Beyond Biology: Using Gardens to Grow Early Physics and Engineering Thinking, Skills, and Understanding

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Mystery object

1. Describe this thing. What do you observe?
2. What could you DO with this thing? What could it be for?

Is this a "real" preschool science activity?

1. Were inquiry skills used? Which ones?
2. Does it involve science, technology, and engineering concepts?
3. Would kids be able to do it?

What does it illustrate about pre-K science?

1. It doesn't have to be an experiment.
2. It doesn't have to be a big production – less is more.
3. It doesn't always yield the "right" answer or end result.
4. It doesn't require lots of fancy materials, although can benefit from creativity about them!
5. Connection is important (more on this soon).

SciMath-DLL Project

- **Purpose**: Develop and pilot test STEM PD supports for pre-K teachers
- **Description**: Three main components (workshops, reflective coaching, workgroups/ PLCs), iterative development process
- **Progress**: 2013-2014 final year of study, positive impacts on teachers and coaches

SciMath-DLL Project

"This project has … helped me to incorporate more science and math activities into my classroom. It also has helped me to view teaching in a different, more effective way. Instead of providing materials, activities, etc. for my students all of the time, I now see how important it is to also let the students explore, think, and problem solve on their own…."

- Teacher participant

Our approach to early STEM

- Hands-on (usually)
- Rich use of language (teachers and children)
- Age-appropriate concepts that are relevant to children's lives and interests
- Research-based, standards-friendly activities
- Linked to children's prior experiences
- Integrated, when appropriate (e.g., literature connections)
- "Thinking outside the kit"

Examples: Beyond biology in the garden

- **Focusing on FORM AND FUNCTION in the garden**
- **SG Learning Experience 1: Tools & Machines in the Garden**
  - **STE concepts/skills:** Form & function, problem-solving
  - **Hands-on exploration:** Moving heavy stuff
  - **Vocabulary:** soil (*suelo, tierra)*, wheelbarrow (*carretilla*), tool (*herramienta*), wheels (*ruedas*)
  - **Theme appropriate and relevant to children:** Simple problem that we all confront when we need to move something heavy from one place to another and that children have the knowledge to solve

Learning objectives

- investigate physical science concepts (simple machines and the ways that they "make work easier")
- explore and describe properties of human-made objects
- explore ways that the shape, material, and form of objects relate to the jobs that they can do

Discussion questions

1. What are some educational benefits of introducing tools and (simple) machines in a problem-solving context?
2. What are some other activities you might develop to explore the learning objectives?

A few extensions

1. Can you use a different tool to solve the problem?
2. Wheel hunt – What jobs do wheels do? How do they help people?

Examples: Beyond biology in the garden

- **Focusing on FORM AND FUNCTION in the garden**
- **SG Learning Experience 2: Contain Yourself**
  - **STE concepts/skills:** Form & function, problem-solving
  - **Hands-on exploration:** Create an unusual garden using unique planting containers
  - **Vocabulary:** planter (*maceta*), holes (*hoyos*), soil (*tierra, suelo*), seedlings (*planta de semillero*)
  - **Theme appropriate and relevant to children:** Children engage in flexible thinking about form and function as they consider whether various objects have the critical features of a "good" planter.

Learning objectives

- engage in flexible thinking about the jobs different tools can do
- explore and describe properties of human-made objects
- explore ways that the shape, material, and form of objects relate to the jobs that they can do
- attend to and use attributes of objects and materials to make predictions or solve problems

Discussion questions

1. What kinds of learning experiences could you provide to help children understand why holes are important for a planter? (They aren't as critical a feature as "being able to hold soil," but they do contribute to healthier plants.)

2. What kinds of learning experiences could you provide to help children understand why not just any holes will work (for example, one huge hole or many large holes will be problematic)?

A few extensions

1. Google "unusual planters" or "recycled planters" to find photos and ideas for containers.

2. To highlight the importance of the material of the planter, use similarly-sized containers made of, say, terra cotta and cardboard for planting, then observe what happens to each.

Examples: Beyond biology in the garden

- **Focusing on FORM AND FUNCTION in the garden**
- **SG Learning Experience 3: Does It Hold Water?**
  - **STE concepts/skills:** Form & function, problem-solving
  - **Hands-on exploration:** The tool we usually use for a task (watering can) is missing. What can we use instead?
  - **Vocabulary:** water (*agua*), watering can (*regadera*), container (*recipiente*), problem (*problema*)
  - **Theme appropriate and relevant to children:** Children engage in flexible thinking about form and function as they consider whether various objects can be used to hold and carry water.

Learning objectives

- engage in flexible thinking about the jobs different tools can do
- explore and describe properties of human-made objects
- explore ways that the shape, material, and form of objects relate to the jobs that they can do
- attend to and use attributes of objects and materials to make predictions or solve problems

Discussion questions

1. In what ways does this activity support children's thinking about the T and E in STEM (technology and engineering)?

2. What are some other ways you could reinforce the learning objectives of this activity by engaging children in activities that involve containers?

A few extensions

1. Some items hold water, but they aren't great for the job because of their size. Encourage kids to compare two "holders" to find out which works better for the task.
2. Try pouring water from the good holders and carriers. What features of an item make it work well for pouring?

To sum up…

Preschool science learning experiences

- don't have to be experiments.
  - *I also think that I have broadened my thoughts on what activities are appropriate for my students.*
- can be simple – less is more.
  - *At this time, I go one step at the time; I make sure that my students understand little by little, not like before. I used to plan activities that have a little of everything and it was a little confusing for them.*
  - *My first lesson, was a complete disaster because I had too much going on. I think sometimes, you overanalyze, and are too ambitious and the lesson was too much.*
- don't always yield the "right" answer or end result.
  - *Children are asking more how and why questions. They are experimenting more with materials without expecting a product.*
- don't always require lots of fancy materials, although it can benefit from creativity about them.
  - *Like for me I had too many materials, and the kids were overstimulated. After we talked about it, and I was like duh. The objective was there, the idea was there, the whole mapping it out, though was not.*
- should be connected.
  - *Teachers seem happy to discuss how their lessons turned out and are also ready to share their plans for extension/follow up.*

Questions? Comments?

Thank you!