Photovoice for Children's Climate Change Engagement: *Using Digital Photography to Bridge Knowledge and Action*

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Abstract

A priority for climate change educators is to present evidence-based information while promoting students' positive engagement. A crucial avenue towards achieving these goals is to combine classroom activities with opportunities for students' active engagement with sustainable solutions through individual and collaborative action projects. The present article describes *Science, Camera, Action!* (SCA), a fifteen-week after-school program carried out with fourth- to seventh-graders. SCA's *Science* component used interactive activities to demonstrate the interrelationships between Earth's changing climate, ecosystems, and sustainable actions within communities. Photovoice, SCA's *Camera* component, involved the use of digital photography to explore youths' climate change perspectives and to identify opportunities for their active engagement. Finally, SCA's *Action* component aimed to cultivate youth potential as agents of change in their families and communities through the development and implementation of youth-led action projects. Action projects included local policy advocacy, a tree-planting campaign, a photo gallery opening, development of a website, and the establishment of a Boys and Girls Club community garden. Following the program, participants demonstrated increased climate change knowledge, improved pro-environmental attitudes and behaviors, and an enhanced sense of agency to positively impact the environment. They also gained a deeper appreciation for science (e.g., in school, careers, and society) and reported increased interest, confidence, and performance in school science.

Introduction

In the U.S., there is widespread public support for educating young people about climate change. A recent nationally representative study found that a large majority (78%) of U.S. adults believe that the causes, consequences, and potential solutions to global warming should be taught to children in schools (Leiserowitz, Maibach, Roser-Renouf, Rosenthal, & Cutler, 2017). So far, eighteen states—representing more than 35% of U.S. students—require climate change to be taught in the classroom through adoption of the Next Generation Science Standards for K-12 STEM (science, technology, engineering, and mathematics) education (National Science Teachers Association, 2017). Moreover, nearly 75% of public school science teachers report devoting classroom time to climate change,

indicating that most students are likely to encounter climate change at some point in their education (Plutzer et al., 2016).

A concern among teachers is the "doom and gloom" nature of the problem, and the need for activities that inspire and empower students (Plutzer et al., 2016). An important avenue for cultivating students' sense of agency is to offer opportunities for their active engagement. Social science research has consistently found that knowledge alone does not motivate action (Chawla, 2009), but that action is indeed a powerful antidote to negative emotions (Spence & Pidgeon, 2009). In the context of climate change, strengthening students' action competence involves presenting sustainable solutions at both personal and societal levels (Jensen & Schnack, 2006), and ideally, offering opportunities for individual and collaborative action. This article describes a novel after-school program, conducted as part of the National Oceanic and Atmospheric Administration's (NOAA) Climate Stewards Education Project, that used digital photography to bridge children's climate change knowledge with youth-led action projects for environmental sustainability.

In late 2017 the NOAA Climate Stewards Education Project changed its title to the NOAA Planet Stewards Education Project.

Science, Camera, Action!: Program Components and Implementation

Science, Camera, Action! (SCA) was a fifteen-week after-school program that combined interactive climate change education with digital photography to empower youth to act as agents of sustainable change within their families and communities. SCA was carried out with 55 fourth- to seventh-graders across three Boys and Girls Clubs in Northern Colorado. Program content was framed by the 'Head, Hands, and Heart' model for sustainability education (Sipos, Battisti, & Grimm, 2008), and its process was guided by photovoice methodology for purposes of science learning, placed-based inquiry and connection, and youth-led participatory action (Cook, 2015).

Science: Making the Invisible Visible through Hands-on Activities

SCA's Science component consisted of six, hour-long, hands-on activities to demonstrate the interrelationships between Earth's changing climate, ecosystems, and sustainable actions within communities (see Table 1). Educational program content explored the scientific and social dimensions of climate change under the theme "Making the Invisible Visible," while providing a platform

Table 1. Science, Camera, Action! (SCA) Program Overview

Week	Component	Topic	Activity
1	N/A	Introduction	Gallery Walk
2	S	Ecosystems	Weaving the Web
3	S	Climate vs. Weather	Climate and Weather with Skittles
4	C	Photovoice #1	Photo-printing and Discussion - Topics 1-2
5	S	The Greenhouse Effect	Greenhouse Gas Tag
6	S	Climate Change & Ecosystems	Oh Deer! & Glaciers: Then & Now
7	C	Photovoice #2	Photo-printing and Discussion - Topics 3-4
8	S	Sustainable Solutions #1: Energy & Waste	Energy Bingo & Carbon Footprint Contest
9	S	Sustainable Solutions #2: Teamwork & Leadership	Young Voices for the Planet Videos
10	C	Photovoice #3	Photo-printing and Discussion - Topics 5-6
11-15	A	Action Projects	Various

Note. S = Science: Educational activity; C = Camera: Photovoice process; A = Action: Collaborative action project. Each science activity was paired with a photovoice prompt. For example, following "Weaving the Web," participants were asked to find evidence of ecosystems in their own lives; "This week, we thought about how people, plants, and animals depend on one another for survival. In your own life, what examples of this can you find? What does this make you think about? How does it make you feel? Take a few photos of these ideas." Photovoice sessions followed each pair of SCA activities.

Figure 1. Students' brainstorm their ideas about climate change using the Gallery Walk method.

Figure 2. Participants' take photographs to connect climate change topics to real-world experiences.

for youth to take informed action on learned concepts (see Figure 1). Descriptions of each activity are available online (Trott, 2017).[1] In the framework of 'Head, Hands, and Heart,' the science component of SCA emphasized critical and systems thinking ("Head") through interactive activities to enhance climate change knowledge. SCA's Science component also introduced participants to various STEM disciplines (e.g., ecology, climatology), with particular emphasis on how STEM careers can make a difference in people's lives.

Camera: Bringing it Down to Earth through Photovoice Process

Following each science activity, participants used digital cameras in a process called "photovoice" (Hergenrather, Rhodes, Cowan, Bardhoshi, & Pula, 2009). Specifically, participants were asked to photograph images conveying their thoughts and feelings about program topics (see Figure 2). Subsequently, participants engaged in group discussions about the content and meaning of their photographs. During each of three photovoice sessions, participants were encouraged to narrate their photos and reflect on what they learned, while also making connections between their own and others' photographs and experiences. The final step in photovoice involved identifying common themes discussed during photovoice sessions and translating themes into action plans (Trott, 2017).

The main goals of photovoice methodology are to enable participants to record and reflect community strengths and concerns, to promote critical and reflexive group dialogue on important issues using photographs, and to promote social change (Wang et al., 2004). Although photovoice has traditionally been used as a participatory action research method, it has also been developed as a pedagogical technique, connecting students to science and empowering them to make improvements to the environmental conditions of their communities (e.g., Schell, Ferguson, Hamoline, Shea, & Thomas-Maclean, 2009). According to Cook and Quigley (2013):

> Applied as a pedagogical tool in science education, photovoice puts cameras into the hands of students in order to document and address scientific issues from their position and point-of-view. This technique offers students new and reflective ways to perceive their own world and the science around them, as well as the potential to generate change in their own community. (p. 340)

In the framework of 'Head, Hands, and Heart,' the photovoice method encouraged participants to experience connection ("Heart") to their surroundings through greater awareness of the interconnectedness of the natural world. Moreover, photovoice was intended to facilitate youths' ability to make connections between their own lives and SCA's science content, simultaneously making abstract science concepts more concrete as well as personally relevant.

1 Additional information about program content is available online at sciencecameraaction.com. For additional materials or questions about implementation, please contact the author directly.

Action: Putting Ideas into Motion through Individual and Collaborative Action Projects

In the final phase of SCA, participants contributed to sustainable change in their families and communities by: (1) Developing family action plans to promote engagement in small-scale, everyday sustainable solutions, and (2) Designing and carrying out a larger collaborative action project (Trott, 2019). In the latter, youth were supported in realizing their visions for a community-focused sustainability initiative. Both action projects were aimed to advance youth potential as agents of change. In the framework of 'Head, Hands, and Heart,' they each promoted youths' active engagement ("Hands") with learned concepts through everyday practices and innovative projects.

Family Action Plans. Halfway through the program, participants estimated their carbon footprints by filling out a 20-item survey (Trott, 2017; 2019). Items focused on youths' environmentally-significant behaviors and were summed into a total number of pounds of carbon dioxide emissions per year associated with their daily routines. Carbon dioxide-equivalent (CO_2e) "scores" were then handed back, providing participants with individual-level recommendations for lowering their carbon footprint. Participants then developed and implemented family action plans to reduce their environmental impact. In the process, they were encouraged to take on a leadership role within their families, sharing knowledge and promoting sustainable actions in the areas of household energy use and waste.

Figure 3. Participants' reflect on digital photography to generate plans for action.

Collaborative Action Projects. In the final five weeks of SCA, participants translated their knowledge into collaborative action projects. After reflecting on themes derived from all photovoice sessions, participants engaged in a brainstorming and consensus process to formulate plans that were specific to their shared interests and goals (see Figure 3). The process of deciding on youth-led projects was open-ended, but bounded in terms of focus (i.e., climate change), time (i.e., five weeks), and funds (i.e., $500 or less). Action projects included local policy advocacy (i.e., a City Council presentation), a tree-planting campaign (see Figure 4), a "photovoice" gallery opening and program website to generate community interest and engagement with climate change solutions, and a community garden to provide local food to the Boys and Girls Club community (see Figure 5).

Figure 4. Following their speech to City Council emphasizing the importance of local leadership to address climate change, these participants were granted permission to plant trees in public parks.

Figure 5. After clearing an overgrown lot on the property of their Boys and Girls Club, these participants planted more than one hundred fruit and vegetable plants and formed a "Garden Club" for summertime garden maintenance.

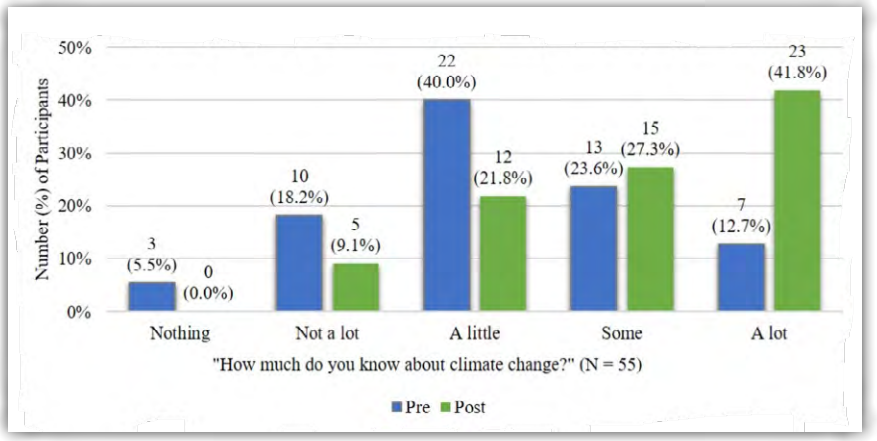

Figure 6. Pre-post program differences in self-estimated climate change knowledge.

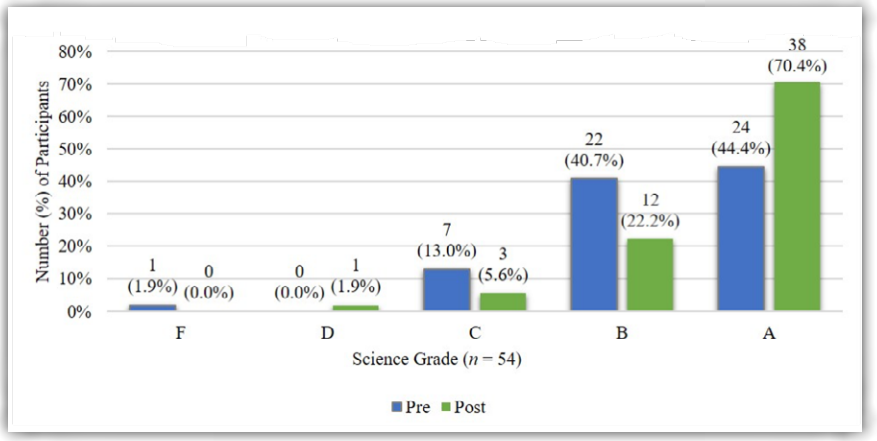

Figure 7. Pre-post program differences in self-reported science grades.

Summary of Program Impacts

The SCA program was evaluated using a mix of pre-post survey and post-program focus group methods. Selected program impacts are presented below.

Climate Change Knowledge, Attitudes, and Behavior. Following the program, participants demonstrated increased knowledge of the scientific and social dimensions of the causes and consequences of climate change, as well as its solutions through human action. They also felt more informed on the issue, estimating their own knowledge to be greater following the program (see Figure 6). Participants left the program with an increased sense of respect for nature, an enhanced sense of environmental responsibility, and a greater sense of urgency towards the need for climate change action. Finally, participants reported increased engagement in personal pro-environmental behaviors.

Sense of Agency. As participants reflected on the impact of SCA during focus groups, it was clear that the program strengthened their self-confidence in their abilities. Many left the program feeling informed, capable, and inspired to continue making a difference for the environment. Participants commonly described undergoing a perspective-shift that allowed them to view themselves, and young people in general, as competent and effective change agents in their families and communities.

Science Engagement. Through SCA, participants gained a deeper appreciation for science (e.g., in school, careers, and society) and reported increased interest, participation, confidence, and performance in school science. Although most participants were already performing well in science class, many reported improved class grades (see Figure 7), Several participants said that learning about climate change made science more interesting. As one eleven-year-old described, *"I didn't really like [science] before, and I wasn't interested in it. But now I know that you really need to know about it and you can't just ignore the changes happening in the world."*

Conclusion

The immensity of the challenges to social systems and lifestyles that climate change presents is palpable in urgent calls for global transformation towards sustainability. Climate change educa-tion in both formal and informal contexts is a promising avenue for strengthening children's role as knowledge-bearers and change agents for a sustainable future. Through SCA, youth participants role in the sustainable transformation of their families and communities.

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