined (to promote connectedness to nature), the educators were asked to discuss the most suitable place for the teaching instead, i.e., Where?

The second reason for asking the educators to discuss *What?* and *How?* was based on the preschool educators' previous participation in the science-focused professional development course. During the course, developmental pedagogy (Pramling Samuelsson & Asplund Carlsson, 2003) was the theoretical perspective used concerning science teaching. In this theory, learning is viewed as always directed at something specific. This "something" can be described in terms of the learning object (*What?*) and the enacted learning process (*How?*) (Pramling Samuelsson & Asplund Carlsson, 2003). Thus, this developmental pedagogy framework was deemed accessible for the preschool educators and appropriate to the posed questions. In addition, the questionnaire included a second question: *What teaching opportunities have we observed in children's free play in nature?* While related and of research interest, the analysis of that question is beyond the focus of this article.

Following the work-team discussions and responses to the questionnaire, either online or on a paper version (dependent upon group preference), a joint discussion took place where the groups shared their thoughts. This initial joint discussion was recorded with permission from the participants. Preliminary results from the questionnaire and the initial discussion were reported to the participants at a second workplace meeting four months after the first. Feedback was presented (as concrete examples given by the participants) for each of the three questions What, How, and Where in their answers to the question 'What opportunities do we see in our teaching to promote connectedness to nature for children?'. The participants' examples were not categorized in the presentation but listed. The lists included, e.g., 'What' aspects such as 'understanding and respect for animals,' 'air,' 'weather, and 'How' aspects, e.g., 'walks in the neighborhood,' 'exploring,' and 'talks.' The educators discussed these results, and this second, follow-up discussion, was recorded. The recording and other aspects of the data collection adhered to the ethical guidelines of the Swedish Research Council (2017), and all participants were informed of their rights, both written and verbally (Swedish Research Council, 2017).

Analysis

In the first step, the initial discussion was transcribed, and the researchers performed content analysis (Bryman, 2016) for both questionnaire and the discussion. As described above, these preliminary results were reported back to the participants for the second round of discussion. In the next step, the follow-up discussion was transcribed. The analysis of the transcripts was based on earlier work describing childhood experiences influencing

connectedness to nature (Beery et al., 2020; Chawla, 2020); this previous research identified multiple elements that have been used in this current study as a framework for analysis (See Table 1). After that, the initial discussion was re-analyzed, and both researchers analyzed the follow-up discussion. A high level of agreement was found between both researchers' analyses, and variations were discussed to reach a consensus.

Not all elements, or categories, could be identified in the transcripts from the initial and follow-up discussions, and the absent categories were therefore left out in the results section. Further, the categories 'Emotional response' and 'Related to empathy' were merged to create 'Emotional response.' It was not easy to separate these related ideas, for example, when categorizing what the preschool teachers expressed about children's concern for nature. We recognize significant overlap in our data, as evidenced in participant comments that we coded into multiple themes.

Results

In the following section, the preschool teachers' expressed thoughts concerning the above-described factors are presented and summarized under four thematic headings based on the analysis:

- *Children's cognitive interest in focus*
- *Educators' role in promoting engagement and empathy for nature*
- *Children's agency as the basis in teaching for connectedness to nature*
- *Context and place-based learning.*

We provide data examples from all of the data sources to explain and support the themes of the analysis.

Children's cognitive interest

The theme 'cognitive interest' contains the participants' thoughts on possible nature-related content in focus: the 'what' aspect of the teaching. It also contains the participants' thoughts on teaching arrangements, that is, 'how' the teaching should be enacted to promote interest for, learning about, and connection to, nature. Keywords looked for during analysis were specified content areas (where the wording 'content area' is chosen since 'subject' is related to the school curriculum and not to preschool in Sweden) such as chemistry, physics, and biology. Other keywords were specified phenomena within these areas, e.g., water or raising vegetables. A more general mention of science and what enables interest and learning is also part of this theme.

The participants were asked to reflect on possible science content, which made their prior experience from the professional development course in science education evident in the data. They gave examples in both the questionnaire and in the discussions related to chemistry and physics (e.g., water phase changes, objects sinking or floating, exploring air), which were the course's main topics. However, most examples involved biology or other physical sciences, e.g., raising vegetables or butterflies, working with bees, or weather and seasons. The participants reflected on being originally more familiar with the biological aspects of science yet developing a greater awareness and knowledge about chemical processes and physical phenomena. They also stated that they perceived the biological content as closer to children's interest than chemical and physical phenomena are, as expressed by the following two participants:

"It's easier with biology because it's very much in the children's interest to find animals to take care of and so on."

"I don't know, it feels as if they are born with a wish to take care of animals and nature."

The participants also related the biology content to sustainability practice, yet another content area identified in the analysis. They discussed how children should learn about how people, animals, and nature interacted and gave examples from work with bees and other outdoor activities:

"What should we do with our apple cores? Well, we could leave them to the animals, and when we visited the place a couple of days later, we found that the animals had eaten it. We also found garbage and collected it to leave the nature in good condition and talked about littering. The children were so engaged in this."

When reflecting on 'How' to develop children's cognitive interest, the participants emphasized the children's previous experiences and interests as a starting point when choosing content. In one participant's words: "Many children were interested in killer slugs, so we of course started from there." Prominent in the answers was also the concept of a joint exploration where teachers learn and find answers with the children. They also viewed children as essential learning resources for each other, which is reflected in the following two statements:

"I'm thinking that the children are teachers for each other and that the conversation is important in the group, to make sure they share their experiences in an exchange."

"You could have a broader perspective if you are in a group. Someone else may think differently than I and if I'm in a group and get another angle from someone else, then it enriches me and maybe I can think outside the box too."

Similarly, participants gave examples of how some children's explorations of killer slugs in the preschool yard immediately drew the attention of other children, whereby the more experienced children explained about the slugs to the others. Present in the data material is also a view that teaching of a content area should start from a small perspective, with young children:

"I'm thinking that when children see growth and growing on a small scale, then they easier understand growth and growing on a larger scale."

The educators' role in promoting engagement and empathy for nature

The analysis identified vital terms defining the theme of engagement, including fascination, curiosity, and initiative. The results that helped identify and define empathy included reference to the human relationship with nature and understanding and respect for animals. Together, defining these terms in the results helped identify the theme of *The educators' role in promoting engagement and empathy for nature*, which was prominent in the results. This theme was reflected in several subthemes, including general engagement, specific topic engagement, and the process of engagement. An example of general engagement was visible in participant comments: "Our engagement is super important..." and comments describing how engagement from teacher to student is contagious.

From a general sense of engagement to engagement in specific scientific topics were visible in comments from participants such as: "We have just begun to work with bees as we work with natural science teaching...and there we will make sure the idea of how nature and people impact each other, and it is obvious in our work with bees." Beyond both the general and specific focus of engagement, the teachers are interested in the process of engagement. For example, consider the following shared ideas: "We believe it is important that we have variation in the instruction, as children learn in different ways and adults teach in different ways. Moreover, another example of engagement in the process is: "But we cannot have a pedagogical planning that is so well planned that we do not have room for children's questions and initiative" and relatedly, "...through open questions from the children that guide us forward." This dynamic between making room for child agency, i.e., children self-directing their outdoor time vs. planned teach-based instruction and activities, is evident.

The theme of empathy, as roughly defined above as closely linked to understanding and respect for animals, emerged throughout the data. Consider these examples:

"So there was actually no one who thought they were disgusting." (*About killer slugs*)

"I think that children developing respect for living things is good for the future, important that our small children think so."

"When a small child has been able to raise a butterfly, they gain a perspective on certain things that matter in the big picture."

Further, numerous comments about the emotional response to nature had a clear link to the idea of empathy; consider these examples:

"So, I think that we are a part of nature, and I felt it strongest when I had my baby, that I was not so far from other animals in the process."

"It lies in a child's interest that they find animals and take care of them."

In relation to the participants comments about their own connectedness to nature, they also reflect on their teaching and if they indeed talk enough with children about emotions awoken by nature:

"Are we good at mediating the feeling? I'm thinking now that we discuss feelings. Do we use it when we talk to the children? "What emotion do we get from this situation?" Maybe it's a concept we don't use as much?"

Children's agency as the basis in teaching for connectedness to nature

The participants gave several examples of children's thoughts, values, and choices visible in their actions. These actions could be verbal and in the form of questions from the children:

"They asked new questions, that gave them more knowledge, and then there are new ideas all the time from the children. About what they want to explore. And then it's important that we teachers listen and explore together with them."

Other examples include children expressing awareness about littering and their concern for nature. The participants' examples include children yelling "Garbage in nature, garbage in nature!" when they have found something on the ground, or as one participant expressed it:

I was working with the youngest today and then one of them comes to me: "Band-aid, band-aid, band-aid!" He was very concerned about having found a band-aid in the yard.

The participants also reported how parents had given examples of how their children tried to influence them towards more sustainable habits. The parents described their children as 'police officers,' keeping track of their actions so that no animals will be hurt, for instance. One participant reflected on how this may lead to parents acting in more sustainable ways:

"According to the parents, they talk a lot about it [bees] at home, which may affect the parents. When we were kids, we just rolled down the car window to throw out the old gum, but maybe your child can raise your awareness about sustainability and science."

The children also transfer sustainable behavior between the home and preschool. One participant explains how a child came from home with apple cores in a small bag after he had taken part in different gardening projects at preschool. He had 'forced' his parents to give them to him to raise apples in preschool. The participant interpreted the child's action as an example of new knowledge gained and expressed.

Context and place-based learning

Context, in part a response to the didactic question of *Where?* is defined through the results as the outdoor setting or outdoor classroom; this context was referenced in many similar ways, such as “outdoors,” “near-school setting,” or “outdoor environment.” Participants discussed this outdoor context in very favorable terms, for example, comments such as: “We can do as much outdoors as we can indoors.” Prevalent in the data is also the idea that science education for connectedness to nature can be conducted *both* outdoors and indoors, and that the outdoor experience can bridge to indoor learning experiences. The participants give examples of taking material such as play-dough or computer tablets outside and they also talk about transitions between teaching outdoors and indoors. Examples of this include starting to grow tomatoes outside before taking them in to see if they can grow just as well in a window, and exploring ice outdoors before continuing to explore it indoors.

Participants also highlighted a professional use of outdoor spaces for specific objectives; for example, multiple participants described using the outdoors without any of the toys or extra materials “...to be on the school grounds without taking toys, fantasy gets a real lift!” and “...play was a completely different activity without preschool materials, just using nature as the material for play.”

Two other subthemes within the broad theme of context were child behavior and place, and place-based awareness and connectedness to nature. Participant observation of how child behavior showed a relationship to place, for example:

- “...the meeting with the children in the different environments actually becomes different. The children may be able to... play with others and with other material than what you only have in the schoolyard”
- Children that use to play with certain children play with other children in different environments.
- The idea that places of play were a window on the world also elevated the topic of place; consider this comment: “I think that if children can learn in these small outdoor spaces, they will be better able to see the bigger perspective on earth.”

A place-based subtheme was based on participant awareness of repeated use of outdoor sites, for example: “...we always went to the same site, that way we could follow the development of the seasons.” Related to the reality of seasons in the outdoor context was one participant’s description of children’s study of water and how winter provided access to ice.

Discussion

As noted in the background, previous research has shown that connectedness to nature shows a relationship with many positive factors for children's health, wellbeing, and development (Chawla, 2020). Moreover, while the specific concept of connectedness to nature is not well integrated into the early childhood education profession in Sweden, the importance of nature experience in Swedish preschools is well documented (Änggård, 2010). An interest in coupling C2N with natural science learning was based upon research showing a relationship between C2N and environmental knowledge (Chawla, 2020). In this study, we aimed to investigate Educator perceptions of the idea of C2N and, further, one possible pathway to support C2N; Specifically, Swedish preschool teachers' view on how natural science teaching, part of the national curriculum for preschool, could promote children's connectedness to nature.

This study is a small puzzle piece of a significant endeavor, i.e., a better understanding of the human relationship as part of nature. With the world facing critical socio-ecological challenges such as biodiversity loss and climate change (UN, 2021), contributions to greater environmental knowledge and sustainability behavior are of great value. This current research exploring early childhood teachers' perception of connection to nature and a potential link to natural science education may support a better understanding of the development of sustainability behavior.

This study provides a snapshot of early childhood educators' perspectives on supporting connectedness to nature. While C2N was not a familiar term to participants prior to the workshop, the underlying foundation of nature

experience was part of the educators' perceptions of their role as educators. For example, educator confidence in using outdoor spaces was identified; participants viewed outdoor spaces as necessary in their educational efforts. This confidence in their role as outdoor educators and use of outdoor spaces was not a result of our discussions with teachers but rather a reminder that this perspective is valuable to ongoing early childhood C2N efforts. Promoting access to nature experience, allowing nature play, and developing science in nature were all discussed and celebrated as essential aspects of the early childhood educator role.

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Results from this study were analyzed using the current understanding of early childhood C2N as a guide for organizing the data. As presented in the results, the data was organized into four themes relevant to understanding early childhood C2N:

- Children's cognitive interest in focus
- Educators' role in promoting engagement and empathy for nature
- Children's agency as the basis in teaching for connectedness to nature
- Context and place-based learning.

Participants saw these elements of their work as complimenting the idea of connectedness to nature as evidenced in their reflections of their educator role, thus addressing the research question. A quick review of each theme in the context of previous research highlights outcomes.

An emphasis on process, curiosity, and wonder in early childhood science education (Blair, 2009; Lindholm, 2018; Rios & Brewer, 2014) aligns well with participants' reflections about children's cognitive interest and engagement with natural phenomena. Such interest—wonder, and curiosity have implications for supporting C2N and science learning.

The educator role regarding empathy for nature emerged via participant discussion of respect and care for nature they described as a part of their outdoor experiences with young children. The importance of empathy regarding early childhood C2N, as described by Chawla (2020), is also present in many of the definitions of C2N related concepts as described as being a part of the C2N perspective (Beery & Wolf-Watz, 2014), for example, the emphasis on the affective relationship with nature as described by Mayer and Frantz (2004). Except for the participants' thoughts on the importance of their own engagement for to promote children's engagement, there were also reflections about the actual process of becoming engaged in something. Here, the participants emphasized the meaning of a varied teaching, for both children and teachers. In the words of a participant: "We believe it's important to make use of variation in the teaching, because children learn in different ways plus, we grown-ups teach in different ways.". This idea of a varied teaching is part of the developmental pedagogy, where variation and highlighting children's different experiences in group discussions are considered a foundation in preschool teaching (Pramling Samuelsson & Asplund Carlsson, 2008).

The importance of support for children's agency as expressed by participants can be traced back to the definition of early childhood C2N presented as background to this study, which includes this phrase: "...connection to nature in two- to five-year-old children involves freely chosen personal elections to interact with nature..." (Beery et al., 2020, p.16). The importance of children's agency also provides a strong example of how the themes from the analysis showed considerable overlap; for example, cognitive interest is predicated on children's active choice based on their engagement with nature, places, or phenomena. The results also show how sustainability behavior was discussed

by participants, e.g., the themes of empathy and agency. The discussion highlighted children's self-elected behaviors on behalf of respect and care. The analysis also revealed tensions between the teachers' promotion of children's choices about 'being' in nature while at the same time having learning goals to strive for as described in the curriculum. This tension, or dilemma, is important to reflect upon in relation to teaching for C2N. As a preschool teacher, you are indeed expected to teach and give children the possibility to learn about nature. At the same time, and aligned with the C2N-literature, there is another value in giving children time for wordless wonder and to just 'be' in nature, without learning goals. Our perspective is to not polarize between teaching and 'just being' in nature. Spending time in nature with a group of children with an aim to just 'be' without necessarily putting words to, or draw conclusions from, the children's nature experiences may lay the foundation for future teaching. In other words, we would like to suggest a balance between a deliberate teaching on some occasions (e.g. put words to, directed observation, and discussion of aspects of nature) and on other occasions just being in nature, without a pronounced learning in focus.

The emphasis on place-related ideas in participants' descriptions of outdoor play and activity is supported in the literature of C2N (Beery & Lekies, 2018). Further, the importance of place as a factor in early childhood nature experience is well documented (e.g., Duhn, 2011; Nxumalo, 2019). Participant's consideration of nature as a learning place or the outdoor classroom as necessary also resonated in their comments and is well supported in the research literature (Beery, 2020; Dennis et al., 2014; Lindfors et. al, 2021)

Participants in this study saw the idea of C2N as fitting into the work they are doing. Teachers showed confidence in the use of the outdoors for structured activity or free play. Participants acknowledged the importance of choice for the children and subsequent opportunities to use child engagement to guide their work with the children. Participants saw natural science education intertwined with the idea of C2N, most notably regarding the opportunity for promoting child wonder and curiosity. Time in nature for free play and exploration not only serves C2N but is a gateway for natural science learning.

An analysis of the results identifies C2N as a valuable idea to facilitate professional discussion. The multidimensionality of the C2N perspective fits very well with the whole child view of early childhood education in Sweden.

Implications and Conclusion

Based upon the methods and results of this study, three critical implications for teacher practice have emerged; one is the value of in-service C2N training. C2N is not a well-known concept in Swedish preschools, and the discussion around it indicated interest and curiosity. The methodological approach of using teacher in-service for training and reflective discussion of practice was highly effective for both sharing new information and gaining insight on professional practice. Both the research team and the teacher participants had the opportunity to share, learn, and reflect. Also, the arrangement with an initial discussion, followed by a second discussion about the study's preliminary results, showed a deeper reflection and more examples given by the teachers during the second meeting. This is in line with research pointing to the benefits of professional development for a whole staff and over time as compared to just letting one teacher participate, expecting them to re-tell the content to their colleagues (Timperley, 2019). This process further supports previous research highlighting the value and importance of in-service teacher training (Álvarez-García et al., 2015; Sandberg et al., 2007).

A second critical implication of this study is the value of C2N research and literature to provide support for educators' desire to allow children to "be" in nature, i.e., allowing children to make decisions and undertake self-selected activities. The final critical implication is the role C2N to support the ever-growing emphasis on education for sustainability in Swedish preschools. Education for sustainable development has been further strengthened in the newest version of the Swedish preschool curriculum. The curriculum stresses that preschool education should lay the foundation for a growing interest in environmentally sustainable development (Swedish National Agency for Education, 2018). C2N can help establish the foundation for the awareness, knowledge, and intention to act that is necessary for a sustainable societal transition.

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