

# Green Minds: An Introspective Look at Gardening Curriculum for Science Skills in Preschoolers

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**Abstract:** Gardening with preschool children is often limited to basic gardening activities. Digging holes, planting seeds, watering growing vegetables, and observation of plants are common activities for teachers to use when implementing gardening curriculum. While this approach to gardening is effective for science learning, there are other innovative educational gardening experiences that teachers can curate. This paper examines indoor, formal, and digital gardening curriculum which can help preschool teachers foster sound science skills for students. Research from studies on these experiences provide evidence for helping these children learn sound scientific concepts. Potential barriers to these creative curricular activities are investigated. These gardening curricular activities can help change the current landscape of helping children learn science from nature's soil.

## Introduction

Within education there are old adages often used to describe the impact teachers have on children's development. Common sayings such as, "Teachers' plant seeds that grow forever" or "It's not what's poured into the student that counts, but what is planted". These adages are usually seen in picture frames hanging in classrooms or as personal desk fixtures for a teacher to remind themselves of the impact they have on their students learning. The sayings continually symbolize the educational relationship between teacher and student, but what role does meaningful garden curriculum play in children's education?

The implementation of gardening curriculum in schools has a powerful educational impact for the children of today. Specifically, those benefitting from this innovative curriculum are the young and malleable minds of preschoolers. The focus of this curriculum has been from a nutritional standpoint to increase healthier eating habits and decrease childhood obesity, but a focus on science skills has recently emerged for these young learners. The science skills learned within this curriculum are important in helping preschoolers with their development of science standards set by state departments of education.

In Ohio, the Department of Education created the Birth Through Kindergarten Entry Learning and Development Standards. According to Ohio's Department of Education (ODE), a science standard that students should meet can be defined as, "Describe, compare, sort, classify and order" (p. 43). Let us think about how this standard could be acquired for preschool students. Two students, Johnny and Eli, tend to their classroom garden. The teacher asks them to pick out two types of vegetables: carrots and tomatoes. As Johnny and Eli pick out the carrots and tomatoes, they can be heard saying, "Let's put the orange carrots on this big rock and put the red tomatoes on the table" The two boys have already acquired and conquered this

standard by sorting and classifying the vegetables into two separate categories. They also describe the differences of the vegetables via the attribute of colors, which further demonstrates their knowledge of this standard.

In this paper, I seek to introduce innovative gardening curriculum that preschool teachers can implement to help foster and strengthen science skills for their students while also addressing the science standards. I will examine different gardening curriculum that teachers can utilize to help their students learn specific science skills. Gardening is often thought of as a leisurely activity, but powerful education lies within the damp soil of the earth. Teachers can dig up this knowledge and pass it onto their students to help them strengthen and acquire sound science education.

## **Formal Gardening Curriculum: Thermometers & Composting Bins**

The first gardening curriculum that preschool teachers could implement are formal gardening activities. Gardening curriculum is often presented as an informal learning experience, but there are many innovative formal gardening curricula that can help foster preschool children's science skills. According to Sawitri (2017), a formal learning environment is described as an, "Environment where information is often delivered orally, or using letters and numbers that need to be decoded, this approach is more exciting to follow" (p. 2). An example of a formal activity would be the creation of a classroom thermometers to help children learn about weather systems. According to Ashbrook (2016) preschool children need to learn about weather systems as stated in the early childhood standards of learning. Ashbrook (2016) cites, "Preschool learning standards also ask children to observe weather and the needs of living organisms" (NAEYC 2016)" (p. 16).

Another formal curriculum experience that would strengthen preschool students' science skills would be the implementation of a composting activity. Composting is often thought of as an "easy" and "simple" activity for children. However, there are powerful formal science skills hidden within the decomposition of discarded food and waste. Ashbrook (2016) defines composting as "a way to purposefully use the process of decay to break down organic materials in a location where the resulting mixture can be harvested for enriching garden soil" (p. 22). A composting activity that teachers could implement would be creating a classroom composting bin with food waste and other recyclable materials (paper plates, towels, etc.).

Teachers would need a clear plastic bin with soil to start and would ask their students to discard any waste from their lunch and snacks into the bin. Throughout the days of the week, children would be able to see the decay process of their waste. It would also be beneficial for teachers to create a classroom chart for children to document their findings on what is happening to the materials within the bin (See Table 1).

Table 1  
*Composting Chart Day 4*

Composting Materials	What Do the Materials Look Like?
Apple	"The apple looks smaller"
Banana Peel	"The peel looks darker and is brown"
Pear Half	"The pear lost all the green"
Paper Towels	"The paper towels look the same"
Paper Plate	"The paper plate looks squishy"
Styrofoam Cup	"The cup is still dirty"

Note: This sample chart shows student-generated data for the composting decay process.

Implementing a chart where children are describing what is happening to these materials helps these young learners meet one of Ohio Department of Education's (ODE, 2020) early learning science standards: "Record observations using words, pictures, charts, graphs, etc." (p. 44). This activity is extremely useful for children because the formality of the activity imparts valuable and specific scientific skills in the areas of documentation and observation in the decomposition process.

## Indoor Gardening Curriculum: Botanical Sorting & Vivariums for Gardening Animals

In addition to the formal gardening experiences, indoor gardening curriculum is another fantastic approach to help preschool students acquire sound science concepts. Weather and climate do not often allow for year-long tending to gardens, thus hindering the child's ability to learn science through gardening activities. However, curating indoor gardening curriculum can help teachers provide consistent use of gardening materials for children. A study conducted by preschool teachers detailed this approach by creating an indoor flower activity with preschoolers. The study demonstrated the scientific concept of identifying similarities and differences of living things, specifically, different species of flowers (marigolds, pansies, and coleus). Children were tasked with identifying the similarities and differences in stems, petals, shapes, and coloring of these flowers. The students then charted their findings onto a data chart, which allowed them to extract their findings formally (Trundle et al., 2013).

Along with identifying different types of plants and flowers as an indoor gardening activity, curating indoor curriculum with the use of animals is another great opportunity for teachers to help preschool students strengthen their science skills. Watching and documenting plant and flower growth is often the "go-to" for many gardening experiences in preschool. However, the use of animals can help preschool children attain specific science standards. For instance, a science standard crafted by the ODE learning standards detail preschool children's interaction with animals. The ODE (2020) states, "With modeling and support, identify physical characteristics and simple behaviors of living things" (p. 54). Utilizing and creating gardening curriculum with insects or other living organisms would meet this standard expertly.

One way teachers could introduce animals in an indoor garden could be crafting a lesson on the creation of a vivarium habitat within the classroom. According to Hachey & Butler (2012) vivariums are distinguished as, “Indoor enclosures that stimulate the natural environments of small animals.” (p. 40). Teachers could bring in snails, worms, and even ants to create a natural habitat for children to observe. Children would be able to identify different characteristics of these animals, such as coloring/markings of the animal, the number of legs/arms of the animal, and how the animal moves within the vivarium. This would meet the previously mentioned standard in nuanced and effective ways.

## **Digital Tools for Gardening Curriculum: Digital Garden Wonders**

The third and final gardening curriculum that would benefit and foster science skills for preschoolers would be the implementation of digital tools to create gardening curriculum. Digital tools in gardening are somewhat new to the field, but it utilizes innovative technology to help these students learn science skills in an engaging way. Gardening curriculum often encompasses time and patience because the duration of growing plants is a tedious process. Presser et al. (2017) emphasize this by stating, “Many plants take a long time to grow, it is often hard to facilitate engagement in some practices” (p. 42). The use of digital tools come into play to help provide meaningful and consistent engagement in gardening curricular activities while taking the focus off the long growing process.

A study conducted by Presser et al. (2017) utilized a digital journal application and demonstrated the concept of how effective digital tools are for the acquisition of science skills. The digital journal app was used to help students study bean growth by utilizing the digital journal’s camera. With modeling and support, teachers helped the students take pictures of the beans to document daily observable growth in the bean. The pictures were then kept within the journal for students to compare and describe the differences or similarities in the bean’s growth. With teacher guidance, students were able to accurately describe and identify characteristics of the bean’s growth. This activity helped students meet numerous next generation science standards (NGSS) such as, description, documentation, observation, and data collection. It is clear, this digital tool could be used alongside other growing experiments to help teachers increase their students’ interaction and focus. It should also come as no surprise that young children have a hard time focusing on a subject for long periods of time. The use of this digital journal can help minimize distraction by putting the focus on the details of the growth of various seeds and plants.

Moreover, another great digital tool that teachers could incorporate in creating engaging gardening curriculum would be creating virtual avatars to help students learn different science skills. This technological tool is very new and exciting. Lochner et al. (2019) explains the use of virtual avatar in relation to students taking care of a plant. They explain how the virtual avatar, “displays the attitude/mood of the plant through facial expressions and text bubbles. If the child clicks on the avatar, he will be asked to input certain data related to the physical conditions of the plant” (p. 184).

While this study applied to primary and secondary students, preschool teachers would be able to utilize their own personal avatars to coincide with a gardening

activity. For instance, teachers could create a “virtual” avatar and classroom that simulates a learning environment for preschool students. Teachers would create an avatar based on their looks and then create a classroom that is representative of their own. Next, teachers would utilize this avatar with hands-on gardening curriculum within the real classroom. For instance, teachers could update charts, “water plants”, and “measure” growth of plants within the virtual avatar and classroom. Instead of solely relying on the classroom, they could keep all data collection within this virtual environment. This would help keep active and long-term engagement with preschool children. Technology fascinates children and the digital tools examined can help their ability to learn sound science skills.

Below is an original example of a virtual avatar of myself in a classroom created with the software applications, Google Slides and Bitmoji (Figure 1). I would utilize my avatar and classroom to coincide with an in-class lesson plan that is currently taking place. In this case, my students and I would be continuing our observations and data collection of growing classroom flowers. We would likely utilize this curriculum for a month, as this will allow for optimal time and opportunity for many species of plants and flowers to grow within the classroom.

Figure 1

*My Virtual Avatar*



Note: This is a sample of the type of virtual avatar that can be created.

## Gardening Curriculum: Some Potential Barriers

While the gardening curriculum discussed meets various ODE science standards, it is important to discuss if it is worth implementing. This curriculum is far from perfect and there are potential barriers to the implementation of this type of science education that preschool teachers may encounter.

One barrier to this type of curriculum is the lack of research focused on the benefits of gardening curriculum in preschools. Vandermaas-Peeler & McClain (2015) make this clear by stating, “The majority of research on school gardening has

been conducted in elementary school settings, and less is known about preschoolers' interactions in this context" (p. 10). The lack of research in gardening curriculum for preschools could be a potential barrier in helping teachers get "on board" with implementing this education with their students. Teachers might navigate to other research-based science curriculum that is proven and studied thoroughly. However, it should be noted that the lack of research is not solely due to a lack of garden curriculum, there is a significant amount of research on gardening and the nutritional benefits for young children.

Another barrier to the implementation of this curriculum would be teachers experience and willingness to implement this education. A study conducted with Head Start teachers discovered that teachers were least confident in implementing garden-based education because of their lack of experience in teaching it (Fraizer et al., 2019). Teacher perception of gardening curriculum is a significant factor in children's ability to learn educational concepts. If teachers are not prepared to execute meaningful gardening curriculum, students will not be able to gain science skills from it. It is possible that this hesitation in teachers could be helped by administering gardening education for teachers to learn.

If teachers were able to access some engaging gardening education, they could feel confident in disseminating it effectively to their students. However, it should be noted that Fraizer et al.'s (2019) study was focused only on outdoor gardening curricular experiences for preschool students. There was not a substantial amount of information on the specific curricular gardening experiences in the study that were explained within this paper. While these barriers can be mitigated with more educational research and hands-on education for teachers, it is important to acknowledge the potential roadblocks to this curriculum.

## Conclusion

In summary, there are a variety of gardening curricular experiences that can help preschool students gain science skills. Teachers can curate and implement formal gardening curriculum that helps students meet specific science standards. The thermometer and the composting lessons are great examples of formal activities that can help children acquire science skills. Furthermore, indoor gardening curriculum can help combat the barrier of access to a garden when plants are in hibernation or when gardening space is not available. This sub-set of gardening curriculum will allow teachers to bring a "garden" into the classroom with engaging activities. Incorporating gardening insects and a flower identification activity are just a sample of indoor activities' teachers can implement to strengthen their student's science skills.

Lastly, digital tools in the formulation of gardening curriculum melds the concepts of technology and science together. Digital journals with cameras can help young learners with documentation and observation standards. This is a great way to help children accurately discern similarities and differences in plant growth. Moreover, the use of virtual avatars and classrooms is great way to "digitize" the classroom environment for children. While, face-to-face learning is fun, children would be in awe to be welcomed by their virtual avatar "teacher". Utilizing this avatar to coincide with gardening curriculum will be useful in helping children learn sound science skills that they will take with them throughout their schooling.

While this curriculum can be ground-breaking for preschool teachers, potential barriers can exist. However, as previously explained these barriers can be mitigated with the proper supports and will not diminish the objective of these gardening educational experiences. Gardening and interacting with Earth's materials is a pure form of connecting to mother nature. Children deserve to have the opportunity learn from this planet and can gain valuable science knowledge from it. These beings should not only have "green thumbs" in caring for our planet, but they should have "green minds" by being able to learn science skills from talented teachers who plant thoughtful gardening curriculum.

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