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"This green tomato does not look ready to pick!": Preschool Children's Photography of Gardening and Cooking Activities

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ABSTRACT

This study was conducted to explore preschool children's engagement in gardening and cooking activities and to incorporate their perspectives on these activities through digital photography. Additionally, the study explored how connections between home and school could be fostered through a cooking activity at home. Eighteen four-year-olds in two preschools participated in gardening activities with their teachers and peers and engaged in a cooking activity with family at home. The children were videorecorded as they participated in the gardening activities, and they took photographs in the garden at school and during the cooking activity at home. Qualitative analyses of the observations and photographs yielded four integrated themes, including: photography supports playful exploration and inquiry; teachers guide integrated learning in gardens; children develop appreciation and knowledge of nature; and photography can facilitate home-school connections. Results indicated preschool gardens are engaging learning environments that facilitate co-construction of knowledge through shared inquiry and communication processes. Cameras are constructive tools for incorporating young children's voices and perspectives into research and observing the relational processes through which children take the photos as well as considering the content of their photographs is valuable for shared understanding and meaning-making. Photography, gardening, and cooking are accessible activities through which to foster home-school connections. This research underscores the important role of gardening and cooking activities in providing unique learning experiences that go beyond traditional classroom settings, fostering holistic development and distinct understandings of the natural world.

Keywords: early childhood education; school gardens; cooking; child-led photography; Mosaic approach

This study was conducted to explore preschool children's engagement in gardening and cooking activities and to incorporate their perspectives on these activities through digital photography. Additionally, the study explored how connections between home and school could be fostered through a cooking activity at home. Four-year-olds in two preschools participated in gardening activities with their teachers and peers and engaged in a cooking activity with family at home. A qualitative research design using a sociocultural theoretical framework was employed to study children's engagement and perspectives.

Sociocultural Framework and Child-led Photography

Within a sociocultural theoretical framework, young children learn through interactions with others as they participate in everyday routines and activities (Rogoff, 2003; Vygotsky, 1978). Children co-construct knowledge through shared inquiry and communication processes, sometimes known as "negotiated learning" in early childhood education (ECE) practices (Forman & Fife, 2012, p. 248). From this perspective of ECE, teachers, parents, and children form a community of learners who negotiate meaning through shared understandings. Teachers work to understand children's beliefs and theories through observation and conversation and guide their inquiry skill development and knowledge about the natural world (Forman & Fife, 2012).

From a sociocultural perspective, research with young children should include and respect their voices and perspectives. Whereas for many years psychological studies have been conducted *on* young children, with adults interpreting their experiences but not seeking input from the children themselves, researchers are increasingly moving towards Mosaic approaches that engage children's perspectives, not only verbally but also through drawing, photography, mapping, conversations, and more (Aragón et al., 2023; Calan, 2015; Clark & Moss, 2001; Einarsdottir, 2005; Green, 2017). The Mosaic approach was developed to include children's voices in research through a combination of methods, such as observation, discussion, and tools such as cameras and drawing materials. A key element of this approach is a focus on children's lived experiences (Clark, 2005). Child-led photography has emerged as one useful qualitative research method for inclusion of young children's perspectives, affording them freedom to choose which pictures to take and how to talk about them (Eirnarsdottir, 2005, 2007; Rayna & Garnier, 2021; Sturges, 2023).

In a study of children's views on their daily activities in playschool in Iceland, Einarsdottir (2005) provided children with digital cameras and asked them to show the researchers around their school, photographing what they thought a guest should see, such as play spaces, artwork, and other children. Another group of children were free to take whatever photographs they wanted with disposable cameras. Children's photographs were mainly of people engaging in typical daily activities around the school, such as eating lunch and playing outside. Interestingly, Einarsdottir found that a subset of children's "free" photos contained "taboo" subjects (e.g., taken in private spaces such as the bathroom), demonstrating their agency in taking pictures that might not be sanctioned by the adults. In another study using photography to discover what children find to be important about their preschool environment and routines, Sturges (2023) found that the majority of children's photographs were taken outdoors and most of their stories of the photos were about the relationships with these places and their peers.

In addition to analyzing the *content* of children's photographs, Rayna and Garnier (2021) explored the active *processes* of taking pictures as children aged 2 to 3 years took pictures of everyday life in their preschools in France. The researchers analyzed the relationship between the children and the cameras themselves (e.g., handling the camera and adopting certain postures), and the children's interactions with the subjects they photographed (e.g., deliberately positioning items and engaging peers as subjects). Rayna and Garnier (2021) concluded that studying young children's processes of photography adds a relational dimension beyond the content of the photographs themselves and offers deeper insights into their setting and "aesthetic products" (p. 318).

Children's voices and perspectives were incorporated in this research through two qualitative methods, digital photography and video-recorded observations. Each participating child was given a digital camera to use during gardening activities at school and to take home to photograph a cooking activity. The second means of incorporating children's voices into the study was through videorecorded observations during gardening activities at school. Observing and recording children's language and behaviors in the garden facilitated understanding of their photographic processes and their engagement in gardening activities with peers and their teachers.

Gardening in Early Childhood Education

Gardens have long been appreciated as a context for children's engagement and learning about the environment, sustainability, health and well-being, and academic domains such as math, literacy, and science (Greathouse, 2021; Muzaffar et al., 2023; Skelton et al., 2020; Soltero et al., 2021). Bowker and Tearle (2007) conducted a multi-national

study of children's experiences in school gardens and found that across contexts, children responded very positively to gardening experiences and developed complex mapping skills related to ecological knowledge and awareness. School gardens are places where children can be actively engaged with the natural world, and learning occurs through free play and inquiry (Pope et al., 2023). In their longitudinal study of a Reggio Emilia-inspired preschool, Vandermaas-Peeler and McClain (2015) observed children's participation in gardening activities over the course of one year. With their teacher's support and guidance in a wide variety of gardening experiences, children utilized complex math and science skills and displayed ecological awareness and positive affective responses to the natural world. Similarly, Hachey and Butler (2009) elaborated the potential of gardening for the development of young children's science attitudes (inquiry and exploration), process skills (seeking answers and building skills such as graphing and drawing), and content (including knowledge of plants and animals). Thus, past research has demonstrated that gardening projects in ECE environments can foster enjoyment, inquiry, and domain-specific thinking and learning.

ECE teachers' and directors' support is critical for children's holistic learning and engagement in gardening activities. In one study, ECE directors who were interviewed before and after a gardening education project cited multiple perceived benefits of gardening for children, including self-esteem, language and academic skills, and nutrition and health information, among many others (Soltero et al., 2021). One director commented that gardening experiences can help "level the playing field" for children from low socioeconomic backgrounds through social and academic skill development (Soltero et al., 2021, p. 269). Murakami et al. (2018) analyzed ECE teachers' narratives about the impact of gardening programs and reported that in addition to traditional realms of learning (e.g., food behaviors and science), garden education was utilized to foster autonomy, relatedness, and competence. These developmental benefits were purposefully supported through inquiry-based, creative activities (e.g., building houses for the "Three Little Pigs" with different materials in the garden).

Bridging School and Home Environments

Within a sociocultural framework, researchers recognize the extensive knowledge and experiences young children bring to and from home and educational environments (Chesworth, 2016; González et al., 2005; Melzi et al., 2018; Rogoff et al., 2003). Bridging, or facilitating transfer of knowledge from one context to another, is a key strategy to support early learning within and across home and school settings (Hedges, 2014; Vandermaas-Peeler et al., 2019). Teachers utilizing inclusive pedagogies acknowledge the diversity of children's home backgrounds and construct curricular connections between home and school environments. When teachers nurture diverse cultural and linguistic practices, children co-construct meaning, develop agency, and practice inclusive, creative learning and play strategies (Chesworth, 2016).

In a recent study exploring home-school connections in ECE, cooking was identified as a culturally important activity that could bridge learning at home and school (Durán & Lopez, 2022). Family members were invited to make recipes together at home and children were encouraged to integrate literacy and play through cooking activities and materials at school. Cooking enabled children to draw on knowledge from home, often through recipes, and facilitated classroom literacy and play activities (Durán & Lopez, 2022). Additional past research has identified cooking as a source of significant learning opportunities, including literacy skill development (e.g., reading recipes), numeracy (e.g., measuring and counting ingredients), and scientific reasoning (Durán & Lopez, 2022; Finn & Vandermaas-Peeler, 2013; Vandermaas-Peeler et al., 2012).

The present study aimed to create home-school connections between gardening and cooking through an activity in which families made their own recipes with ingredients that were seasonal in the garden. Children were encouraged to photograph the cooking activity and these photographs were shared with the teacher and peers in the form of a book created for each classroom.

Purpose and Design of the Study

This qualitative research study utilized a sociocultural theoretical framework to study preschool children's engagement in and perspectives on gardening and cooking activities. Children's perspectives were included through

videorecorded observations of their participation in gardening activities and through their use of digital cameras during the gardening and cooking activities. The photographic processes they enacted to take the pictures *and* the content of their photographs were studied, deepening the photography methodology (Rayna & Garnier, 2021). The following research questions were examined: (1) How does children's participation in gardening activities with peers and their teacher foster learning and engagement? (2) How do children use the cameras during gardening activities? (3) What do children take photographs of during gardening activities at school and a cooking activity at home? and (4) Do children establish connections between home and school environments through these activities?

METHOD

Research Context

In the spring of 2023, the researchers worked with outdoor learning specialists in two non-profit organizations focused on early childhood education in central North Carolina to identify preschools with active gardening programs. Directors of three preschools participating in a "Grow Fresh" program, in which ECE centers received small grants from local non-profits to support gardening activities, were invited to participate in the research project. Two preschool directors agreed to participate, both in the same suburban town of approximately 21,000 people. Each preschool director selected one teacher and their four-year-old classroom to participate. To protect confidentiality, the schools are identified hereafter as Preschool A and Preschool B.

In Preschool A, the garden is adjacent to the preschool building and the parking lot, separate from other outdoor play spaces (see Figure 1). It is surrounded by a fence and there are raised beds throughout the garden, along with gardening tools and two picnic tables. In Preschool B, the garden beds are located within a fenced playground and spread throughout the play spaces (see Figure 2). A bike track runs around the outside of most of the gardening areas and some playground equipment (e.g., a sandbox and toys).

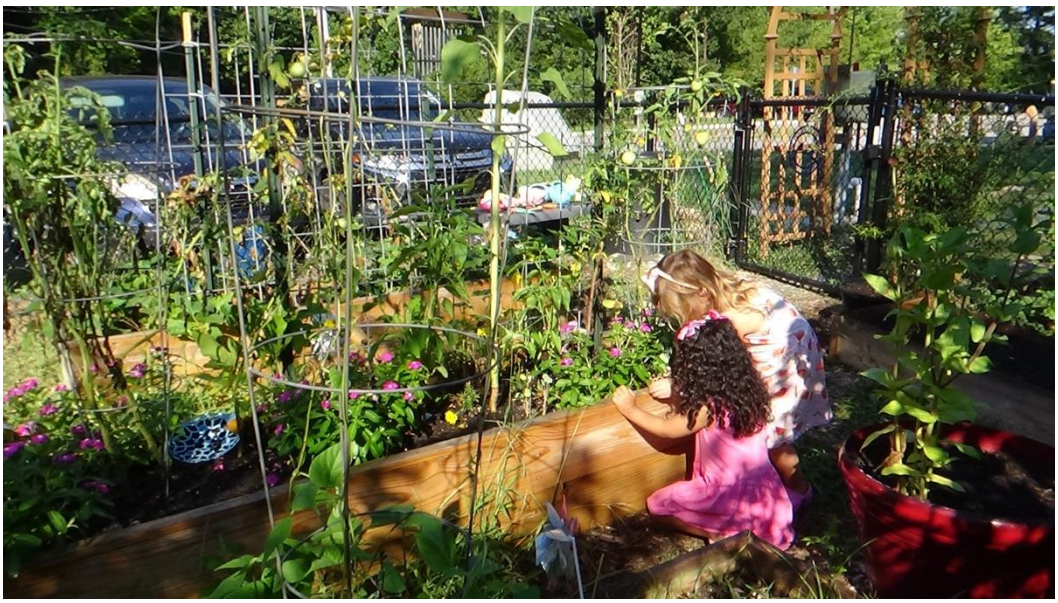

Figure 1. The garden at Preschool A

The participating teachers in both preschools typically involve children in gardening activities multiple times a week, and sometimes daily. The gardening activities observed in this study were planned by the teachers based on their curricula and seasonal activities germane to gardening (e.g., planting or harvesting summer vegetables). The teachers identified convenient times for three to four visits to the preschools to conduct this project.

Participants

Parents and caregivers in the two participating classrooms were sent information about the research study and invited to participate. Ten out of 10 children (four males and six females) in Preschool A participated and eight out of nine children (three males and five females) in Preschool B participated in the project. All 18 child participants were four years of age. English was spoken in every home, and in one home the family also spoke Mandarin and in another, Hindi. In both preschools the parents' levels of education ranged from "some college" to PhD. Eleven children were identified by their parents as Caucasian, five as Black/African American, and two as Biracial. One parent in each family completed the demographic forms.

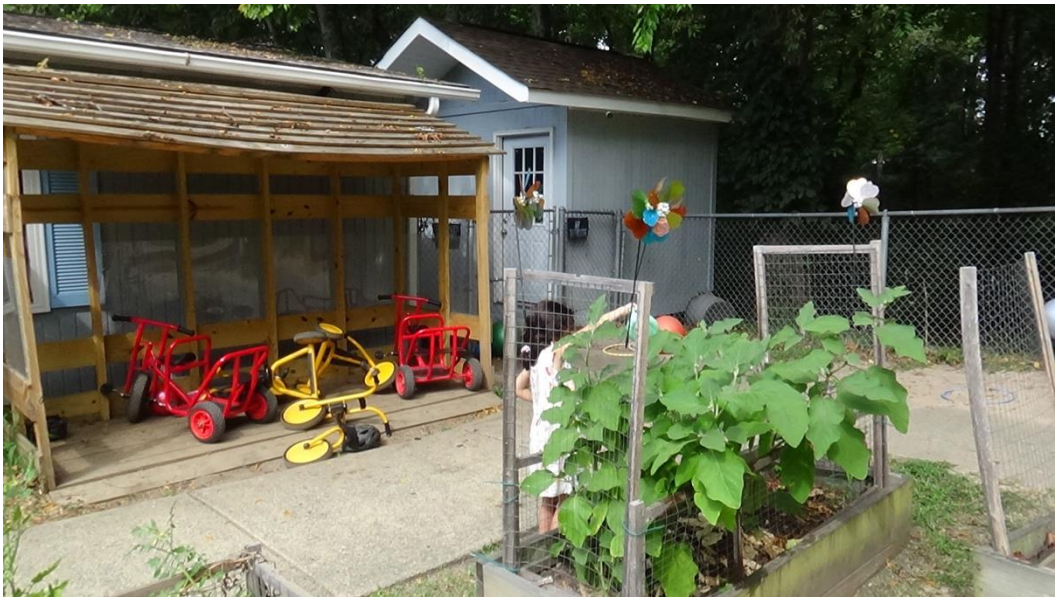

Figure 2. The garden at Preschool B

Procedure

The research was approved via the university Institutional Review Board (IRB) and parents gave permission for their children to participate by signing and returning the IRB-approved informed consent letters. Teachers explained the research project to the children in the participating classes. Child-friendly digital cameras were brought to each classroom and teachers practiced using the cameras with the children. Each class was observed on three occasions in the garden in July, August, September, and/or October. The activities varied, depending on the teacher's curriculum and what needed to be done in the garden, ranging from planting, picking, watering, and observing and photographing what was growing. Sometimes other activities were integrated with the gardening experiences. For example, during one observation at Preschool A, the teacher planned a scavenger hunt, with the children taking turns hiding and finding shapes in the garden beds. At Preschool B, the garden is in the center of the playground and during each observation, the children had free choice of playing, riding bikes, and gardening. Time spent in the garden averaged about 45 minutes per observation.

During the gardening activities, the cameras were available for children to use whenever they desired. There were rarely specific prompts to guide their photography, although sometimes teachers offered suggestions. All children used the cameras at least once and usually took a dozen or more (sometimes many more) photos on each day. Each class was given the cameras to keep after the research was completed.

Families were invited to participate in the project through a cooking activity conducted at home. In each class, the teacher selected one or more seasonal ingredients; one teacher (Preschool A) chose blueberries and strawberries, and the second teacher (Preschool B) chose apples. These ingredients were purchased at a local market, as the

preschool gardens generally did not generate enough produce to send home. Each family received the ingredients on a school day of the teacher's choosing, with instructions to make a family recipe of their choice. Cameras were sent home with the fruit, and children were encouraged to take photos of the cooking activity. The cooking activities were generally completed within a few days of receiving the fruit, and all children took some photos of the process. The cooking processes differed for each family, depending on the recipe they selected. Some families baked cakes, muffins, and pies, while others chose more simple recipes such as smoothies.

After all garden observations and cooking activities were completed, the researchers compiled selected photographs taken by each child into a photobook for each classroom. In Preschool A, the teacher and children were videorecorded reading the photobook together for the first time.

Coding and Analyses

The primary sources of data for this study were the children's photographs of the gardening and cooking activities and the video-recordings made by the researchers on each visit. The video-recordings were transcribed by a professional company and all transcripts were checked by two researchers. The videos were consulted as needed to clarify language and/or context (e.g., if a child's comments were unintelligible or didn't make sense without further information that could be obtained from the recording).

The research team used the "Sort and Sift, Think and Shift" methodology developed by Maietta et al. (2021) to analyze the transcripts and photographs. This method of qualitative analysis involves an iterative process of "diving in" to the data to discover the content, then "stepping back" to assess what has been learned and to determine where the findings connect to each other and to the field (see Maietta et al., 2021, for a detailed description). In this study, the analytic processes included: 1) sorting photos into categories; 2) highlighting interesting and salient conversation topics and quotations from the transcripts; 3) memo-writing about the emergent themes; 4) comparing emergent themes across data sources; 5) coming to consensus about the primary cross-cutting themes; and 6) revisiting the entire process.

In the initial phases of coding, we sorted the photographs into specific categories, such as "selfies" and "fruits and vegetables" in the garden, and "cooking tools" and "ingredients" at home. Transcripts of the videorecorded observations were read multiple times and topics of conversation were identified. Specific "episodes" in the conversations were highlighted through quotation identification and memo-writing. For example, teachers and classmates talked about topics such as "knowing when to harvest vegetables by color," and "how to put the plants in the soil." The initial coding categories were discussed by the research team and connections within and across data sources and episodes were identified through iterative analytic processes of "diving in" and "stepping back."

From these analyses, four integrated, over-arching themes were developed, including 1) Photography Supports Playful Exploration and Inquiry; 2) Teachers Guide Integrated Learning in Gardens; 3) Children Develop Appreciation and Knowledge of Nature; and 4) Gardening and Photography Facilitate Connections Between School and Home Environments. These themes are elaborated and illustrated with transcript quotes and photographs in the next section.

RESULTS

Theme 1: Photography Supports Playful Exploration and Inquiry

Children found the cameras to be an exciting new tool for exploration and they co-constructed knowledge with their friends about how to use the myriad functions on the special, child-friendly digital cameras provided by the research team (see Figure 3). They readily helped each other figure out the functions and solve problems that arose. Through trial and error, they quickly learned to use the power button not only for turning the cameras on and off, but also as a solution for resetting the camera. When a child discovered a new feature of the camera, such as taking a video, others would ask, "How did you do that?" The cameras had filters, such as a princess frame or a mustache, and the children delighted in using the filters to enhance their photos of themselves, their friends, and the gardens (see Figure 4). One child took a selfie with the princess filter and excitedly announced, "Guys, I'm a queen, I'm a queen!"

As they added mustaches to photos of tomatoes and friends, they enjoyed the process of taking and then enthusiastically reviewing their own and their friends' photos. They proudly announced these accomplishments to each other and their teachers, sometimes inviting other children to come and take photographs of the same things.

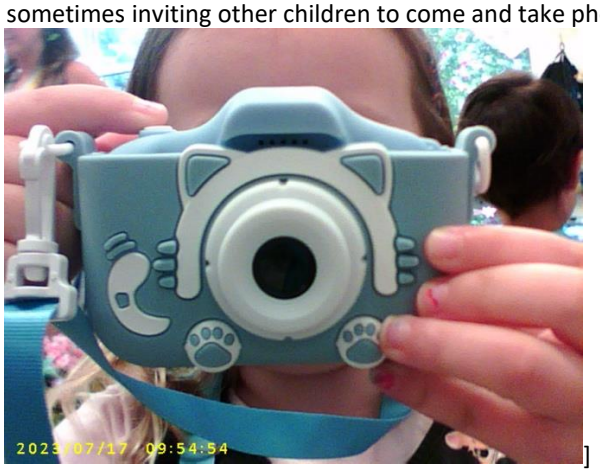

Figure 3. A child using a child-friendly digital camera

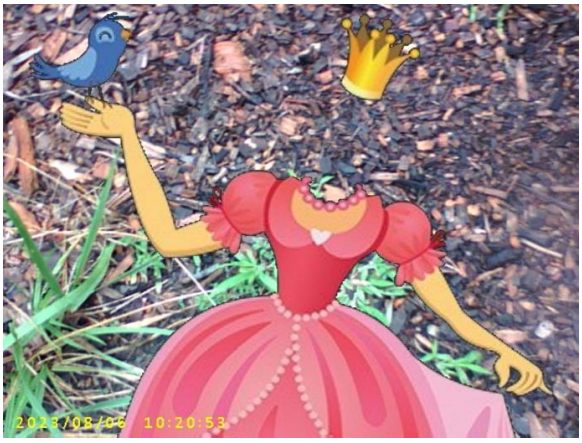

Figure 4. A child applied the princess filter to their photo

The teachers noted children's enthusiasm and also attributed their facile use of the cameras to prior experience. As one teacher noted, "well … they're so clever. At this age, they already kind of know how to use technology because either they use their parents' phones or tablets." However, these special digital cameras were clearly novel and exciting. Some children took dozens of photographs during each activity, and others were more selective. The most photographed subjects at school included the plants and other aspects of the garden environment, themselves (selfies were very popular), their friends using the cameras, their teacher, and the researcher and her video camera. The children were particularly fascinated by the video camera, further evidence of their curiosity about technology.

Although the emphasis was often on the photos themselves, children also discussed the *processes* of photography, wondering why some photos were blurry and experimenting with distance from the subject of their photographs. One technique seen in many photos was zooming in to get a close-up of the subject. Analyses of children's photos also showed their interest in juxtaposing colors and patterns. For example, one child zoomed in to capture a vibrant pink flower and the green background of the leaves and the school building. The children often took up-close photos of the vegetables in the garden, as in Figure 5, during the harvest of an eggplant. Figure 6 depicts the child's observation of light patterns on the plants. Children also took close-ups of themselves and others, for example of their own noses and eyes.

Figure 5. Close photo of child harvesting eggplant

Figure 6. Light and shadows on the leaves

The children demonstrated a curiosity about different perspectives through their photography. For example, they stooped low to examine and photograph the ground and their own feet, or expanded their gaze and took photos of something high above their heads. As seen in Figure 7, one child chose a beach-themed filter and looked up to capture a shot of a garden trellis well above their head. The children photographed a drooping, tall sunflower and wondered if it was dead, as explored below in Theme 3.

Figure 7. Garden trellis overhead

At home, children photographed the cooking processes and products, as well as the home environment and family members and pets. Many of the children's photos were evidence of their particular fascination with the use and transformation of ingredients. They photographed the process of adding ingredients, such as eggs to a bowl (see Figure 8), or of the mixer combining flour and eggs (see Figure 9). Sometimes another family member photographed the child while they cooked. Although the researchers and teachers did not observe the cooking activities at home, taking photographs of "cooking in action" with parents and other family members affords opportunities for inquiry-based learning and co-constructing meaning at school.

Figure 8. Pouring the egg into the bowl during the cooking activity at home

Figure 9. Mixing in progress during the cooking activity at home

Theme 2: Teachers Guide Integrated Learning in Gardens

In both preschools, teachers guided integrated learning as children participated in gardening activities, sometimes in conjunction with photography. They often prompted learning through basic questions, such as "Can you take a picture of something red?" and "What color is the ladybug?" One teacher encouraged children to "See if you can find [and photograph] one thing for each color in the rainbow, that's red, orange, yellow, green, blue." Identification of shapes, sizes, and colors occurred frequently, particularly in relation to whether something was ready to be harvested, such one child's comment that "this green tomato does not look ready to pick!" Comparison was another skill that was fostered through gardening, as depicted in the exchange below:

Teacher: *What shape is it?*
Child: *Round.*
Teacher: *It's round and what color do you see?*
Child: *Green.*

Teacher: *Green. So sometimes things are one color and then as they get older, they can be a different color. Does this look like another fruit that you know?*

In this exchange, the teacher asked specific questions about shape and color and offered content knowledge about how fruit can change colors as it ripens. She also fostered integrated learning through an open-ended question inviting the child to connect their previous knowledge of fruit, supporting the child's ability to bridge known and new experiences.

Sometimes the teachers planned complex, structured activities in support of literacy, numeracy, and science. Planting was an exciting activity that involved multiple steps such as writing the names of the vegetables on markers, measuring and deciding where to plant, getting your hands dirty in the soil, digging with a tool, and watering, among others. One teacher brought a ruler into the garden, instructing children to measure 18 inches as the correct distance between plants. She scaffolded the measuring process, showing them how to use the ruler and looking at the numbers together.

In another activity designed to facilitate integrated learning, children harvested, identified, and sorted the produce, ultimately creating a chart on which they wrote the names of the fruits and vegetables, counted how many were harvested, and graphed the results. The following transcript excerpt shows how the teacher integrated learning throughout the activity:

Teacher: *So, we have equal amounts of strawberry and peppers. Just one. Just one each. Now, you might not recognize what this is, but we have been growing these since winter time. Is it cold or hot in the winter?*
Children: *Cold!*
Teacher: *It's cold in the winter. These guys like to start growing in the cold season. I'm hearing some guesses. They're white like an onion. They're in the onion family but it starts with a "g" sound.*
Child: *Garlic?*
Teacher: *Good guess! It's garlic. And we have a lot of them. Garlic. You guys going to help me count the garlic today? All right. [counting together] We have one, two, three, four, five, six, seven, eight, nine, 10, 11, one more, 12. Twelve, that's quite a big number, 12. And there's enough for each of us to hold one. Give it a smell, feel it in your hand. Let's use some describing words to describe what it feels like, what it smells like, what it looks like. Let's use all of our senses. Give it a sniff. Your parents might cook with this in pasta dishes.*

The teacher's guidance afforded children opportunities to practice numeracy and literacy, think about planting seasons, develop sensory connections to gardening, and establish a connection to cooking at home.

Theme 3: Children Develop Appreciation and Knowledge of Nature

In the garden children learned to identify plants and when to harvest them, and practiced skills such as planting and watering. During these activities, they developed knowledge and appreciation for the plants in the gardens. As his friends participated in a planting activity, one child sat and ate mint leaves, putting multiple leaves into his mouth at once and delightedly munching. A friend joined him and also began to eat the mint. They had an extended conversation (that was somewhat difficult to follow because of the leaves in their mouths) about how to make mint tea by adding the leaves to water. The teacher laughed and explained that sometimes, when the director came out to look for mint for her water or tea, there was none left because the children had eaten it all. She noted the importance of cultivating enthusiasm for what is growing in the garden. Similarly, in the following exchange the teacher and a child discuss their love for sweet potatoes and the plants' need for growth and water:

Teacher: *Well, they might need a drink. We were trying to figure out how long it's going to take before we dig them up.*
Child: *Before we get to eat them!*
Teacher: *I know you can't wait to eat the sweet potatoes, can you? Me too. I like a good sweet potato. Well, I think we're done. We'll have to water them again later.*

Sometimes it was very challenging for children to wait to harvest fruits and vegetables, though this afforded opportunities to develop patience and understanding of "readiness." Two children came into the garden and lamented that all the strawberries were green. One commented sadly, "This one's not even ready yet. So there's none for us to pick today. Boring!" Meanwhile, another child picked quite a few small green tomatoes. When the teacher noticed, she commented,

(*Child's name), can we leave the rest of the green ones so they can grow into red tomatoes, please? Okay? These will turn another color soon, but we want to leave the rest of them on the bush to keep growing. They're not quite ready yet.*

Child: *What?*
Teacher: *They haven't had enough time to grow. That's why they're not red yet. They still need a little more sunshine. What else do they need?*

Child: *Water?*
Teacher: *Water.*

The teacher reinforced this theme in a subsequent conversation, explaining "that one's not quite ready, so we're going to save our picking hands for another day." With her guidance, the children were practicing self-regulation and learning respect for the natural world.

In the garden, children had encounters with the animal world as well as the plants. Children noticed and photographed butterflies and bees in the gardens and talked with their teacher about "where they are going," maybe to "get pollen." While composting their fruit from breakfast one morning, some children found slugs in the compost. The teacher explained, "slugs are really helpful … I'm glad they're in our compost. It's okay to pick it up with your pointer finger and your thumb. Does anybody want to practice picking up a slug?" Some of the children were very curious and wanted to touch them, while others were not so inclined, saying they were slimy. Several children picked up a few and moved them to a pile of leaves beside the composter, saying "I found their home!" Two children discussed the life or death of the small animals in the following conversation:

Child A: *This little cutest baby's dead.*
Child B: *No, it's not. It's just rolled up in a ball. When she's scared, she rolls up in a ball.*
Child A: *Look! His legs are not moving and his antennae is not moving. He's dead.*
Child B: *The sunflower is also dead.*

The children then took photographs of the dead sunflower and moved on to play elsewhere in the garden.

Theme 4: Photography Can Facilitate Connections Between School and Home Environments

Using the cameras at school occasionally prompted discussions of the children's home environments. When the children were taking photographs of the colors in the rainbow, one child shared, "We're painting my room a rainbow color!" Another child asked the teacher if she wanted to come home with her some day and the teacher's enthusiastic reply afforded opportunities to share information about her home:

Child (to the teacher): *Do you want to come to my house someday?*
Teacher: *I would love to come to your house someday.*
Child: *Downstairs, it has a lot of things. But then my playroom is a disaster.*

Teacher: *It's a disaster? Oh my goodness, what do you mean?*
Child: *Toys all over the downstairs!*

This child may have been relaying an adult's assessment of the toy situation, but she was very excited at the prospect of a teacher visit to her home.

During gardening activities, some children spontaneously drew connections between their preschool and home environments. Harvesting the vegetables was especially exciting and a few children recounted times they harvested the same vegetables in their home gardens. One child noted they had harvested even more tomatoes in the harvest at home, but another child sadly commented, "There's a problem at my house where the squirrels ate all the tomatoes." Sometimes the teachers facilitated these conversations, but more often these were quick, child-initiated exchanges.

On the last visit to each preschool, researchers shared the photobooks of selected photographs the children had taken during the gardening and cooking activities as well as a few from the researchers' camera. There was immense enthusiasm for viewing and discussing the photos, and children were particularly excited to see their own photos and photos others had taken of them. The following exchange occurred as the teacher read the book to the children in Preschool A:

Teacher: *Oh, oh, let me read the title page, "Gardening and Cooking: Photography Project." And on the front, I see a picture of a flower that we have.*
Child A: *Sunflower!*
Teacher: *A sunflower, that's our sunflower growing in the garden. And then there's some pictures of us.*
Child B: *It died.*
Teacher: *It did, we already took it out. You're right about that. The sunflower has lived its life. All right, so there's no words in this book, but if you see a photo that you want to talk about, you can raise your hand.*
Child C: *Hey, that's me and that's me!*
Child D: *I see myself. I see my blue shoe!*
Teacher: *It is fun to see pictures of yourself.*

As they looked at the book together, the teacher encouraged the children to guess whose photos they were seeing. After they guessed correctly, she invited each child in turn to talk about what they cooked at home. The photographs helped them remember specific details, such as "we cut strawberries" and "we used the mixer." The teacher also pointed out similarities across experiences, such as "you both made blueberry muffins!" One child noted "my dad even knows how to make muffins," and another commented that she'd cooked with her grandpa. The teacher also established connections between the children's photos and a story they'd read previously, saying: "(Child's name) made a blueberry pie! The story we read yesterday had an apple pie and a blueberry pie. That looks just like the blueberry pie from our story."

DISCUSSION

This study was conducted to explore preschool children's engagement in gardening and cooking activities and to incorporate their perspectives on these activities through digital photography. Observing children's processes of photographing, as well as the content of their photographs, afforded an in-depth understanding of their experiences in the garden. Additionally, the study explored how connections between home and school could be fostered through a cooking activity at home. Qualitative analyses of the observations and photographs yielded four integrated themes, including: photography supports playful exploration and inquiry; teachers guide integrated learning in gardens; children develop appreciation and knowledge of nature; and photography can facilitate home-school connections.

Supporting prior research, in this study children were enthusiastically engaged in gardening activities and through teacher-guided planting, harvesting, and watering, they practiced inquiry skills and developed knowledge and appreciation for the plants and animals in the garden beds (Bowker & Teale, 2007; Hachey & Butler, 2009; Vandermaas-Peeler & McClain, 2015). For example, the four-year-olds in this study learned when to harvest and discussed how the color of the vegetables can be an indicator of readiness. They also practiced patience and self-regulation skills (e.g., not harvesting crops until ready) and co-created shared anticipation for future crops with peers and teachers, for instance while waiting for the sweet potatoes to be ready. Supporting integrated learning through inquiry-based, creative activities, such as those described by Murakami et al. (2018), the teachers developed engaging activities for children to do in the garden that supported math, science, and literacy, including comparing the number, color, and size of produce harvested and creating a chart for the classroom, and using rulers to measure distance between plants while planting. There is a need for teacher education concerning how to incorporate gardening activities into early childhood curricula to support holistic development (Dawson et al., 2013; Soltero et al., 2021). This study adds to a growing body of evidence that preschool gardens facilitate inquiry and foster ecological awareness, among other emergent skills, and that teacher guidance is essential to support young children's learning outside of the classroom.

Our findings also confirm that gardens can be rich contexts for sensory experiences and playful engagement (McVittie, 2018; Pope et al., 2023). Preschoolers naturally play when they spend time outdoors and children were social and playful as they spent time in the gardens, particularly in Preschool B, where the gardens were integrated into the playground. Children were captivated by the small animals they found serendipitously as they composted and put their hands in the soil, and touching the animals provoked curiosity and sensory awareness. This was clearly more comfortable and familiar for some children than others. Our findings support previous research concluding that preschool gardens can serve as a pathway for *all* children to have early opportunities for exploration and discovery of the natural world (Soltero et al., 2021).

The cameras were tools that supported playful inquiry and social engagement. Analyses of the children's processes of taking pictures afforded an understanding of how photography was a relational process (Rayna & Garnier, 2021; Sturges, 2023). Social engagement was enhanced by giving all children cameras to use at the same time with an open invitation to take pictures of whatever they wanted in the garden. Children negotiated meaning and understanding through their discovery of camera functions and joint problem-solving when things went awry, and shared enthusiasm for taking and reviewing photos of plants, animals, themselves and each other in the gardens, inviting each other to "come and see!" and to take similar photos. The camera filters were a surprising and fun element that children discovered on their own. There was significant value added by videorecording the children as they took photos, because they often narrated their processes of taking photos and explained their actions to each other in ways they might not have done with unfamiliar adults (researchers). Einarsdottir (2005) emphasized the importance of allowing children to explain their photographs in order to understand their perspectives. The results of this study lend support for the use of videorecorded observations as another mechanism for inviting children into the research process and gaining deeper understanding of their perspectives by observing their processes of photography.

To invite families into the project and enhance connections between home and school, researchers and teachers facilitated a home cooking project using seasonal ingredients that were also grown in the preschool gardens. The photobooks of children's photographs of their home environments and the cooking projects facilitated conversations about what children cook and eat at home. As one teacher noted, children sometimes made the same food, but their processes and who they cooked with may have differed. Children used the photographs as a springboard for remembering details of the cooking activity and all children were delighted to see themselves in the photos. Bridging facilitates the transfer of knowledge and understanding, and the photographs and photobooks were tools that supported negotiated learning within the community of teachers, children, and parents (Forman & Fife, 2012; Hedges, 2014; Vandermaas-Peeler et al., 2019). Although this activity may be too complex or expensive for widespread implementation, it would be relatively easy for teachers to foster conversations about what families typically cook, how children help, and what recipes feature seasonal ingredients (Durán & Lopez, 2022). Parents and teachers could share photos taken on cell phones in each context (as already happens in many preschools). In addition to providing teachers with information about children's home experiences, this could also help families connect to the gardening activities in preschools.

Conclusion

The results of this study supported the conclusion that preschool gardens are engaging learning environments that facilitate co-construction of knowledge through shared inquiry and communication processes. Cameras are constructive tools for incorporating young children's voices and perspectives into research, and observing the relational processes through which children take the photos as well as considering the content of their photographs is valuable for shared understanding and meaning-making. Photography, gardening, and cooking are accessible activities through which to foster home-school connections. Our research underscores the important role of gardens in providing unique learning experiences that go beyond traditional classroom settings, fostering holistic development and distinct understandings of the natural world.

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