Educação, Sociedade & Culturas
n.º 62, agosto 2022, pp. 1-25
https://doi.org/10.24840/esc.vi62.478

Children's climate change meaning-making through photovoice: Empowering children to learn, care, and act through participatory process

Construção de significados pelas crianças sobre as alterações climáticas através do photovoice: Empoderar as crianças através de um processo participativo para aprenderem, cuidarem e agirem

La formation des enfants du sens du changement climatique par photovoice: Renforcer le pouvoir des enfants à apprendre, se soucier, et prendre action vis-à-vis le changement par une procédure participative

Stephanie Lam* & Carlie D. Trott

Psychology Department, Community & Organizational Research for Action, University of Cincinnati, Cincinnati, USA.

Abstract

Most studies of children and climate change focus on instilling literacy (a 'top-down' process), positioning children as passive recipients of climate change knowledge rather than active agents in shaping their lived realities. Photovoice, a form of participatory action research, can help explore how children make sense of climate change, while inviting their critical reflection, arts-based expression, and action (a 'bottom-up' process). By qualitatively examining children's photovoice discussions from a fifteen-week after-school program, the present study explores how children made connections between their own lives and climate change through photovoice. Participants were 55 children (ages 10 to 12) who participated in Science, Camera, Action!, a program consisting of hands-on educational activities, photovoice process, and youth-led action across three neighboring cities in the U.S. Data consisted of nine audio-recorded photovoice discussions analyzed using thematic analysis. Findings suggest that photovoice helped children to learn about, care about, and take action on climate change. Moreover, these processes were interdependent and fueled by children's enjoyment of the program and children's engagement in collective meaning-making during group-based photovoice discussions. As climate change intensifies, photovoice can be an important pedagogical approach and enjoyable experience for children that simultaneously facilitates their learning, affective engagement, and agentic action.

Keywords: children, climate change, participatory action research, photovoice, youth

* ***Correspondence:*** *University of Cincinnati, Edwards Building One, 44 Corry Blvd, Cincinnati, OH 45221-0376, USA.*
Email: *lamse@mail.uc.edu*

Resumo
A maioria dos estudos sobre crianças e alterações climáticas focam-se em facilitar a literacia climática (um processo de "cima para baixo"), posicionando as crianças como recetoras passivas de conhecimento sobre as alterações climáticas em vez de atores ativos na construção das suas realidades. O *photovoice*, um modo de investigação ação participativa, pode ajudar a explorar como é que as crianças dão significado às alterações climáticas, ao mesmo tempo que se convida à sua reflexão crítica, à expressão baseadas nas artes e à ação (um processo "de baixo para cima"). Através de uma análise qualitativa de discussões das crianças no âmbito de um programa de atividades extracurricular, com duração de 15 semanas, o presente estudo explora como, através do *photovoice*, as crianças estabelecem ligações entre as suas vidas e as alterações climáticas. Participaram no estudo 55 crianças (com idades entre 10 e 12 anos), que estiveram envolvidas no programa "Ciência, Câmara, Ação!" (*Science, Camera, Action!*). Este programa foi implementado em três cidades vizinhas nos EUA, e envolveu um conjunto de atividades educativas práticas, *photovoice*, e ações lideradas pelos jovens. Os dados consistiram em nove discussões *photovoice* gravadas em áudio que foram analisadas através de uma análise temática. Os resultados sugerem que o *photovoice* ajudou as crianças a aprenderem sobre, a preocuparem-se com, e a tomarem ações sobre as alterações climáticas. Adicionalmente, estes processos foram identificados como interdependentes e alimentados pelo entusiasmo das crianças pelo programa e pelo envolvimento das crianças na construção coletiva de significado durante as discussões de *photovoice* em grupo. À medida que as alterações climáticas se intensificam, o *photovoice* pode constituir-se como uma abordagem pedagógica importante e uma experiência agradável para crianças, facilitando simultaneamente a aprendizagem, o envolvimento afetivo e a ação intencional.

Palavras-chave: crianças, alterações climáticas, investigação ação participativa, *photovoice*, juventude

Résumé
La majorité des études sur les enfants et le changement climatique se fixe sur inculquer le savoir, réduisant les enfants à des récipients passifs plutôt que des individus avec agence. Photovoice, une sorte de recherche active participative, peut aider l'exploration de la compréhension des enfants du changement climatique et engage leur réflexion critique, expression artistique, et action. Cette étude explore comment les enfants forment des connections entre leurs vies et le changement climatique en examinant qualitativement les discussions photovoice des enfants qui ont participé à un programme après-école durant quinze semaines. Cinquante Cinq enfants (entre 10 et 12 ans) ont participé à "Science, Camera, Action!", un programme conduit dans trois villes voisines aux États-Unis qui se consiste d'activités éducationnelles pratiques, photovoice, et actions de jeunes. Les données étaient neuf discussions, enregistrées en audio, de photovoice analysées par analyse thématique. Les résultats suggèrent que le photovoice pousse les enfants à apprendre, se soucier et prendre action vis-à-vis le changement climatique. Ces procédures étaient interdépendantes et alimentées par la jouissance des enfants en formant du sens collectif. Puisque le changement climatique s'intensifie, photovoice peut servir d'approche pédagogique agréable aux enfants pour leur apprentissage, engagement affectif, et action agentique.

Mots-clés: enfants, changement climatique, recherche active participative, photovoice, jeunesse

Introduction

Children and youth will be disproportionately impacted by climate change throughout their lives (UNICEF, 2021). As such, children are key stakeholders in the planning process to address the climate crisis. Despite this, young people are often excluded from decision-making

and action on climate change. Research suggests children's climate change curriculum tends to center on problems rather than solutions, target older age groups, and lack an action-based approach (Rooney-Varga et al., 2014). Simultaneously, adults often exclude children from climate change decision-making and action because children are underage (e.g., unable to vote), perceived as needing protection from anxiety-related topics, and are subject to cultural assumptions limiting children's role in society (Harris, 2018; Jensen & Schnack, 2006).

Despite children's exclusion, there is a growing global movement of youth activists advocating for bold climate action, for example through Green New Deal legislation (Fisher, 2016; Sunrise Movement, 2020). This suggests that, despite adults' gatekeeping, many young people are political actors who engage with climate change, care deeply about the issue, and demand action (Biswas & Mattheis, 2022). Relatedly, many children and young people around the globe are experiencing negative mental health consequences from the climate crisis, leading to calls for further research and action to address compounding problems (Hickman et al., 2021; McBride et al., 2021). Emerging research suggests that young people's meaningful climate change engagement is made possible by inviting children to reflect on climate change in connection with their own life experiences and interests (Stapleton, 2019; Trott, 2019, 2020; Trott, Even et al., 2020). To date, few studies explore how children relate to climate change on their own terms (Cutter-Mackenzie & Rousell, 2019), including how children's perspectives and life experiences help them make connections to climate change topics (Ojala, 2020). To support children's constructive climate change engagement, it is paramount to explore how children make sense of climate change from their own points-of-view (a 'bottom up' process) beyond traditional educational efforts to instill climate change literacy (a 'top-down' process).

The present study addresses this gap by examining how children make personal connections with climate change through photovoice, a form of participatory action research (PAR). Photovoice puts cameras into the hands of youth to capture images representing their lived realities and reflect on their experiences, express themselves creatively, discuss their thoughts and feelings, and take collective action on issues impacting their lives (Wang & Burris, 1997). By analyzing audio-recorded photovoice dialogue with ten- to twelve-year-olds over the course of a fifteen-week after-school program, the present research generates insight into how children are making sense of climate change in relation to their own lives.

Children and climate change

To date, climate change education in the U.S. is typically only offered to older age groups (i.e., beyond primary) and often lacks an action component (Monroe et al., 2019; Rooney-Varga et al., 2014). Traditional pedagogical approaches aiming for science-based literacy rarely attend to children's feelings or invite learners to plan or take action themselves (Lawson et al., 2019).

An exclusive focus on problems (i.e., teaching facts) without agency-building opportunities (e.g., action) can result in distress and negative emotions beginning in classrooms and lasting into adulthood (Jones & Davison, 2020). Recommendations include making climate change information "personally relevant and meaningful for learners" (Monroe et al., 2019, p. 799) – including primary school students (Percy-Smith & Burns, 2013) – with a curriculum positioning children as agents of change through participatory engagement (Cutter-Mackenzie & Rousell, 2019).

Despite limitations in the formal classroom, young people nevertheless demonstrate interest to be actively involved in addressing the climate crisis (Fisher, 2016). A growing research literature shows that children and youth can be key collaborators and leaders in local climate change mitigation and adaptation projects (Cocco-Klein & Mauger, 2018; Cutter-Mackenzie & Rousell, 2019). For example, Haitian children and youth participating in a participatory photography program inspired adults in their community to change their behaviors and address local environmental issues (Trott, Rockett et al., 2020). More broadly, young people have spearheaded climate activism and political movements around the globe (Cocco-Klein & Mauger, 2018), expressing dissent and demanding systemic change (Fisher, 2016; O'Brien et al., 2018; Ojala, 2020). Children worldwide have led by example in combating climate change denial, motivating other young people to take action, and suing their government for neglecting to take responsibility for ensuring a healthy environment for future generations (Cocco-Klein & Mauger, 2018).

The stark contrast between children's climate change engagement inside versus outside the classroom suggests a need for educational approaches that engage with children on their own terms and makes space for children's emotions and meaningful actions addressing the climate crisis. In short, pedagogical approaches focused on 'transmitting' climate change information to passive recipients and instilling climate change literacy are missing a potentially transformative opportunity to meet young people where they are in terms of their knowledge, emotions, and motivations. What is needed are bottom-up educational approaches that embrace a childist perspective by acknowledging that adults can learn from children through mutual teaching, and consequently, by taking children's knowledge and actions seriously (Biswas & Mattheis, 2022). Such approaches have the potential to build youth agency by inviting young people to critically reflect on problems from their own perspectives and collaboratively act for change in their communities (Cutter-Mackenzie & Rousell, 2019; Papenfuss et al., 2019).

Photovoice for children's climate change engagement

A promising approach to climate change engagement that invites young people to express their thoughts and feelings as well as to lead action on climate change is photovoice. Photovoice

is a form of PAR increasingly used to collaborate with children and young people in addressing various climate-related issues in environmental education, planning, and conservation contexts (Harris, 2018; Trott & Weinberg, 2020). Applying PAR principles, photovoice centers the perspectives of historically marginalized groups and recognizes community members as experts in identifying local issues and solutions (Beh et al., 2013). Photovoice has been used in various educational settings, and uses participants' photography as a platform for critical reflection and collaborative action (Derr & Simons, 2020; Herrick et al., 2022).

Photovoice is a community-based participatory tool allowing participants to communicate their perspectives on social issues and demand change (Wang & Burris, 1997). Moreover, as an arts-based methodology, photovoice can be highly-engaging to young people, offering a novel way to learn about the world, develop place-based affective ties, and motivate action (Heras et al., 2016; Sipos et al., 2008). Beyond immediate impacts on youth (e.g., sense of agency), photovoice can have multi-level effects in family and community settings (Trott, 2021). Despite a growing body of research applying photovoice to climate-related issues, no known studies to date have examined audio-recorded photovoice dialogue to explore how participants are making sense of the climate crisis in personally meaningful ways. Exploring how children are connecting to climate change from their own perspectives has potential to generate insight into how young learners are relating to climate change, while illuminating pathways to facilitate children's constructive climate change engagement in educational settings.

The present study

The present study explored ways photovoice helped children make connections between climate change and their lives through the after-school program Science, Camera, Action! (SCA; see also Trott, 2019; 2020). SCA focused on interactive learning with younger children by integrating the arts and sciences through hands-on activities, reflective discussion, and youth-led local action. This study was guided by the research question, "How are children making connections between their lives and the larger idea of climate change through photovoice?".

Method

Program and research context

SCA was a fifteen-week after-school program and multi-site research study, designed and implemented by the second author, that took place at three Boys and Girls Clubs of America (BGC) in the Western U.S. The BGC (2021) provides affordable after-school services to families

across the U.S. in its 4,700 Clubs where members are 70% youth of color and 60% low-income (BGC, 2021). The BGC was chosen for SCA because these groups often lack access to science enrichment after-school activities, yet they have a disproportionate stake in efforts to address climate change (Trott, 2020).

SCA used photovoice to examine children's climate change connections and build pathways to youth-led action (Trott, 2019). Grounded in transformative sustainability learning theory (Sipos et al., 2008) and photovoice process (Wang & Burris, 1997), SCA consisted of six hands-on educational activities ("Science") paired with three photovoice discussions ("Camera") leading to local action projects led by youth ("Action"). Educational activities were often modeled after common children's games (e.g., Energy Bingo; Greenhouse Gas Tag; see Table 1) and are described in greater detail in Trott (2019). Following each educational activity, children took photographs related to how they "think and feel" about climate change topics. Later, in a series of photovoice discussions, children described their thoughts and emotions as a platform for action in family and community settings. Family action plans focused on household energy use and daily habits, while site-based community action projects included a tree-planting campaign, community event, city council presentation, and community garden (see Trott, 2019).

TABLE 1

Program activity topics and photovoice discussion prompts

Session	Topic	Activity	SHOW(eD) Discussion Prompts
Photovoice #1	Ecosystems	Weaving the Web	*Sessions 1-2 focused on what the photographs "SHOW":*
	Weather *vs.* Climate	Little Shop of Physics - Skittles	(1) What do you See here? (2) How does this relate to Our lives? Had you thought about this connection before? (3) What does it mean to you? In other words, what may not be clear about your photo but is important for you to explain?
Photovoice #2	The Greenhouse Effect	Greenhouse Gas Tag	
	Earth's Changing Climate	Oh Deer! & Glaciers: Then & Now	
Photovoice #3	Sustainable Solutions: Energy	Energy Bingo & Carbon Footprint Contest	*Session 3 focused on what the photographs "SHOWeD":*
	Sustainable Solutions: Teamwork & Leadership	Young Voices for the Plant Videos	(1) What do you See here? (2) What is really Happening? In other words, what may not be clear about your photo but is important for you to explain? (3) How does this relate to Our lives? Had you thought about this connection before? (4) Why does this problem or strength exist? (5) What can we Do about it? What are the challenges? What are the opportunities?

Note. Across photovoice sessions, children were also asked the following questions: (1) Can you tell me about the story behind your photograph? (2) What made you choose this particular photograph or scene? (3) What was going through your mind when you took this photograph? (4) Can you tell me how your photograph captures what you think or feel about the topic?

Participants

Across sites, 55 children ages 10 to 12 (M = 11.1 years) participated in the program. There were 29 (53%) girls and 26 (47%) boys, who were attending fourth grade to seventh grade. Thirty-one (56%) children identified their racial background as White, 14 (25%) as Hispanic/Latinx, eight (15%) with multiple, and two (4%) with 'other' racial and ethnic identities. Thirty-four children (62%) received free and reduced-price lunches, and 24 (44%) lived below the poverty threshold. Across sites, participants were more racially/ethnically diverse and lower-income compared to the communities where they lived, but were reflective of BGC members (BGC, 2021). Pseudonyms for the research sites are Town (n = 9; 16%), City (n = 19; 35%), and Suburb (n = 27; 49%). In this IRB-approved study, youth participation was voluntary and parental consent and youth assent were obtained for all participants. Recruitment consisted of visiting BGCs in the weeks before program launch, discussing the program with children, and providing folders with program information for parents and children. To ensure all children could fully participate in program activities, digital cameras were provided to every child.

Data collection and analysis

Data consists of nine audio-recorded photovoice discussions centered on children's personal connections to program topics (e.g., ecosystems, climate change, and local climate action). After each activity, children took home a prompt asking them to reflect on the *SCA* topic through their photography (see Table 1). During photovoice sessions, children were asked to choose one or two photos they would like to print and give each of their printed photographs a title and caption. Some children who forgot to take pictures or bring their cameras to *SCA* drew pictures relating to their reflections that mirror the "write, draw, show, and tell" process (Noonan et al., 2016). During photovoice sessions, program facilitators asked children to describe the content of their photograph (or drawing) and to reflect on related *SCA* activities. Photovoice discussion questions followed the traditional SHOWeD method (see Table 1), as well as other follow-up questions (Sutton-Brown, 2014).

The nine photovoice sessions (three discussions per site) totaled 8.5 hours of audio (see Table 2), which were transcribed verbatim prior to coding. The coding team of five psychology researchers, led by the first author, consisted of three graduate students, an undergraduate student, and an incoming graduate student who each listened to audio recordings, cleaned transcriptions, and coded the data in multiple stages (i.e., data familiarization, initial coding,

generating themes) using thematic analysis (Braun & Clarke, 2006). Analyses culminated in a conceptual model representing all themes and sub-themes.

TABLE 2

Photovoice dialogue data overview

Discussion Session	# Recordings per Site			Total Duration*
	Town	City	Suburb	
Photovoice #1	3	5	3	5:03:40
Photovoice #2	1	3	3	1:54:51
Photovoice #3	3	4	3	2:34:54

Note. * Time in hours: minutes: seconds

To ensure trustworthiness in the data analysis process (Guba, 1982), the five-member team engaged in reflexive discussions to identify how they connected with the data and project (Barrett et al., 2020). Data was independently coded and deliberated until team consensus was reached (Creswell & Poth, 2018). In addition, throughout analysis, the team practiced the role of critical friends to openly discuss thoughts, critique each other's codes, and ask provocative questions about influences, biases, and assumptions (Costa & Kallick, 1993). Finally, consultation with the second author occurred as needed throughout data analysis to provide additional context.

Positionalities

This manuscript is the culmination of two degree-earning projects. SCA was the second author's dissertation research conducted in the Western U.S., and analysis of photovoice data is the first-author's thesis project conducted in the Midwestern U.S. We both identify as women who were first in our families to receive college degrees. The first author is an Asian, cis-gendered woman with Chinese ancestry, and doctoral student of Community Psychology who values working in solidarity with people most impacted by social issues. The second author is a white, cis-gendered woman with Western European ancestry who was a doctoral student of Applied Social Psychology at the time of data collection and is now an Assistant Professor in Psychology and doctoral advisor to the first author. SCA was the product of a myriad of intersecting values and intentions, including a commitment to participatory engagement, a disaffection for research 'about' rather than 'with' young people, a sense of urgency about meaningful climate action, and a desire to work in solidarity with marginalized groups – children and youth, low-income families, and communities of color who are often most affected but least prioritized in conversations and actions addressing the climate crisis.

Results

Three thematic categories were generated during analysis. Specifically, photovoice helped children to *learn* about, *care* about, and *take action* on climate change. The first three sections below expand on these major themes, and quotations illustrate thematic findings. The fourth section describes additional forces at play that facilitated children's climate change connection-making. Specifically, two cross-cutting themes of *children's enjoyment* and *collective meaning-making* blended processes of learning, caring, and acting to facilitate children's connections to climate change through photovoice. Pseudonyms are used in place of children's names, and children's research sites and ages are provided where possible.

Children's climate change learning through photovoice

The first major theme generated was that photovoice helped children to learn about climate change. This primarily cognitive process occurred in two distinct ways, as encapsulated by the sub-themes *Seeing Connections* and *Bridging Knowledges*, described below.

Seeing connections

A common way children gained knowledge about climate change through photovoice was by seeing connections between SCA's climate change educational content and the world around them. Specifically, children photographed or drew people, places, or notable things from their environments, and later explained their connection to program topics. This occurred for all six activities and across all three research sites as children sought to connect climate change concepts to what they see in their everyday lives. Children saw climate change connections when they looked at trees, their pets, and various forms of transportation. For example, Mika (Suburb), who made connections to SCA's ecosystems activity, said "I did this picture of a tree, the clouds and a swing set and the sun because the sun gives [energy to] the tree to grow". Izu (Suburb) described a similar picture, this time hand-drawn, saying, "[S]o, the reason I drew this picture is because the sun gives the tree energy and the cloud gives the tree water. And the tree gives the bird shelter". Also inspired by SCA's ecosystems activity, Sammy, age 11 (Town) shared two photographs comparing the same plant during different seasons (see Figure 1), saying:

> These go together... The first one shows what it looks like when it's grown. And the second one shows when it's not grown... in the winter. And I called this "[Compare + Contrast]"... So, I was at my grandma's house one day and it was early spring. And I took this photo and then when I went back...

I took the exact same photo but just when it was... really cold out. You can... see the differences between the two flowers.

FIGURE 1

Not all connections children were seeing had to do with plants and animals, however. Making a connection to the "Sustainable Solutions: Energy" activity, Katherine, age 12 (City) thought of airplanes: "This is a picture of a plane that my dad was flying in. It goes with *Energy Bingo* because it's a picture of a plane and... it also puts [carbon] pollution in the air". Other images were more explicitly connected to the role of people protecting their environments. For example, Cecilia, age 10 (Town) drew people being stewards of the Earth. She related her picture to the activity focused on "Sustainable Solutions: Teamwork & Leadership". Cecilia explained:

It's called "The Earth". I'd say [it relates to the activity with] *Young Voices for the Planet* because [the video] talks about the Earth and how it connects to everyone and how people are helping the Earth. And that's why, [in my drawing, the people are] holding hands.

Bridging knowledges

A second way children learned about climate change through photovoice was by "bridging knowledges", or making explicit connections between their own previous (e.g. school-acquired) knowledge and topics covered in SCA. Across age groups and research sites, children drew on

knowledge from multiple disciplines, from science to history. For example, Tallis (Suburb) bridged what they learned in school to the SCA activity on "Weather vs. Climate". As Tallis explained, "We're learning about climates at school. Climates are basically weather, most of the time. The average weather, for the whole year. Weather is the condition of the atmosphere given day or week". Bridging her school-based knowledge to the same SCA activity, Nora, age 12 (City) explained the impact of weather and climate on rock formations and living things:

> This is a picture of a crystal rock, which is on a field trip at the [City] Museum of Nature and Science ... [My photo] ties into the... weather and climate [activity]. Here's a fun fact. Weather has a huge impact on our lives and on the way things form, including this crystal rock.

Like Nora, several children drew connections between the natural world and human lives. Bridging previous knowledge with *SCA*'s ecosystems activity, Eli, age 11 (Suburb) discussed pine trees and the importance of controlled burns. As he explained, "Animals rely on plants and some plants rely on fire". Noting the importance of human activity as part of the ecosystem, he continued:

> The pinecone... needs to be super-heated by fire... to drop its seeds and spread... to make more of those plants... I read an article in... fourth grade... [that] firemen actually go out in the forest and burn controlled fires to help the environment.

Owen, age 12 (Suburb) also noted the importance of human action when he made connections between the "Sustainable Solutions: Energy" activity to what he had previously learned about electric cars by relating it to a source of energy from a coal-powered electric grid that powers a house.

> I drew an electric car. If you use an electric car, they don't use carbon whenever you drive. [That's why you] don't keep your [house's] lights on because they use carbon to generate electricity. And when you constantly have that on, that's when the coal is burning to keep your house running.

By drawing a second picture, this time an arch, Owen used a metaphor to explain the interconnectedness and mutual dependence of species within ecosystems. The delicate balance of the ecosystem was represented by a 'keystone', a topic from history he learned in school.

> I'm drawing an arch because... there's the keystone that kind of pulls it all together... The Roman arch we learned about this year... there's that little keystone in the middle that distributes the weight of the top of the arch along more stones. So, if you knock down that keystone everything just [falls].

Children's climate change caring through photovoice

The second major theme generated was that photovoice helped children to care about climate change. This cognitive-affective process occurred in two distinctive but variously overlapping ways, as encapsulated by the sub-themes *Caring Connections* and *Caring for the World,* described below.

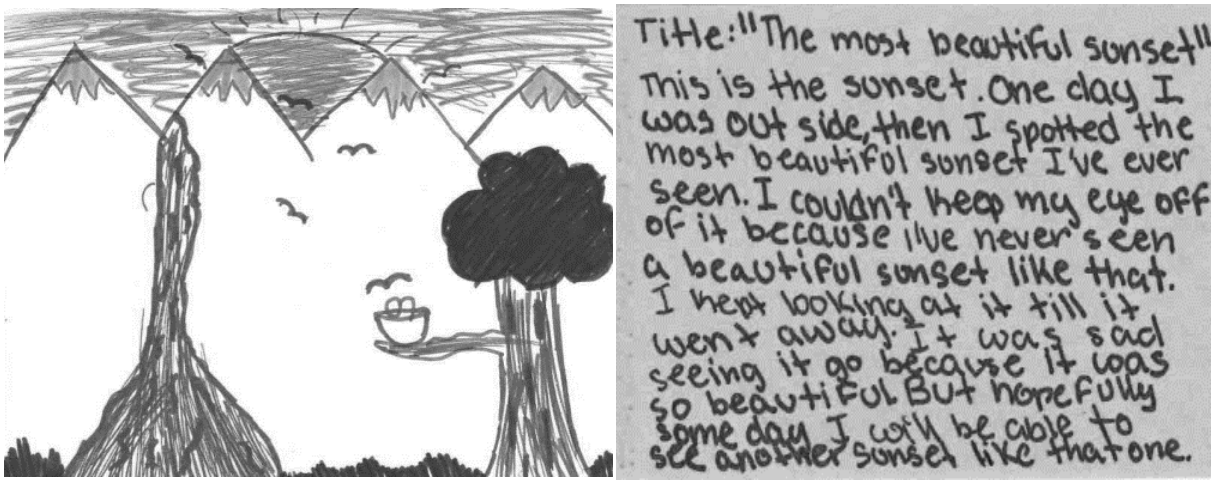
Caring connections

Throughout SCA's photovoice discussions, children regularly brought in photographs of things they cared about such as family members, pets, or concerns in their environment. For example, Kirby (Suburb) shared a picture of a horse in a pasture, and Impa (Suburb) shared a picture of their baby sister. Both articulated that they "love" what or who was depicted in the photograph, and how it is affected by or threatened by climate change. Inspired by the ecosystem activity, Annie, age 12 (City) reflected on her drawing of a 'beautiful sunset' in admiration of the memory and mentioned that she hopes to see it again (see Figure 2). As she explained:

> We were learning about the sun... [and] I spotted the most beautiful sunset I've ever seen. I couldn't take my eyes off it... I kept looking at it until it went away. It was sad to see it go because it was so beautiful. Hopefully someday I'll be able to see another sunset like that one.

In summary, a crucial process facilitated by photovoice was that children came to care about climate change by making affective connections between climate change problems and things they already cared about in their lives.

FIGURE 2



Caring for the world

Another way children made affective connections to climate change through photovoice was by expressing care for the world and sharing their sense of concern for how environmental degradation would impact their lives personally as well as their generation and the 'more than human' world. Specifically, they described feeling worried about what may happen in the future from climate change. During a discussion session, Cloud, age 10 (Suburb) was concerned about pollution generated from factories and the impact on children's lives and future.

> I'm drawing a factory that's polluting the air. It's something we don't want. It's basically going to mess up our lives. When I'm in college and so on... I thought of it a while and I think, "That's going to mess up our lives". It's the worst feeling in the world. Soon there won't be an animal. What about the honeybees?

Importantly, Cloud used a collective framing ("we" and "our") when thinking about the impacts of climate change on young people – a common framing identified during analysis. This shows a sense of collective care and concern for other young people in the program and future generations affected by climate change.

Other children expressed care by imagining or inventing solutions to climate change. For example, Eli, age 11 (Suburb) activated their imagination and drew a machine to clean the ocean: "I drew trash in the sea and then I drew a helicopter picking up the trash in the sea. And then I titled it, Helicopter Save Dat [sic] World".

Children's climate change action through photovoice

The third major theme generated was that photovoice facilitated children's climate change actions and/or the ways they made connections between climate change and their own and others' behaviors and actions. This primarily behavioral process occurred across four primary domains, as encapsulated by the sub-themes *Individual Actions, Existing Actions, Influencing Others,* and *Action Projects*, described below.

Individual actions

SCA's action component focused on changes at multiple levels, including individual household behaviors within children's sphere of influence as well as collective, community-based action facilitated through site-based action projects. Much of the conversations focused

on individual action because children's collaborative action projects took place at the very end of SCA (i.e., after all photovoice discussions were complete). In this context, individual action refers to a range of day-to-day choices and behavioral shifts that children can engage in to minimize their environmental impact. For example, Isabella, age 11 (City) shared an individual action they did in response to the SCA activity "Sustainable Solutions: Energy" by drawing two pictures, an unplugged outlet and lights that are off. Explaining the images, Isabella shared, "I unplugged the outlet for my energy... [and] I turn off the lights when I do not use them".

Photovoice discussions became a continued learning opportunity, as when children reminded one another of what individual action can be. For example, Lana (City) reminded her sister Fi (City) about energy-saving activities they have probably done at home.

> I've been turning off every single light that there is in my house every single time we're not using it.... I literally will take runs around the house going downstairs, checking to make sure every light is off. If it's not, then I turned them off. Then I go up, check the bathroom light because my little sister leaves them on a lot. Turn that off, go into her room, make sure that her light is off, go into my room and everything.

Bill, age 12 (Suburb) shared a photo of his new helmet to show he was biking for the "Carbon Footprint Contest", a friendly site-based competition to practice carbon-saving behaviors and raise awareness. Bill said he was riding his bike to school to minimize his environmental impact. As Bill explained, "I thought of my bike and how I've been riding it to school often". Of particular note, during photovoice, children discussed individual actions they can take and expressed an eagerness to practice them at home as well as during the program.

Existing actions

During photovoice discussions, many children expressed that, prior to SCA, their families already practiced living low-carbon lifestyles. For example, Navi (City) shared, "I turn off the light, I unplug chargers, I turn off my computer, and I turn off TVs – [and I've] always do[ne] that". Navi then elaborated that doing so "bring[s] the... electricity [bill]... down". When asked whether Navi convinced their mother to conserve resources, they explained, "[My mother] made me do it". At times, children's pre-existing actions were given new meaning in relation to climate change. Where once these behaviors were economically-driven, they came to be seen as climate action.

Food practices were also identified as a pre-existing way some children lived a low-carbon lifestyle before and during SCA. Children also expressed that food choices are sometimes out of

their control. For example, when asked whether their family action plan included reducing meat consumption, Ravi (Town), Purah (Town), and Sally (Town) discussed their food practices as well as food choices during school:

> Ravi: I barely eat meat...
> Purah: At school... they serve[d] chicken patties, chili, [and] chicken soup.
> Sally: [W]e had all meat for lunch today.
> Purah: And we had [peanut butter and jelly sandwiches]... And so sometimes I'll just pack my own lunch.

Perhaps most notably, children's photovoice discussions often turned to their existing actions, seen newly through a climate lens, and often raised awareness of actions children felt were within their control.

Influencing others

A common theme raised in photovoice discussions related to children's climate actions was the act of influencing others, specifically family members. Influencing others often meant applying a practice learned in *SCA* to children's home life and sharing in conversation about adopting new practices. For example, Li (Suburb) described encouraging their sibling to recycle, saying, "I might have made my little brother... [take] an aluminum can... over to the recycling". Additionally, Marin (Town) attempted to convince their aunt to switch to an energy-saving lightbulb. Marin shares:

> This one I took [a photo] of a lightbulb and it's not like one of those ones that takes a lot of energy, it's one those ones that seems powered [efficient]... Did you know there's light bulb that costs a dollar to run all year?... Yeah. We're going to buy them.

Perhaps most critically, children explained in photovoice discussions that they learned about climate actions and that they conversed about these action opportunities with family members in efforts to spread information and create more widespread change.

Action projects

The purpose of photovoice in *SCA* was to capture images relating to how children "think and feel" about climate change from their own position and point-of-view, then to plan and implement collaborative, site-based action projects inspired by their photography. Consequently, a final action-focused theme in children's photovoice discussions was "action

project" ideas that children would lead in their local community. For example, Gabe, age 11 (Suburb) used the metaphor of building a house to represent the teamwork required to effectively act on climate change. Inspired by the collaborative youth-led action he saw in a series of videos shown during *SCA*, Gabe explained of his drawing, "It takes teamwork to save the environment. You can't do it alone".

In another photovoice discussion that took place in City, children excitedly discussed their collaborative action project, while playfully vying for credit about who suggested the activity first.

> Logan: I have another idea on what we can do for our activity that we can do as a group. We can go to a local river and clean up all the trash.
> Turner: I said go to the park.
> Reynolds: I said go to the park!

Most critically, photovoice encouraged children's collaborative climate change action through youth-led projects inspired by their photographs and discussions.

Children's climate change connections across domains

During photovoice discussions, it was clear the three major thematic categories of learning, caring, and acting were not mutually exclusive processes. Rather, they overlapped and interacted with one another in mutually-reinforcing ways. Blending cognitive, affective, and behavioral process, two cross-cutting themes were identified that, throughout the photovoice process, supported children's climate change connection-making across domains: *Children's Enjoyment* and *Collective Meaning-making.*

Children's enjoyment

Children's connection-making between climate change and their lives through photovoice was supported by children's enjoyment of the program. Throughout SCA, children learned climate change concepts through games and hands-on activities, which were designed to be a departure from more structured instructional classroom activities. During photovoice discussions, laughter can be heard in the recordings as well as playful conversations. For example, Jimmy, age 10 (Town) used their imagination, drew a taco, and explained the world in one taco as a metaphor for the ecosystem.

> A funny one... I drew a taco. Because it's got a bunch of animals and stuff. I think wheat in corn is a plant, so that's what the shell is made of. And the lettuce is a plant. Then the beef is an animal and

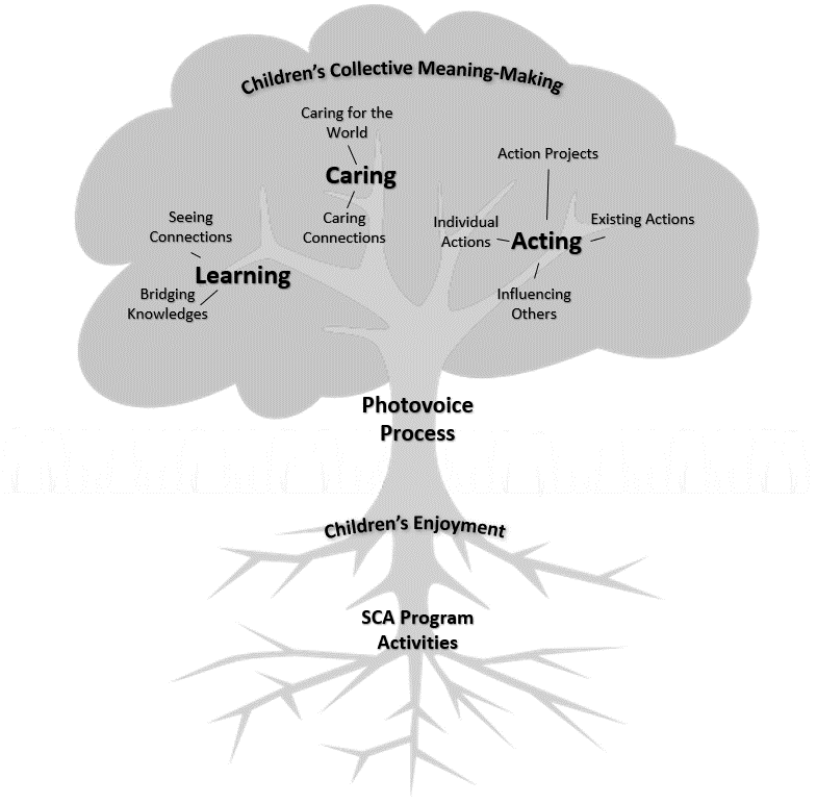
then the tomatoes is a plant. I named it "Taco"! And... it made me think of ecosystems, because... plants and animals are in it at the same time, except they're cooked!

Children's enjoyment was often seen in association with the freedom they had to express themselves in their own way throughout the program. Children's creativity, humor, and playfulness was encouraged, and *SCA*'s openness to free expression seemed to aid in the program's appeal to children.

Children's collective meaning-making

A final cross-cutting theme that supported children's learning, caring, and acting on climate change through photovoice was children's collective meaning-making. Specifically, the interpersonal interactions that occurred in photovoice discussions (e.g., reflection, dialogue, exchange of ideas, free expression) seemed to be a key driver of children's engagement. For example, there were instances where children arrived to SCA with a limited understanding of previous climate change topics, and photovoice discussions served to deepen their awareness and engagement. In other words, children's limited grasp was an opportunity for further connection and exchange of ideas. Figure 3 presents a conceptual model of all themes and sub-themes generated during analysis as well as relationships among themes.

FIGURE 3



Discussion

This study explored how photovoice helped children make connections between their lives and climate change. Three major thematic categories were generated during analysis: photovoice facilitated children's climate change *learning*, *caring*, and *action*. During photovoice discussions, children demonstrated their climate change learning through 'seeing connections' between climate change as well as by their own lives and bridging their existing (e.g., school-acquired) knowledge with their newly-acquired climate change knowledge. Additionally, children's photographs and narratives showed their care and concern about climate change through photovoice-driven personal connection-making to their environment, family, and personal futures. Finally, photovoice fueled children's climate change actions by giving meaning to their pre-existing climate-protective behaviors, learning new modes of climate action, and motivating children to encourage others' action (e.g., friends, family). Analyses also revealed connections across the three domains of learning, caring, and acting during photovoice as children enjoyed themselves while collectively making sense of climate change topics related to their own lives. Findings shed light on photovoice process as a promising method for enabling children's constructive climate change engagement while positioning them as agents of change in their families and communities.

Photovoice for transformative learning and affective engagement

In exploring children's connection-making through photovoice, this study found that children's learning, caring, and acting were not mutually exclusive processes. Rather, they intermingled and were interdependent upon one another to make a fully enriching experience for children's constructive climate change engagement. This finding mirrors the process of transformative sustainability learning (Sipos et al., 2008), which emphasizes how cognitive, affective, and behavioral dimensions of learning can work together to create a transformative experience, allowing learners to see the world differently. A recent study by Herrick et al. (2022) found that photovoice can be a "transformative experience" (TE) for primary school students (i.e., fifth graders) because learners derive deeper meaning from bridging their life-worlds inside and outside the classroom. As they explain, TE's arise when "students' everyday experiences enhance the act of learning and learning enhances students' everyday lives" (p. 3). During SCA, children were encouraged to make personal connections between their lives and climate change through photography, discuss their thoughts and feelings collectively, then later develop and implement action plans. Analyses identified two cross-cutting themes that facilitated photovoice as a TE for young learners: collective meaning-making and children's enjoyment.

Collective meaning-making refers to "when [children] tell, listen to and act out each other's stories" (Faulkner, 2016, p. 85), which is an active, ever-changing process through children's interactions. Similarly, shared meaning-making has been defined by Kukkonen and Chang-Kredl (2018) as involving children's collaboration in communication and expression through sharing ideas and negotiating common understandings through an activity. The present study suggests photovoice created a space not just for discussion and exchange, but for continuous learning through interaction (i.e., peer-to-peer and children-to-facilitators) as well as through making connections — cognitively and affectively — with others' ideas and stories. Thus, collective meaning-making through photovoice can be a meaningful pedagogical process, or what Vásquez (2006) refers to as a *pedagogy of the future* capable of addressing "a social reality in flux and an ongoing definition of political, moral, and social foundations" (p. 42) as we collectively address the uncertainty and complexity of today's challenges. As this study found, photovoice can simultaneously invite children to express their thoughts and emotions about the climate crisis while allowing the adults in their lives a glimpse into their internal worlds—a promising starting point for meaningful engagement.

Throughout *SCA*, children's enjoyment was a key catalyst of processes of learning, caring, and acting. Children freely expressed their thoughts, laughed, and joked throughout the program while they learned about climate change topics that, in the broader climate change education literature, have been found to give rise to feelings of anxiety and fear (see Hickman, 2019; Jones & Davison, 2020). Rather than withdrawing, children chose to return to *SCA* week after week, fueled by their enjoyment of activities. Compared to formal U.S. classrooms, after-school programs can offer a space for alternative pedagogies that weave together learning, flexibility, and fun due to being a less restrictive context (Trott & Weinberg, 2020). In contrast to dominant 'transmissive' learning traditions, *SCA*'s arts-based and youth-centered curriculum was accessible, relevant, and enjoyable for children, cultivating an empowering learning space with 'transformative' potential by engaging 'head, hands, and heart' (Papenfuss et al., 2019; Sipos et al., 2008). This study adds to the growing literature of counternarratives that children can be active citizens in the climate change decision-making process while having fun.

Photovoice for artistic expression and collective action

Beyond facilitating children's collective meaning-making and enjoyment, photovoice holds additional significance as an arts-based approach to spurring social change, led by groups often excluded from decision-making and action (Wang & Burris, 1997). As a marginalized group in the climate change arena, U.S. children are rarely given opportunities to participate in climate change discussions that will shape their present-day and future lives. As this study found, children's photographs and drawings ignited conversations about, and actions for social change

– cultivating a space of resistance. Additionally, there was some evidence that children came to view themselves collectively through a generational lens, using "we" and "us" to describe groups who will be most impacted by the climate crisis. Through photovoice, children crafted messages through artistic expression, demonstrating they have ideas and desires that should be included for climate healing. Historically, perspectives of marginalized groups have been shared in non-academic spaces through various artforms, media, literature, and daily conversations (Collins, 2000). Utilizing arts as a tool for expression, communication, and engagement can facilitate actionable transformation through community and policy change (Bentz, 2020). Arts-based engagement can be especially useful for integrating diverse perspectives on the climate crisis, while resisting dominant narratives limiting children's role in society.

During the program, when children forgot to bring their cameras to photovoice discussions, they instead were given the option to draw their thoughts and ideas about climate change topics. Many of their drawings showed meaningful metaphors and connections that allowed for images that could not be captured through photography. Rather than offering a sub-par alternative to traditional photovoice, giving children the option to draw their ideas was beneficial because their reflections included already-known knowledges that connected with newly-learned climate change topics. This is consistent with Lopez et al.'s (2018) reflection on the restriction of the photography format in communicating deeper ideas. Findings from the present study suggest that children's drawings represented meaningful reflections of their knowledge, concern, and connection to climate change topics. CreativeVoice is a photovoice adaptation in which participants choose to engage in any artistic medium to share their various perspectives (Lopez et al., 2018). For scholars and practitioners seeking to engage children on the topic of climate change, expanding beyond photography to include other media (e.g., via CreativeVoice) can allow children to capture and depict images not just from reality but from their imaginations in the form of symbols, metaphors, and future scenarios.

The transformative potential of children's photovoice engagement aligns with what Dutta (2016) refers to as "nonhierarchical relations between the core and periphery of knowledge production" (p. 1), and expands what Sonn (2016) calls the ecology of knowledge—diverse perspectives and voices that contribute to knowledge and narratives. Children's views and experiences took center stage as a platform for youth-led action rippling to inclusive and intergenerational processes (Trott, Rockett et al., 2020). These teachable moments from children to adults represent a form of "mutual teaching", inverting adultist hierarchies in educational spaces where adults are almost always positioned to unidirectionally bestow knowledge upon young learners (Biswas & Mattheis, 2022, p. 145). In resisting dominant narratives, photovoice helped children to break away from 'top-down' adult-centered processes for climate solutions by imagining and enacting collective local solutions in their own terms. Specifically, children showed their willingness, competence, and passion in healing the climate

on a local level through community engagement and policy advocacy.

Limitations and strengths

There are various limitations that hinder the specificity with which children's experiences can be described in this study. Specifically, due to the nature of audio-recorded group-based discussions, it was not always possible to connect voices with children's identities. As a result, pseudonyms are reported alongside findings, but only some ages were possible to include. Additionally, numerous noisy activities were present – including sports and games outside *SCA*'s room as well as loud-speaker announcements, laughter, and boisterous conversation inside the *SCA* room – making recordings difficult to decipher at times. Due to these distractions, it is possible that some children may have been prevented from delving deeper into conversations with their photographs. A strength was that *SCA* maintained children's interest as play was involved in the program, which is a critical part of the process of learning and engagement (Theobald et al., 2015).

Conclusion

As the climate crisis deepens, young people around the world are rising up to demand systemic change (O'Brien et al., 2018). For younger children, there is a need for alternative pedagogies that move from 'transmissive' to 'transformative' – positioning children to be active participants in the transformation of their communities who are able to understand, communicate about, and take action to address the climate crisis (Papenfuss et al., 2019). Findings of the present study suggest that photovoice can be an important pedagogical approach and enjoyable experience for children that simultaneously facilitates their learning, affective engagement, and agentic action. Beyond addressing key gaps in the literature regarding children's climate change perspectives, this study sheds light on how the participatory nature of photovoice can reduce hierarchies – between adults and children, educators and learners, researchers and participants – and position children as agents of change towards a more equitable and sustainable future.

Acknowledgments: *The authors would like to thank the STEM Center at Colorado State University, the Boys and Girls Clubs, and the research assistants who made this research possible: Anna Hoover, Christine Zirbel, Jade Croghan, Jimmy McCulloch, Pauline Freud, Emmanuel-Sathya Gray, Christine Shi, Caletta Brandt, Leyla Ashraf, and Delaney Malloy.*

Funding: *This work was supported through small grants by the National Oceanic and Atmospheric Administration (NOAA); the Society for the Psychological Study of Social Issues (American Psychological Association [APA] Division 9); and the Society for Community Research and Action (APA Division 27).*

References

Barrett, Aileen, Kajamaa, Anu, & Johnston, Jenny (2020). How to… be reflexive when conducting qualitative research. *The Clinical Teacher*, *17*(1), 9-12. https://doi.org/10.1111/tct.13133

Beh, Adam, Bruyere, Brett, & Lolosoli, Sam (2013). Legitimizing local perspectives in conservation through community-based research: A photovoice study in Samburu, Kenya. *Society and Natural Resources*, *26*(12), 1390-1406. https://doi.org/10.1080/08941920.2013.805858

Bentz, Julia (2020). Learning about climate change in, with and through art. *Climatic Change*, *162*, 1595-1612. https://doi.org/10.1007/s10584-020-02804-4

Boys and Girls Clubs of America. (2021). *At a glance fact sheet 2020*. Boys and Girls Clubs of America. https://www.bgca.org/about-us/club-impact

Biswas, Tanu, & Mattheis, Nikolas (2022). Strikingly educational: A childist perspective on children's civil disobedience for climate justice. *Educational Philosophy and Theory*, *54*(2), 145-157. https://doi.org/10.1080/00131857.2021.1880390

Braun, Virginia, & Clarke, Victoria (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*, 77-101. https://doi.org/10.1191/1478088706qp063oa

Cocco-Klein, Samantha, & Mauger, Beatrice (2018). Children's leadership on climate change: What can we learn from child-led initiatives in the U.S. and the Pacific Islands? *Youth and Environments*, *28*(1), 90-103. https://doi.org/10.7721/chilyoutenvi.28.1.0090

Collins, Patricia (2000). *Black feminist thought: Knowledge, consciousness, and the politics of empowerment*. Routledge.

Costa, Arthur, & Kallick, Bena (1993). Through the lens of a critical friend. *Educational Leadership*, *51*(2), 49-51.

Creswell, John, & Poth, Cheryl (2018). *Qualitative inquiry & research design: Choosing among five approaches* (4th ed.). SAGE. https://doi.org/10.1017/CBO9781107415324.004

Cutter-Mackenzie, Amy, & Rousell, David (2019). Education for what? Shaping the field of climate change education with children and young people as co-researchers. *Children's Geographies*, *17*(1), 90-104. https://doi.org/10.1080/14733285.2018.1467556

Derr, Victoria, & Simons, Jordin (2020). A review of photovoice applications in environment, sustainability, and conservation contexts: Is the method maintaining its emancipatory intents? *Environmental Education Research*, *26*(3), 359-380. https://doi.org/10.1080/13504622.2019.1693511

Dutta, Urmitapa (2016). Prioritizing the local in an era of globalization: A proposal for decentering community psychology. *American Journal of Community Psychology*, *58*(3-4), 329-338. https://doi.org/10.1002/ajcp.12047

Faulkner, Dorothy (2016). Young children as storytellers: Collective meaning making and sociocultural transmission. In T. Cremin, R. Flewitt, B. Mardell, & J. Swann (Eds.), *Storytelling in early childhood: Enriching language, literacy and classroom culture* (pp. 85-100). Routledge. https://doi.org/https://doi.org/10.4324/9781315679426

Fisher, Scott (2016). Life trajectories of youth committing to climate activism. *Environmental Education Research*, *22*(2), 229-247. https://doi.org/10.1080/13504622.2015.1007337

Guba, Egon (1982). ERIC / ECTJ annual review paper criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication and Technology*, *29*(4), 75-91. https://doi.org/10.1126/science.146.3642.347

Harris, John (2018). Vulnerable youth's perspectives and priorities for informal settlements: Photovoice evidence from Lusaka, Zambia. *Journal of Planning Education and Research*, *38*(4), 398-412. https://doi.org/10.1177/0739456X17709914

Heras, Maria, Tabara, J. David, & Meza, Amayrani (2016). Performing biospheric futures with younger generations: A case in the MAB Reserve of La Sepultura, Mexico. *Ecology and Society*, *21*(2), 14. https://doi.org/10.5751/ES-08317-210214

Herrick, Imogen, Lawson, Michael, & Matewos, Ananya (2022). Through the eyes of a child: Exploring and engaging elementary students' climate conceptions through photovoice. *Educational and Developmental Psychologist*, *39*(1), 100-115. https://doi.org/10.1080/20590776.2021.2004862

Hickman, Caroline (2019). Children and climate change: Exploring children's feelings about climate change using free association narrative interview methodology. In P. Hoggett (Ed.), *Climate psychology: On indifference to disaster* (pp. 41–59). Palgrave Macmillan. https://doi.org/10.1007/978-3-030-11741-2_3

Hickman, Caroline, Marks, Elizabeth, Pihkala, Panu, Clayton, Susan, Lewandowski, Eric, Mayall, Elouise, Wray, Britt, Mellor, Catriona, & van Susteren, Lise (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: A global survey. *Lancet Planet Health*, *5*(12), E863-E873. https://doi.org/10.1016/S2542-5196(21)00278-3

Jensen, Bjarne, & Schnack, Karsten (2006). The action competence approach in environmental education. *Environmental Education Research*, *12*(3-4), 471-486. https://doi.org/10.1080/13504620600943053

Jones, Charlotte, & Davison, Aidan (2020). Disempowering emotions: The role of educational experiences in social responses to climate change. *Geoforum*, *118*, 190-200. https://doi.org/10.1016/j.geoforum.2020.11.006

Kukkonen, Tiina, & Chang-Kredl, Sandra (2018). Drawing as social play: Shared meaning-making in young children's collective drawing activities. *International Journal of Art and Design Education*, *37*(1), 74-87. https://doi.org/10.1111/JADE.12116

Lawson, Danielle, Stevenson, Kathryn, Peterson, Nils, Carrier, Sarah, Strnad, Renee, & Seekamp, Erin (2019). Children can foster climate change concern among their parents. *Nature Climate Change*, *9*(6), 458-462. https://doi.org/10.1038/s41558-019-0463-3

Lopez, Flor, Wickson, Fern, & Hausner, Vera (2018). Finding creative voice: Applying arts-based research in the context of biodiversity conservation. *Sustainability*, *10*(6), 1778. https://doi.org/10.3390/su10061778

McBride, Sarah, Hammond, Matthew, Sibley, Chris, & Milfont, Taciano (2021). Longitudinal relations between climate change concern and psychological wellbeing. *Journal of Environmental Psychology*, *78*, 272-4944. https://doi.org/10.1016/j.jenvp.2021.101713

Monroe, Martha, Plate, Richard, Oxarart, Annie, Bowers, Alison, & Chaves, Willandia (2019). Identifying effective climate change education strategies: A systematic review of the research. *Environmental Education Research*, *25*(6), 791-812. https://doi.org/10.1080/13504622.2017.1360842

Noonan, Robert, Boddy, Lynne, Fairclough, Stuart, & Knowles, Zoe (2016). Write, draw, show, and tell: A child-centred dual methodology to explore perceptions of out-of-school physical activity. *BMC Public Health*, *16*, 326. https://doi.org/10.1186/s12889-016-3005-1

O'Brien, Karen, Selboe, Elin, & Hayward, Bronwyn (2018). Exploring youth activism on climate change: Dutiful, disruptive, and dangerous dissent. *Ecology and Society*, *23*(3), 42. https://doi.org/10.5751/ES-10287-230342

Ojala, Maria (2020). To trust or not to trust? Young people's trust in climate change science and implications for climate change engagement. *Children's Geographies*, *19*(3), 284-290. https://doi.org/10.1080/14733285.2020.1822516

Papenfuss, Jason, Merritt, Eileen, Manuel-Navarrete, David, Cloutier, Scott, & Eckard, Bonnie (2019). Interacting pedagogies: A review and framework for sustainability education. *Journal of Sustainability Education*, *20*. http://susted.com/wordpress/wp-content/uploads/2019/04/Papenfuss-JSE-April-2019-General-Issue-PDF.pdf

Percy-Smith, Barry, & Burns, Danny (2013). Exploring the role of children and young people as agents of change in sustainable community development. *Local Environment*, *18*(3), 323-339. https://doi.org/10.1080/13549839.2012.729565

Rooney-Varga, Juliette, Brisk, Angelica, Adams, Elizabeth, Shuldman, Mitchell, & Rath, Kenneth (2014). Student media production to meet challenges in climate change science education. *Journal of Geoscience Education*, *62*(4), 598-608. https://doi.org/10.5408/13-050.1

Sipos, Yona, Battisti, Bryce, & Grimm, Kurt (2008). Achieving transformative sustainability learning: Engaging head, hands and heart. I*nternational Journal of Sustainability in Higher Education*, *9*(1), 68-86. https://doi.org/10.1108/14676370810842193

Sonn, Christopher (2016). Swampscott in international context: Expanding our ecology of knowledge. *American Journal of Community Psychology*, *58*(3-4), 309-313. https://doi.org/10.1002/ajcp.12038

Stapleton, Sarah (2019). A case for climate justice education: American youth connecting to intragenerational climate injustice in Bangladesh. *Environmental Education Research*, *25*(5), 732-750. https://doi.org/10.1080/13504622.2018.1472220

Sunrise Movement. (2020). *Our plan for the Future: What is the green new deal? How you can help*. Sunrise Movement. https://www.sunrisemovement.org/green-new-deal/

Sutton-Brown, Camille (2014). Photovoice: A methodological guide. *Photography and Culture*, *7*(2), 169-185. https://doi.org/10.2752/175145214X13999922103165

Theobald, Maryanne, Danby, Susan, Einarsdóttir, Jóhanna, Bourne, Jane, Jones, Desley, Ross, Sharon, Knaggs, Helen, & Carter-Jones, Claire (2015). Children's perspectives of play and learning for educational practice. *Education Sciences*, *5*, 345-362. https://doi.org/10.3390/educsci5040345

Trott, Carlie (2019). Reshaping our world: Collaborating with children for community-based climate change action. *Action Research*, *17*(1), 42-62. https://doi.org/10.1177/1476750319829209

Trott, Carlie (2020). Children's constructive climate change engagement: Empowering awareness, agency, and action. *Environmental Education Research*, *26*(4), 532-554. https://doi.org/10.1080/13504622.2019.1675594

Trott, Carlie (2021). Youth-led climate change action: Multi-level effects on children, families, and communities. *Sustainability*, *13*(22), 12355. https://doi.org/10.3390/su132212355

Trott, Carlie, Even, Trevor, & Frame, Susan (2020). Merging the arts and sciences for collaborative sustainability action: A methodological framework. *Sustainability Science*, *15*(4), 1067-1085. https://doi.org/10.1007/s11625-020-00798-7

Trott, Carlie, Rockett, Maria, Gray, Emmanuel-Sathya, Lam, Stephanie, Even, Trevor, & Frame, Susan (2020). "Another Haiti starting from the youth": Integrating the arts and sciences for empowering youth climate action in Jacmel, Haiti. *Community Psychology in Global Perspective*, *6*(2/2), 48-70. http://siba-ese.unisalento.it/index.php/cpgp/article/view/21951

Trott, Carlie, & Weinberg, Andrea (2020). Science education for sustainability: Strengthening children's science engagement through climate change learning and action. *Sustainability*, *12*(16), 6400. https://doi.org/https://doi.org/10.3390/su12166400

UNICEF. (2021). *The climate crisis is a child rights crisis*. UNICEF. https://www.unicef.org/reports/climate-crisis-child-rights-crisis?s=03

Vásquez, Olga (2006). A pedagogy of the future. *Pedagogies: An International Journal*, *1*(1), 43-48. https://doi.org/10.1207/s15544818ped0101_7

Wang, Caroline, & Burris, Mary (1997). Photovoice: Concept, methodology, and use for participatory needs assessment. *Health Education and Behavior*, *24*(3), 369-387. https://doi.org/10.1177/109019819702400309