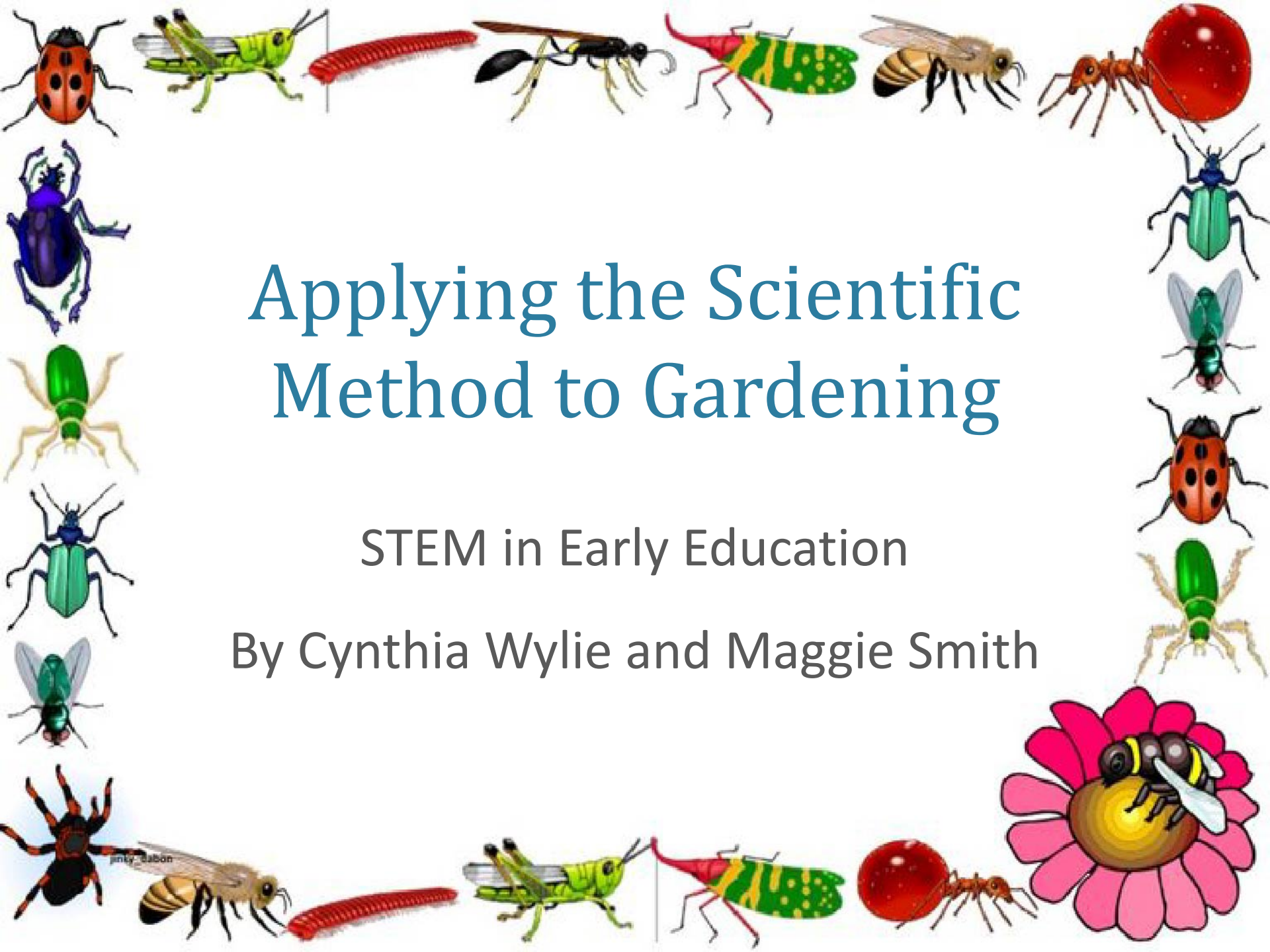


Applying the Scientific Method to Gardening

STEM in Early Education

By Cynthia Wylie and Maggie Smith

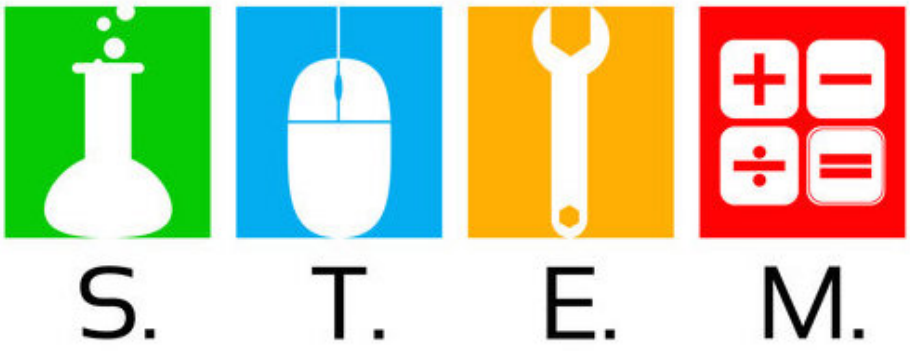
STEM in the Classroom

- Supporting STEM activities in your classroom – what does it look like to you?

STEM in the Classroom

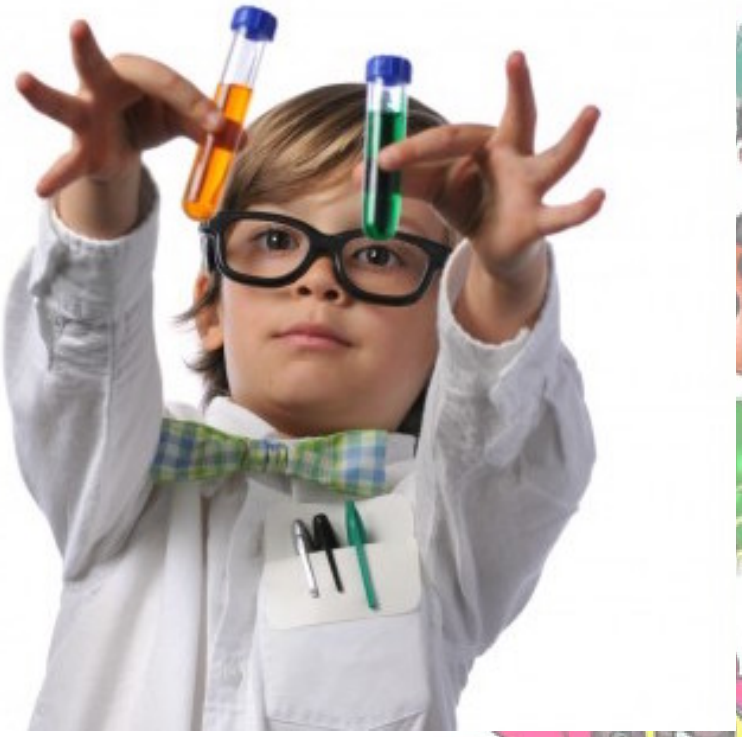
- According to Dr. Sherri Killins, much of what you are already doing supports STEM:

  "… helping children to explore, observe, ask questions, predict, integrate their learning … it's what we've always done in early childhood education."



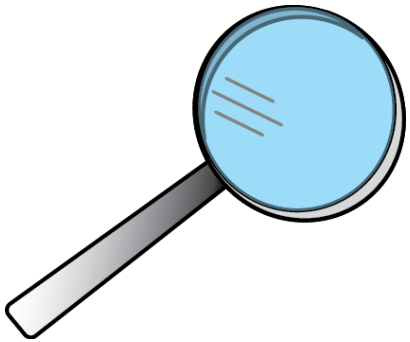
The ‘S’ in STEM: Science and Young Children

- Early learners are natural scientists: inherently curious, young children are trying to make sense of the world around them, the exact aim of science.
- Think of all the *“why”* questions you hear…



Applications in Gardening

- A garden is a opportune venue for an array of science activities and lessons.



Applications in Gardening

No garden? No problem – many hands-on activities can be done inside the classroom using the elements of gardening.

- Seeds, water, dirt, and more
- Can also use small indoor plants

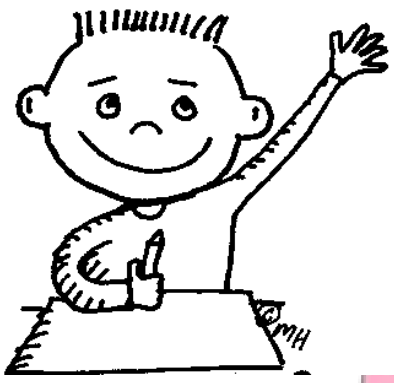
The Scientific Method

The Scientific Method is an organized way of asking and then answering *questions* about the world around us.

If you drop a bag of dirt and a seed at the same time, which one will hit the ground first?

The Scientific Method

It involves a series of steps (typically 6) beginning with a *question* and ending with a *conclusion*.



Steps of the Scientific Method

1. **Question:** what you are aiming to find out.

Our first exa t or darkness?

Steps of the Scientific Method

2. Hypothesis: a guess/prediction of what is going to happen.

Given the same amount of time (say 2 weeks), seeds will grow taller in sunlight.

Steps of the Scientific Method

3. Procedure: the steps of how you're going to test your question (steps of the experiment).

We are going to plant seeds in a cup, water them (the same amount) and put one cup in the closet and one on the window sill.

Steps of the Scientific Method

4. Data: measurable observations such as height or length; or, observations regardless of quantifiability.

Seeds growing in the window are 1 inch tall after 2 weeks. Seeds growing in the closet are 2 inches tall.

Steps of the Scientific Method

4. Observations: a drawing of what you see; recording sensorial observations i.e., what you smell. (With younger age groups, data and observations can be merged into one.)

Steps of the Scientific Method

5. Conclusion: a statement of what happened and why.

The seeds grown in the dark actually grew taller. Our hypothesis was incorrect!

Why? Because the seedlings were striving to find light and therefore grew taller.

Back to the dirt and the seed….

- **1. (question)** If you drop a bag of dirt and a seed at the same time, which one will hit the ground first? **2. (hypothesis)** what do you think will happen? **3. (procedure)** what are we going to do? **4. / 5. (data / observations)** What happened? What did you observe? **6. (conclusion)** what happened?

Methodology

5 important points about using the scientific method with your early learners …

1.

Hands-on: You and your class will be applying the Scientific Method to gardening. It's important that these are *projects* for the kids, (as opposed to just "lessons")

Give students the seeds and let them push the seeds into soil.

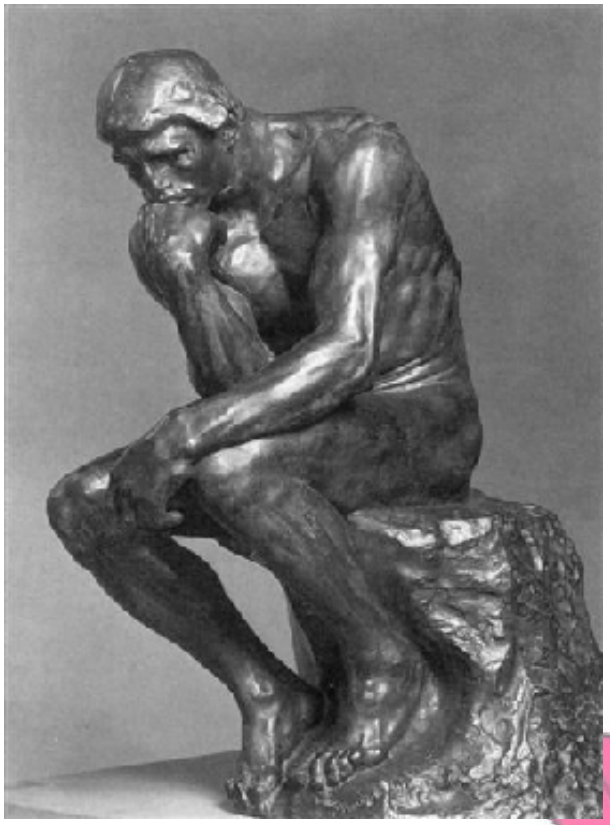
2.

Intellectually Engaging: These activities will be in the interest of engaging *children intellectually.* – i.e., their inherent pull to make sense of the world around them.

We have some seeds here. What do you think we can do with them?

3.

An emphasis on reasoning: reasoning, making predictions, formulating questions, etc. – are important to keep in mind when approaching the scientific method in your own classrooms.



We're planting a seed in soil, what do you think is going to happen?

4.

Familiarize and Introduce: Don't just jump into the activity

Get the children familiar with plants and what it means to grow something before beginning the project.

5.

The children take the lead: a single topic can generate a number of inquiries, all of which are correct. The best question is the one the children ask.

"We're going to put these seeds in a closet and these on the windowsill. What do you think about that?"

There isn't one way to do it right!

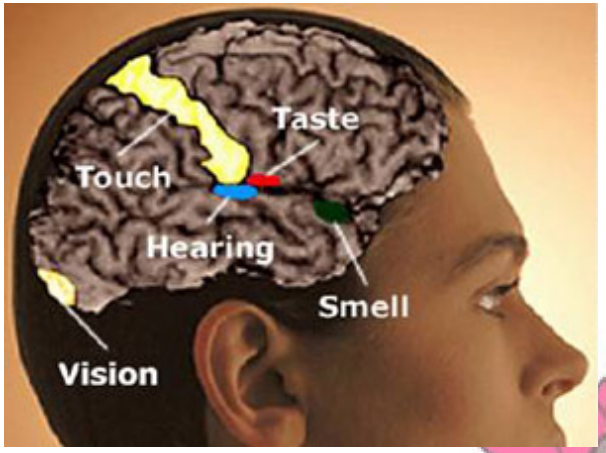
How you teach and use the scientific method in your classroom will differ (depending on level of development, grade level, children's own interests, classroom size, etc.)

You know your young learners best.

Observation

Adjust how you introduce the method and the extent of its application in accordingly. Example: For younger children, focus on practicing each step of the Scientific Method rather than completing all the steps.

OBSERVATION: you can spend a whole lesson on asking the children about what they observe using their senses -> what do you see about the room? What do you smell? What do you hear? What can you touch and how does it feel (i.e. the table, feels smooth), and when appropriate, what does this taste like? How does it compare to the taste of this other thing?



Hypothesizing

Propose relevant questions to the thing they're observing.

What do the children think will happen if we set the seed on a table? What will happen to it? Will it grow? What does a seed need to go? What if we plant it in soil and don't water it? Will it grow? What if we plant it in soil and water it? What will happen?

Experimenting/Testing

Focus on different ways you could test your question/hypothesis.

How do you think we should test this? Can we put this seed on the table and wait a couple days to see if it grows? If we plant this seed in the sunlight and this seed in the closet, how will we know which one is growing better? Ask for ideas:

- Measure height
- Color of leaves
- Count leaves
- Size of leaves

Conclusions

Start by having everyone share what they think happened. You can also have them draw pictures for this.

Ask the children, what they think about the two plants. Can they tell which plant is bigger. Which plant looks healthier? How do they know? Ask them if they can come up with their own conclusions about the experiment. Ideas:

- Will grow better over time?
- Will have more vegetables?
- Which vegetables will taste better?

Applications

Familiarize

What do plants need to grow?

Seed

Soil

Water

Sunlight

Love

Food Coloring + Carnations

Question

Does a flower drink water?

Hypothesis

Yes it does. It needs water to stay alive and to stay alive longer even after it has been cut.

Procedure

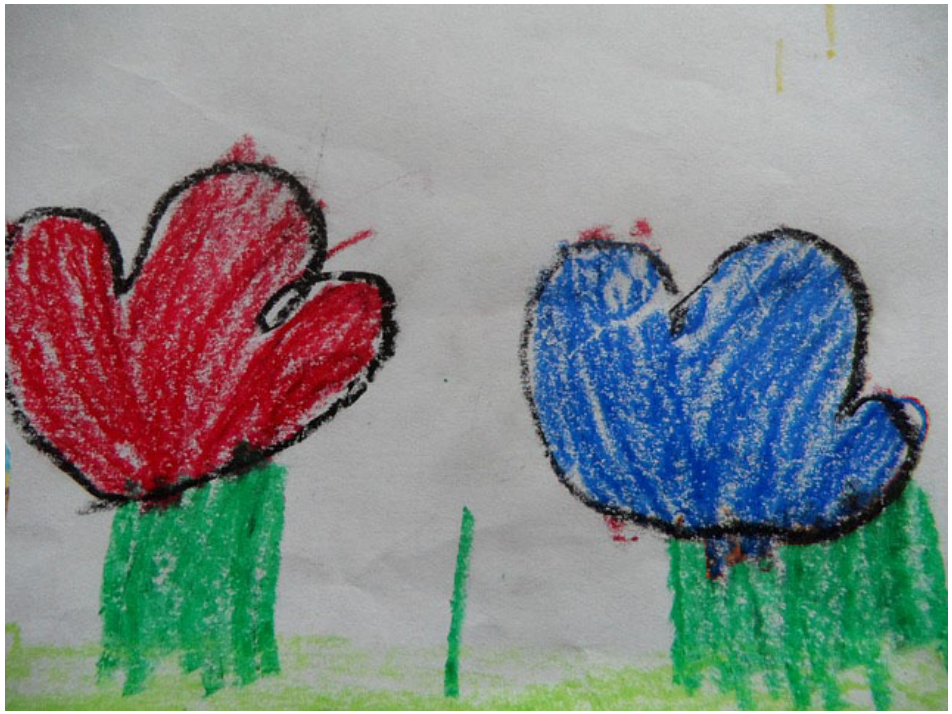
Get two carnations and two glasses of water. Place one flower in each glass. Add red food coloring in water to one glass and blue in another. Wait and check back in 30 mins and 1 hour. Write down what you see when you check.

Data

At 30 minutes, the flowers look the same. At 1 hour, the flower with red water looks pink and the other looks light blue. Check back at the end of the day, or the next day. The flowers are red and blue.

Observation

The children observe that one flower is red and one is blue.



Conclusion

The color of water changed the color of our flowers. So the flowers must have “drunk” the water because that’s the only way the food coloring could have gotten into the flowers. How do flowers drink water? Through their stem! A stem of a plant is like a straw!

Sprouting Seeds + Soil

Question

Can a seed sprout without soil?

Hypothesis

No, seeds need soil to sprout.

Procedure

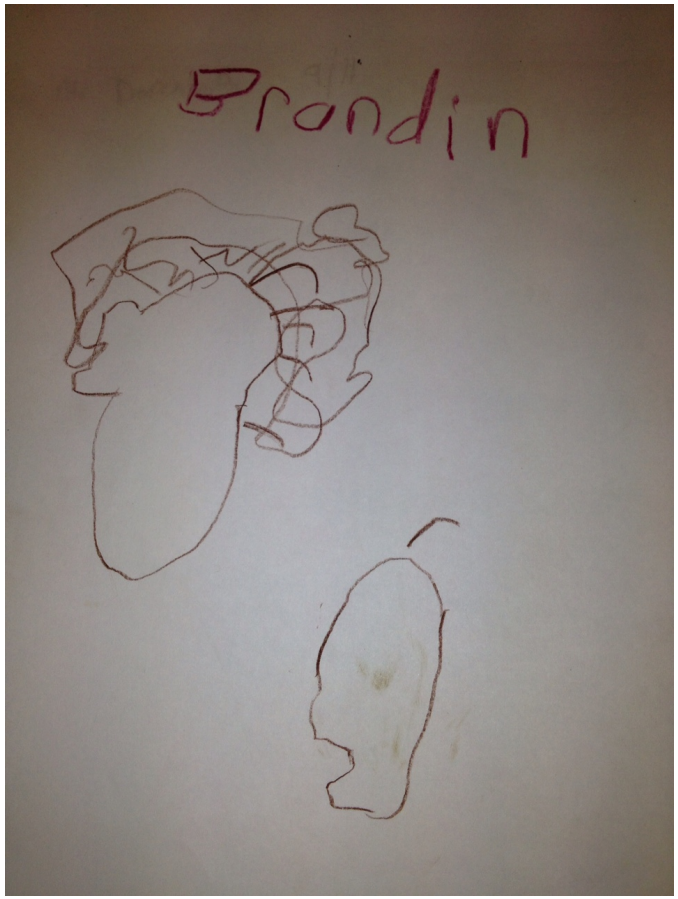
Have each child put a couple seeds in a wet paper towel and then in their own clear baggie. Tape it on a window where it will get sunlight.

Ask them: What do the seeds feel like? Are they hard, soft? Do they smell? What shape and color are they?

Data

Seeds in the plastic bag sprouted in 3 days. By one week they had a little leaf on them. They were 2 inches long.

Observations



Seeds in the plastic bag are growing!

Conclusion

Seeds can sprout without soil. They just need a little water. Our Hypothesis was incorrect.

Vegetables + Their Seeds

Question

Will vegetables that are the same size have seeds that are the same size?

Hypothesis

Hypothesis: Yes! Since the vegetables are the same size their seeds will be about the same size.

Procedure

Bring in two vegetables of about the same size, like a tomato and avocado. Cut them open.

Ask the children if they can point out the seed/seeds.

Data

You can introduce charts to record your data.

Tomato v. Avocado	Height	Width
 Tomato	4"	4 1/2"
 Avocado	4 1/2"	4"
 Tomato Seed	1/8"	1/16"
 Avocado Seed	2 1/2"	2"

Observations

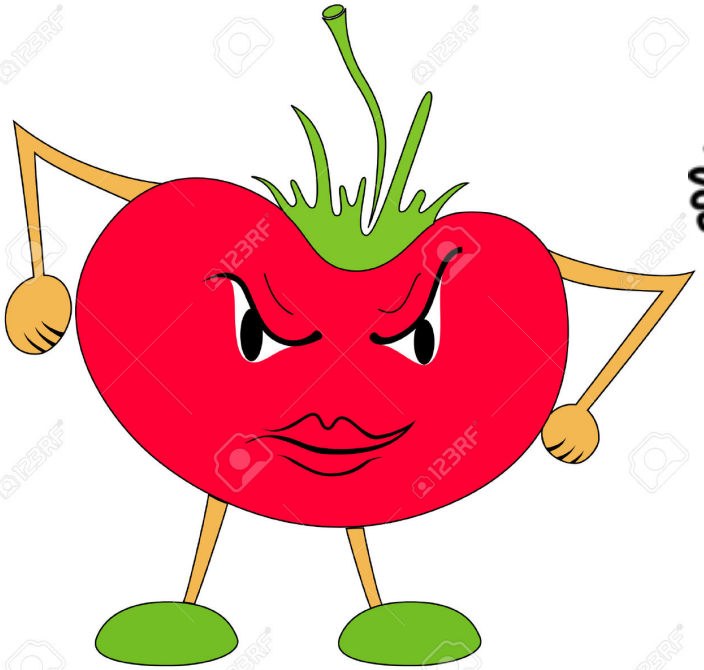
The avocado seed is much bigger than the tomato seed!

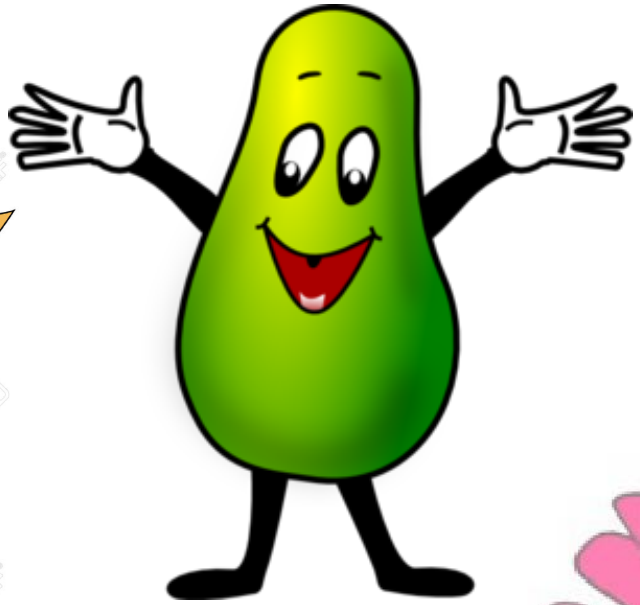
Observations Continued

- The avocado seed is so big that only one can fit inside the avocado!
- The tomato seed is so small that there are many seeds inside one tomato.
- The tomato seed is so small that it is difficult to pick up even one tomato seed.
- The avocado seed is much heavier than the tomato seed.

Conclusion

The size of a vegetable does not tell us what size the seeds will be. Our Hypothesis was incorrect.





Additional Experiments

Seeds:

- Bring in different fruits and ask the children to guess which has the bigger seeds
- See if they can match seeds already taken out of fruits to the fruit they will grow into

Additional Experiments

Seed Sprouting:

- In darkness/bright light/room light
- With/without water
- Length of time to sprout under different soil/sun/water conditions
- Length of time to sprout for different seeds

Additional Experiments

Growing Plants

- Different types of soil: from outside, store bought, sand, pebbles
- Different amounts of fertilizer from none to all
- Different water sources: tap, dirty water, salt water
- Different amounts of water and/or frequency of watering
- Watering from above. Watering from below.

Final Word

The Scientific Method also makes it okay for guesses to be wrong! It involves making a guess (hypothesis) and then proving it either right or wrong. And either is okay!

Bloomers!

www.BloomersIsland.com

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Resources

Teach Preschool: Promoting Excellence in Early Education, “What does STEM look like in preschool and what is STEM anyway?”
http://www.teachpreschool.org/2012/06/stem/

Children’s Center at Cal Tech: Science and Children, “Unlocking the Power of Observation”
http://childrenscenteratcaltech.org/wp-content/uploads/2014/04/Unlocking-the-Power-of-Observation.pdf

Musings of a Primary Teacher, “Scientific Method for Kindergarteners”
http://musingsofaprimaryteacher.blogspot.com/2012/06/using-scientific-method-in-kindergarten.html

Early Childhood News, “Hands-on Science for Young Children”
http://www.earlychildhoodnews.com/earlychildhood/article_view.aspx?ArticleID=431

Master Gardener Association of San Diego: Integrating the Garden into your Curriculum, “Plant a Seed, Watch it Grow”
http://www.mastergardenerssandiego.org/schools/gardenbook/curriculum/downloads/Integrating%20the%20Curriculum.pdf

Education.com, “Kindergarten Gardening: What Kids Learn”http://www.education.com/magazine/article/Kindergarten_Gardening/

Early Childhood Research and Practice (ECRP), “STEM in the Early Years”
http://ecrp.uiuc.edu/beyond/seed/katz.html

Suggested Resources

NAEYC, *"Seeds in the Window, Soil in the Sensory Table"*
http://www.naeyc.org/files/yc/file/200911/HacheyWeb1109.pdf

Mom Tried it
http://www.momtriedit.net/2010/03/teaching-scientific-method-to.html

Dylan Monkey & Squishy Face: Funny Apps for Funny Kids, *"Introduce the Scientific Method to Students (ages 2-6) Through Discussion and Story-time"*
http://www.dylanmonkey.com/lessonplan.htm

Growing Green Hearts, "Preschoolers Do The Scientific Method with Seedlings"
http://www.growinggreenhearts.com/environmental-education-learning/preschoolers-scientific-method-baby-plants/

University of New Hampshire's Child Study and Development Center *Growing a Green Generation* program
http://chhs.unh.edu/csdc/growing-green-generation

National Science Foundation
http://www.nsf.gov/pubs/2000/nsf99148/ch_7.htm
Rutgers NJAES
http://njaes.rutgers.edu/pubs/fs1211/

Clayton Early Learning
http://www.claytonearlylearning.org/blog/?p=541

Early Childhood Research and Practice (ECRP): Volume 12 no. 2 (2010), "Introduction to the Special Issue on STEM in the Lives of Young Children"
http://ecrp.uiuc.edu/v12n2/intro.html