STEM in Pre-Kindergarten, Transitional Kindergarten, and Kindergarten

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Children Observe Hermit Crabs

- SHOW VIDEO
What Did You Notice?

- What were the children doing?
- What was the teacher doing?
Learning Experiences Are Hands-On

- Children are NOT taking in knowledge in a passive way.

- Children ACTIVELY explore, investigate, and observe.

- The physical environment is stimulating, interesting, encouraging experimentations.
A Culture of Inquiry

- Teachers and children become scientists together:
  - They express curiosity
  - Ask questions
  - Explore and investigate
  - Express their ideas

- It’s a collaborative inquiry process. Children construct knowledge through social interactions with peers and adults.

- Teachers MODEL a questioning mind.
Shifting Teachers’ Mental Models

- **From:** “I am going to teach children lots of information about this topic”
- **To:** “I listen to children’s questions and model a questioning mind. We explore together.”

- **From:** “As a teacher, I am the expert and I need to have answers to all the questions they ask.”
- **To:** “I can say: I don’t know. Let’s find out together.”
Some Information About the Program

- “Investigating a crab” comes from UCLA’s University Village Center, a Title 5 program.
- Preschool classes have 24 children ages about 38 – 48 months.
- The teaching team has 3 teachers, with some UCLA student assistance.
- The curriculum is described in the book, “Preschool Pathways to Science,” a text recommended for Kindergarten teachers by the National Association of Science Teachers.
Early Science Education

- **Why** science in early childhood?
- **What** scientific concepts and skills are developmentally appropriate for young children?
- **How** can we best support STEM education in the early years?
Why Science in Early Childhood?

Cognitive Research Indicates:

- Young children have a sense of wonder and natural curiosity to learn about their world

- Young children are competent to learn and reason about concepts of math and science

- Young children build coherent understandings of math and science concepts through play and supportive explorations
Growing Recognition of the Importance of Early STEM Education

- Learning mathematics and science is a “natural” and developmentally appropriate activity for young children (Ginsburg et al., 2008; Research Council, 2000, 2007)

- STEM education can and should begin early

- National Science Teachers Association Position Statement: “Early Childhood Science Education”
“What kind of person do I want my child to be?”
Galinsky’s Seven Life Skills Essential to the Happiness and Success of Children

1. Focus and self control
2. Perspective taking
3. Communicating
4. Making connections
5. Critical thinking
6. Taking on challenges
7. Self-directed, engaged learning
What scientific concepts and skills are developmentally appropriate?

- The Preschool Learning Foundations identify key concepts and skills developmentally appropriate for preschool children in the domains of math and science.

- The Preschool Learning Foundations represent milestones to be reached at around 48 and 60 months of age.
Foundations in Science

Volume 3

- History Social Science
- Science

The Preschool Science Foundations

Process Skills

Scientific Inquiry

Content Area

Physical Sciences

Life Sciences

Earth Sciences
Observation and Investigation Skills

- Raise questions
- Observe & describe
- Use scientific tools
- Compare & contrast
- Predict and check
- Draw inferences
Documentation and Communication Skills

- Record observations
- Share findings & explanations
Properties and Characteristics of Living Things

- Appearance & Behaviors
- Body Parts
- and Bodily Processes
- Habitats
- Knowledge of the difference between animate and inanimate objects
### Example: Appearances & Behaviors of Living Things

<table>
<thead>
<tr>
<th>At around 48 months of age</th>
<th>At around 60 months of age</th>
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<tbody>
<tr>
<td>1.1 Identify characteristics of a variety of animals and plants, including their appearances (insides and outsides) and behaviors, and begin to categorize them.</td>
<td>1.1 Identify characteristics of a greater variety of animals and plants, and demonstrate an increased ability to categorize them.</td>
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**Examples**

- After cutting open a variety of fruits and discovering seeds inside, begins to recognize that fruits have seeds. When asked to predict what’s inside an apricot, a child points to a seed and says “seed.”
- Observes a squirrel climbing up the tree, and notices that it has a long tail.

**Examples**

- Sorts fruits such as mangoes, avocados, apples, grapes, peaches and apricots, based on whether they have one seed or many seeds inside. Points to the avocado and apricot and says in home language, “Look! They both have one big seed.”
- During circle time, shares that one night they saw opossums in their yard.
Next Generation Science Standards (Kindergarten)

Sample standards:

- Use observations to describe patterns of what plants and animals (including humans) need to survive.

- Use and share observations of local weather conditions to describe patterns over time.

- Conduct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
Next Generation Science Standards for KG
Science and Engineering Practices (sample)

- Make observations (firsthand or from media) to collect data that can be used to make comparisons
- Ask questions based on observations to find more information about the designed world.
- With guidance, plan and conduct an investigation in collaboration with peers.
- Use observations to describe patterns in the natural world in order to answer scientific questions.
How Do We Best Support Science Learning in Early Childhood Education?

Let’s take a look at some more video examples
Exploring Crabs

How does the teacher guide the children’s explorations?

- What questions does she ask children?
- How does she encourage children to notice similarities and differences?
- How does she encourage children to describe their observations?
Children Describe Their Observations

Teachers –

• Ask questions to guide their observations:
  o “How do they move their bodies?”
  o “What do you see happening?”

• Do not correct children or judge them for being right or wrong

• Model for children
  o “You observed the eyes” “Let me write it down.”
Children Compare and Contrast

Teachers –

• Ask open-ended questions to encourage children to notice similarities and differences:
  
  "What’s the difference between an octopus leg and a crab leg?"

  "What makes an octopus leg different from a crab leg?"
### Teachers Model the Use of Key Scientific Vocabulary

- Observe, observation
- Predict, prediction
- Test
- Similar, different
- Compare, contrast
- Count
- Measure
- Investigate
- Explore
- Experiment
- Discover
- Record
- Explain
- Hypothesis
**Children Predict and Check**

**Teachers—**

- Encourage children to first *predict* and then *check*;
  - They learn to compare what actually happens with what they thought would happen.

- Elicit children’s predictions by asking questions
  - “What do you think it’s going to look like? (the baby crab)
  - “What is your prediction?”
Recording Observations (Videos)

- SHOW VIDEO
Children Record Observations

Teachers –

- Encourage children to draw a representation of their observations.
- Record children’s observations by writing down their words.
  - “He has one eye.”
  - “He is eating the mussel.”
  - “I see the shell.”
- Encourage children to describe their drawings.
  - “Tell me about your picture. I see a circle with lines. Tell me about what you drew.”
Try out this idea:
Observing Closely
One Block of a Sidewalk

- What might you explore?

- How can you design learning experiences appropriate for your children?

- How can you use this activity to integrate learning in different domains?
  - social, physical, cognitive, communicative, adaptive
Resources

- California Preschool Science Foundations


- Next Generation Science Standards: Kindergarten

- Preschool Pathways to Science

- NSTA Position Statement: Early Childhood Science Education.
  - [http://www.nsta.org/about/positions/earlychildhood.aspx](http://www.nsta.org/about/positions/earlychildhood.aspx)