



STEM for Infants and Toddlers

Infants, toddlers and twos naturally approach the world with the same curiosity required to learn and explore the foundations of science, technology, engineering, and math (STEM).

Taken from [Baby Steps to STEM](#) by Jean G. Barbre, EdD

Ice Breaker/Mix and Mingle



What is STEM

- **Science**
- **Math**
- **Engineering**
- **Technology**

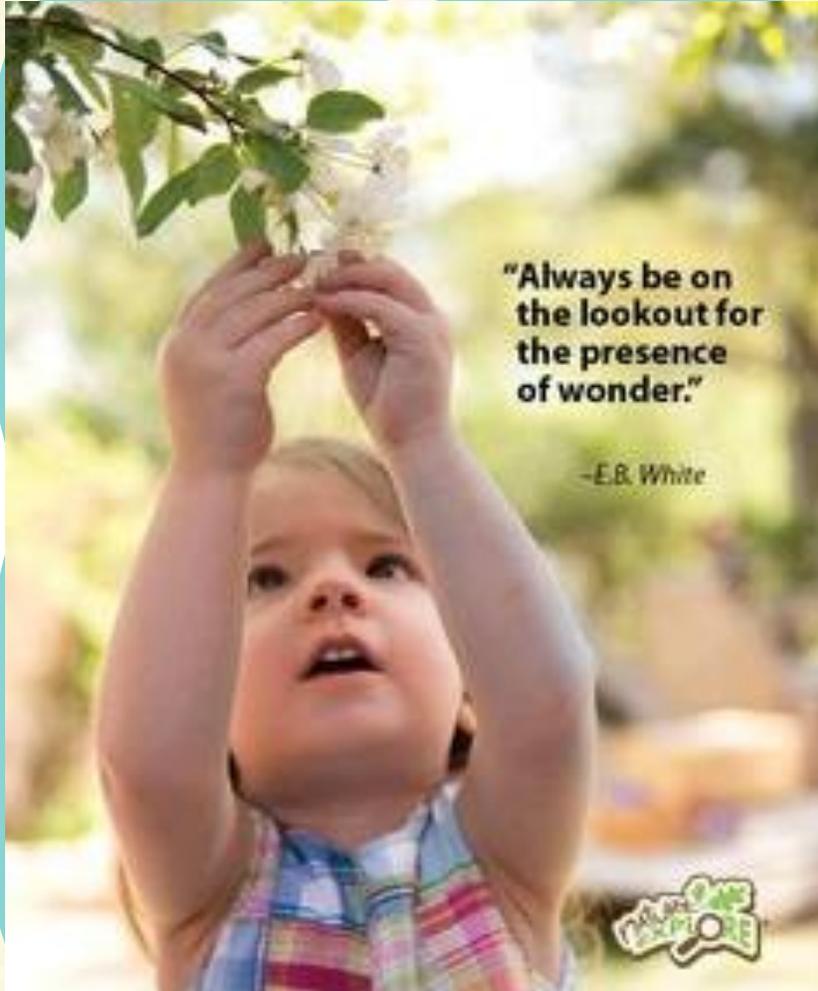




What is Early Stem All About

Brain Building in Progress

- Science is a way of thinking.
- Technology is a way of using tools
- Engineering is a way of problem solving
- Math is a way of measuring.



“The best teachers are those who show you where to look, but don’t tell you want to see.”

Alexandra K. Trenfor



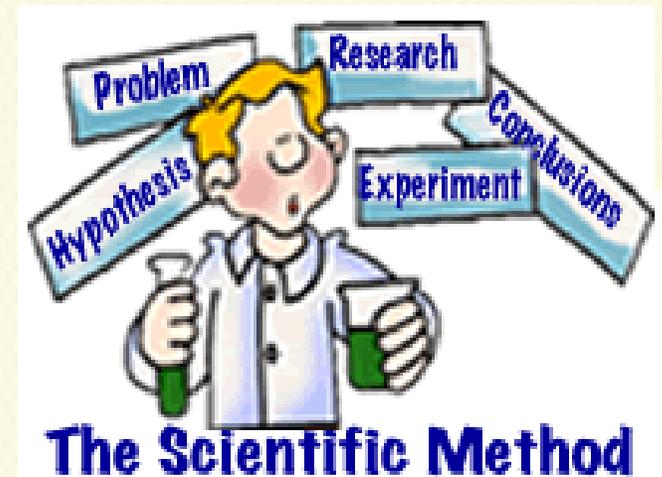
Every baby knows the
scientific method!



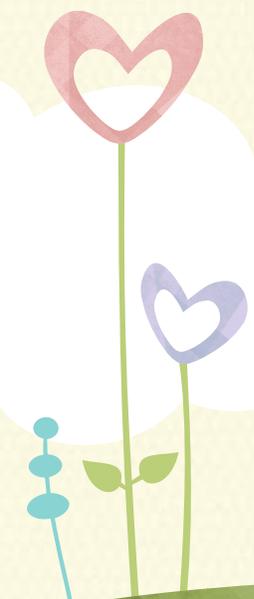
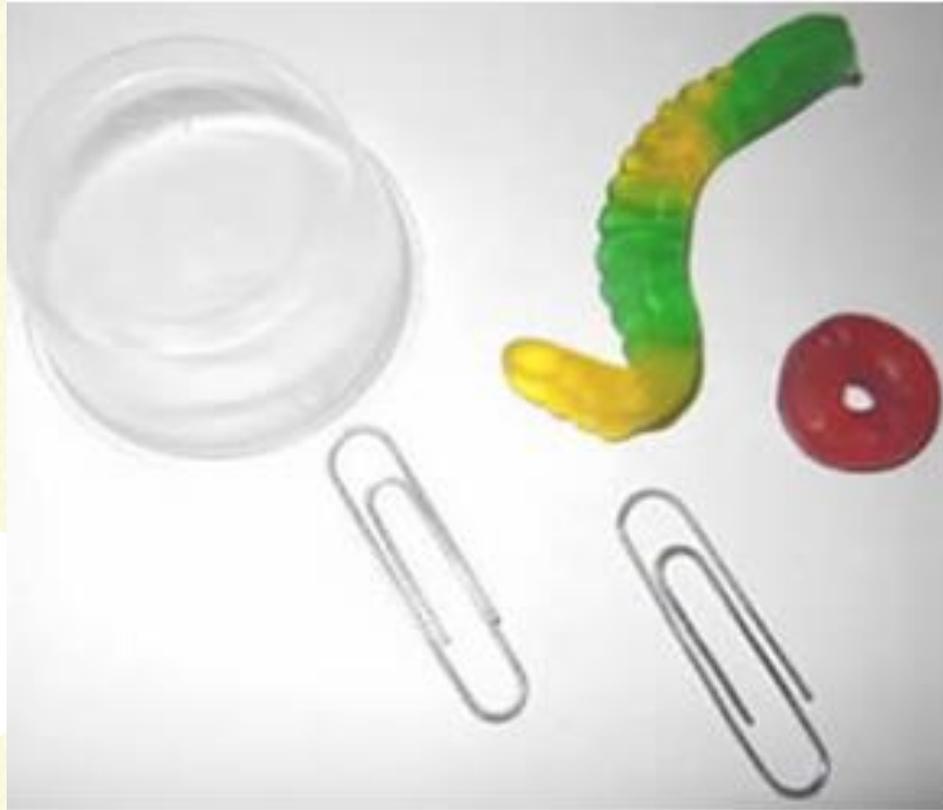
Science begins
with babies!

- Purpose: *What question are we trying to answer or discover?*
- Hypothesis: *What is an educated guess of the answer to our questions?*
- Materials: *What are the supplies or equipment we will need for our experiment?*
- Procedure: *How are we going to conduct our experiment? Step by step?*
- Results: *What happened in our experiment?*
- Conclusion: *Was our hypothesis correct?*

What is the Scientific Method?



Let's Try It Saving Sam





Science and Development

- Understanding the world around them is one of the strongest predictors of young children's later science learning and reading, and a significant predictor of mathematics.

Grissmer et al, 2010

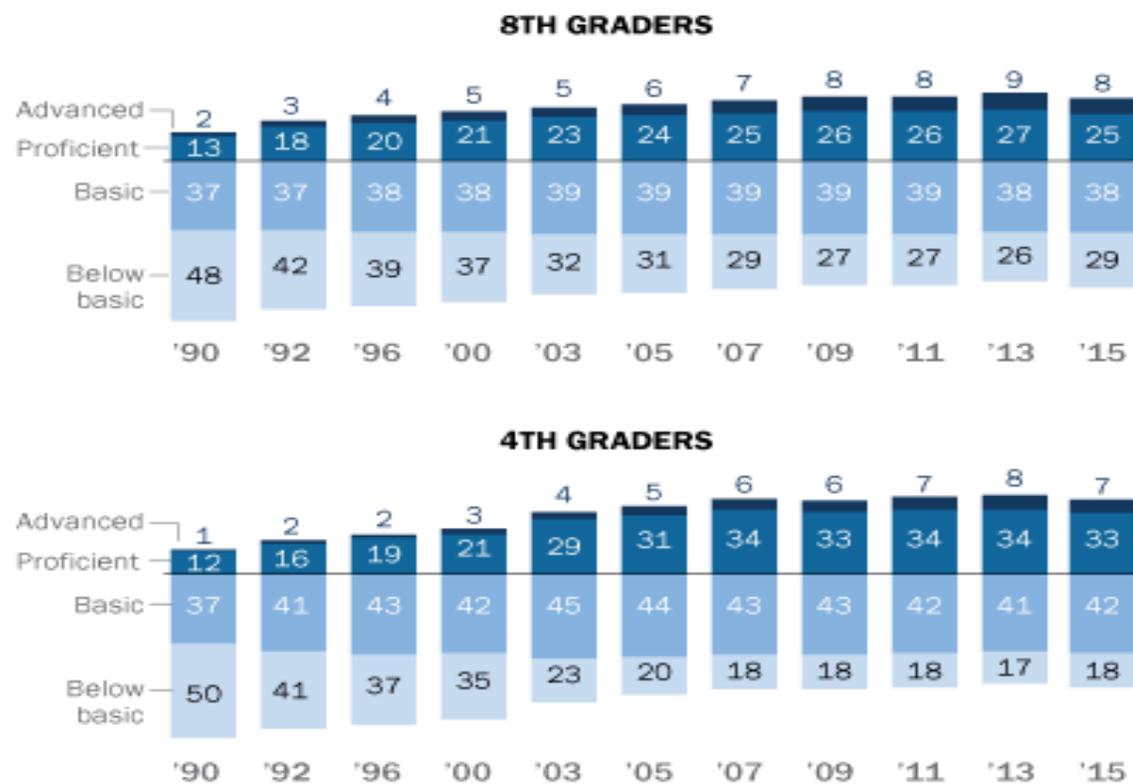


- Unfortunately, research suggest preschoolers have few opportunities to engage in science and learning...
And Therefore learn few science skills and concepts before they enter school

Early et al. 2010; Greenfield, et al., 2009

After years of growth, math proficiency of U.S. students dips

% at each achievement level of the National Assessment of Educational Progress (NAEP)



Source: NAEP Data Explorer, National Center for Education Statistics

PEW RESEARCH CENTER

How do Infants and
Toddlers develop
science skills and
knowledge?





Natural curiosity
(such as intently
watching an adult's
expressions and
actions)





Readiness to
repeat actions
that have an
interesting effect



Need to explore and make sense of
the world

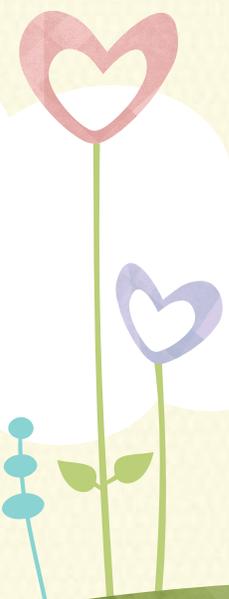
Children Learn STEM

- Through their five senses and hands-on experiences
- Babies communicate interests through kicking their feet or hands in excitement.
- Smiling, gurgling, and squealing
- As they get older, they ask questions.



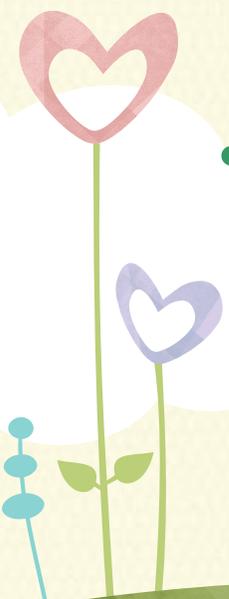
Encourage Open-Ended Questions

- Why?
- When?
- Where?
- What?
- How?



How Can We Support STEM for Infants and Toddlers

- **Provide materials**
- **Join infants and toddlers in exploration**
- **Connect experiences to what children have done or experienced before**



Experiential Learning

- “Young children build their learning and understanding about the world through everyday play experiences.”
- Experiential learning begins at birth.
- Introduce STEM to babies and toddlers by talking, reading and playing with them.
- Babies and Toddlers learn STEM by actively engaging with their caregivers and through their sensory experiences.
- (from Baby Steps to STEM)



Foundations for STEM

- Foundation is formed through everyday sensory activities.
- Babies investigate the world through their five senses.
- As they grow older and more independent, their world changes.
- It is important to remember how children learn.



Activity/Sock Smell

Materials: votive candles with different scents and clean socks



Activity/On/Off, In/Out, Up/Down

- On/Off – Use switches and flashlights
- In/Out – Put toys “in” the box or bucket, then take them “out”
- Up/Down – Pick up child and say, “Up.” Put them down and say, “Down.”



Activity/Dump It Out and Fill It Up

- Materials - Large plastic container with lid such as pretzel can or other food container, assorted materials. Have some materials that make noise and have different colors.
- Toddlers love to dump and fill. It's the beginning of learning how to pick up.



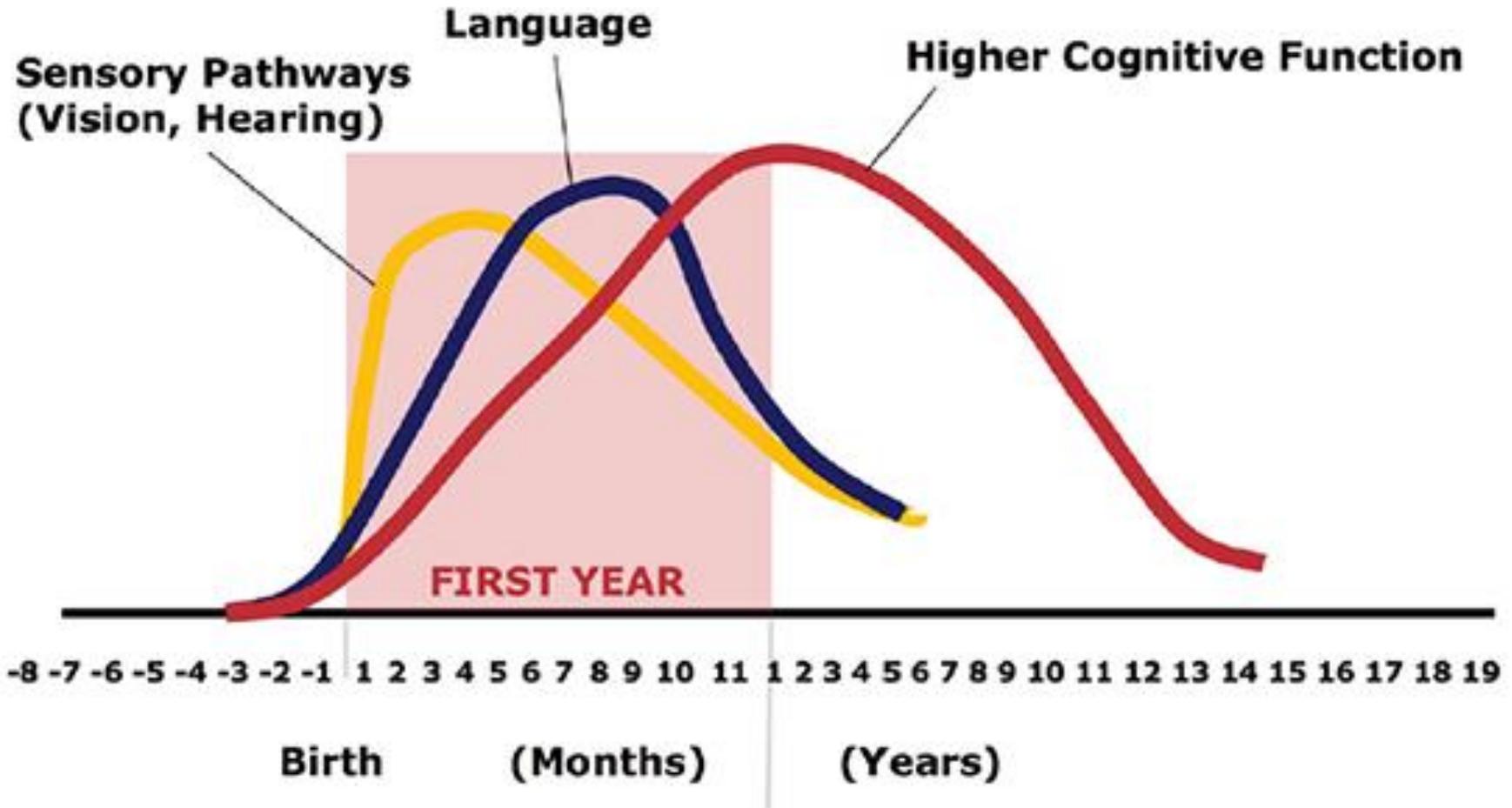
Early Brain Development

- A child's brain is rapidly developing from ages birth to three. This is a critical period in their lives.
- Intentional planning of STEM activities allows brains to take in new information and adapt to new learning.
- Babies are born with billions of nerve cells called neurons which processes and stores information.
- Neurons that are not stimulated go through a natural process called *synaptic pruning*.



Human Brain Development

Neural Connections for Different Functions Develop Sequentially



<https://www.youtube.com/watch?v=WO-CB2nsqTA>



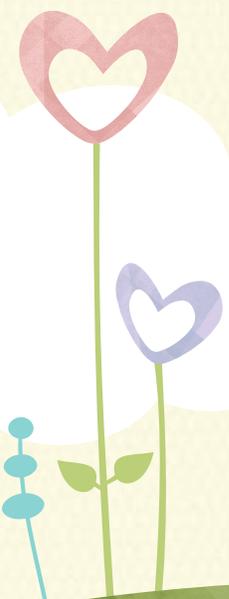
Cognitive Development

- Jean Piaget (1896-1980) theorized that children construct their own learning as they learn to make sense of the world.
- Children's natural curiosity motivated them to explore and investigate their environment.
- "Little Scientists" constantly testing their "theories".



PIAGET'S STAGES OF COGNITIVE DEVELOPMENT

Typical Age Range	Description of Stage	Developmental Phenomena
Birth to nearly 2 years	<i>Sensorimotor</i> Experiencing the world through senses and actions (looking, hearing, touching, mouthing, and grasping)	<ul style="list-style-type: none">• Object permanence• Stranger anxiety
2 to about 6 or 7 years	<i>Preoperational</i> Representing things with words and images; using intuitive rather than logical reasoning	<ul style="list-style-type: none">• Pretend play• Egocentrism
About 7 to 11 years	<i>Concrete operational</i> Thinking logically about concrete events; grasping concrete analogies and performing arithmetical operations	<ul style="list-style-type: none">• Conservation• Mathematical transformations
About 12 through adulthood	<i>Formal operational</i> Abstract reasoning	<ul style="list-style-type: none">• Abstract logic• Potential for mature moral reasoning



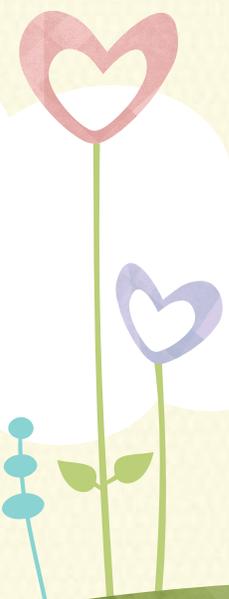
Young Infants

- May watch and observe the colors of the bubbles.
- Caregiver can explain that bubbles float and let baby feel the wetness of the bubbles.



Older Infants

- As the child gets older caregiver can assist the child as they dip the wand into the soapy water, model how to blow in the wand and let the child try it.
- Caregiver can talk about the bubbles and the way they float, the colors, etc.



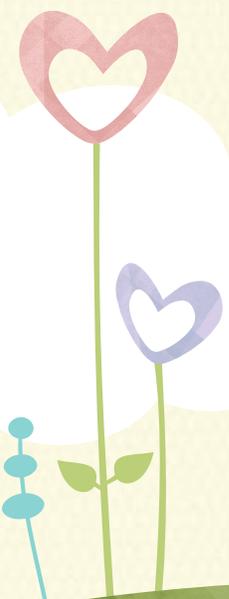
Young Toddlers

- A toddler may have the developmental skills to handle the wand themselves.
- Caregiver can describe what is taking place using concepts such as big, little, wet, round, and shiny.



Toddlers and Twos

- Older toddlers may explore on their own.
- They may make their own wands with pipe cleaners.
- Caregiver could document the experience and have child draw a picture.



The Importance of Play

- Play is an activity that is learned through playful engagement.
- Caregivers should join children in their play and encourage exploration.
- Play begins in infancy and develops as they build relationships with caregivers.
- As they grow, they become more aware of others.



How to Support STEM Play

- Talk to the child as you play.
- Model how to play and use animated expressions.
- Ask inquiry questions and introduce STEM vocabulary.
- Provide children space to play and explore alone and with peers.
- Scaffold the activity by modeling expanded use of the play materials.
- Provide open-ended materials in both inside and outside environments.
- Join the child on the floor as you engage in playful activities.

Taken from: *Baby Steps to STEM*



Science and Critical Thinking

- Avoid giving answers.
- Help children make careful observations.
- Allow children to see that science is rooted in the real world.

I hear...I forget

I see...and I remember

I do...and I understand

-Ancient Chinese Proverb



Early Learning STEM centers

- Things that roll and bounce
- STEM – Math and Science





- Things That Fit in Other Objects
- Engineering and Math

Things that go on
top or can be
stacked

Science, Math,
Engineering



- Things that are smooth or rough/Science
- Things that are shiny or sticky/Science
- Things that reflect light or can be seen through/Science
- Things that can be pounded or pushed/Science, Technology, Math
- Things that are alike but are different sizes/ Science, Math
- Things with wheels/Science
- Things that open and shut/ Science, Technology
- Things that make noise when you shake them/ Science
- Things that can be used for scooping, grasping, and building/ Technology, Engineering
- Things that have wings/ Science
- Things that hop/ Science



Babies in the Rain

- Infants belong in the rain.
- They belong outside in the grass and dirt.
- They belong on the floor with materials that will engage their senses and minds.



Taken from: Babies in the Rain by Jeff A. Johnson

Documentation: Capturing Learning Moments

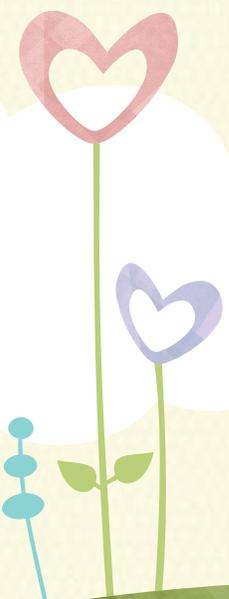
- Documenting children's learning is important
- Learning moments happen quickly
- STEM activities will give you many opportunities to document
- Carefully observe and collect children's work
- Photographs, audio or visual, anecdotal records, portfolio
- Used for future planning and to measure learning





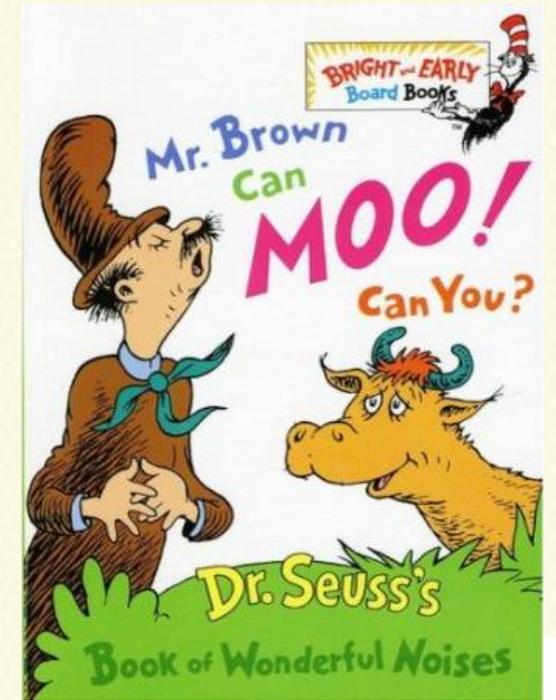
Post photographs of finished and ongoing STEM project.

Post in the classroom or near the parent sign-in area.

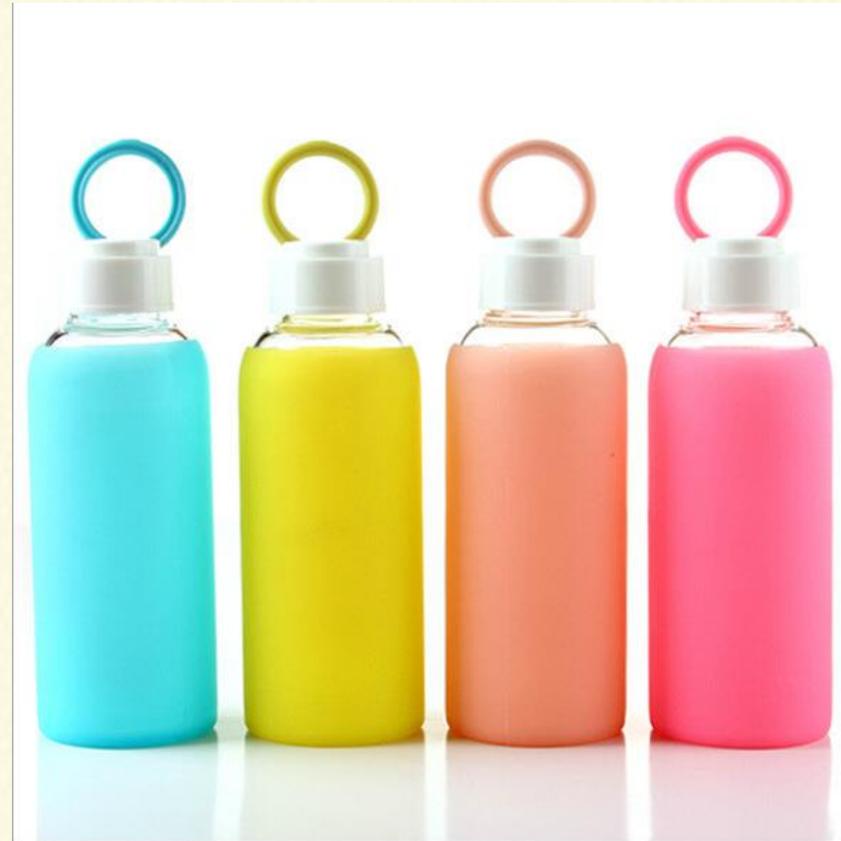


Activity/Who says “Moo?”

- Materials – various stuffed farm animals
- Let children play with animals, then remove one and hid it.
- Ask a question such as what animal goes “meow”.
- When guessed correctly show animal.



Clear Bottle Magic

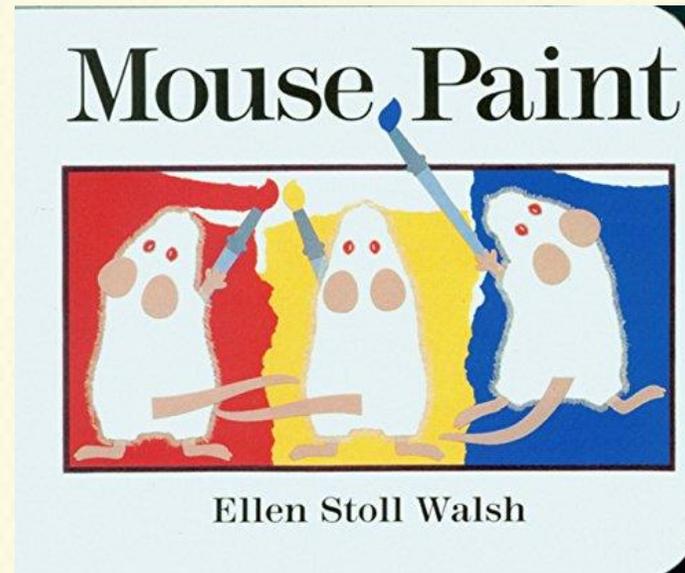


Rainbow Discovery
Bottles



Activity/Color Search

- Show an object and name its color
- Ask a child to find something in the room that is the same color.



Activity/Who Lives Here?

- Materials – small, medium and large boxes and small, medium and large stuffed animals.
- Decorate to look like houses.
- Show children how to match the small animal to a small box and so forth.



Science Vocabulary

Shape

Experiment

Bouncy

Cause and Effect

Size

Build

Texture

Motion

Buoyancy

Melt

Absorption

Height

Freeze

Temperature



Physical Science

- Includes characteristics and physical properties of nonliving objects, including solid and liquid materials and how they change.
- Focuses on children's ability to explore size, shape, weight, texture and flexibility.



Life Science

- Properties and characteristic of living things.
- Observe physical characteristics, behaviors, habitats, and needs of living things.
- Learn that there is diversity and variations in all living things.



Earth Science

- Observing and exploring the properties of earth materials such as soil, water, air, and rocks.
- Plan developmentally appropriate activities.



INFANT/TODDLER ENVIRONMENT RATING SCALE®

REVISED EDITION

Updated
with additional
notes and a
new expanded
scoresheet



Thelma Harms Debby Cryer Richard M. Clifford

Infant/Toddler Environment Rating Scale

22. Nature/Science

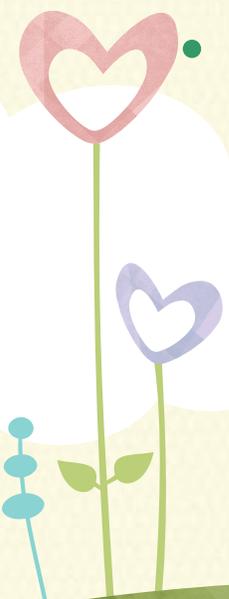
1/Inadequate

2

3/Minimal

- 1.1 No pictures, books, or toys that represent nature realistically.
- 1.2 No opportunities for children to experience the natural.

- 3.1 Some pictures, books or toys that represent nature realistically; all are developmentally appropriate.
- 3.2 Materials accessible daily.
- 3.3 Some opportunities to experience the natural world daily, either indoors or outdoors.



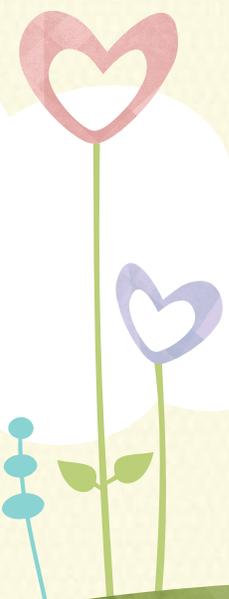
- 5.1 Outdoor experiences with nature provided at least 2 times a week. *
- 5.2 Some daily experiences with living plants or animals indoors. *
- 5.3 Everyday events used as a basis for learning about nature/science. *

- 7.1 Staff show interest in and respect for nature. *
- 7.2 Nature/science materials are well-organized and in good repair. *



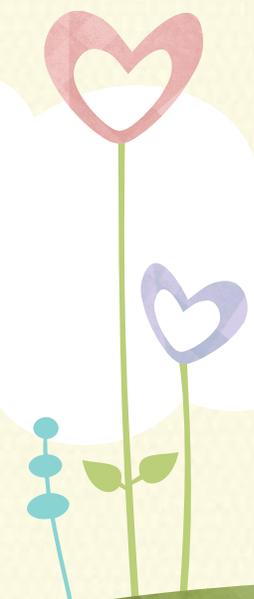
Conclusion

Children are naturally inclined to engage in STEM related learning. This makes it a natural fit for early childhood settings. Nature and the world around us offers endless resources for teachers of our youngest to the oldest child. Have fun, explore, encourage and learn at any age.



References

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