Planned Explorations and Spontaneous Discoveries: Supporting Scientific Inquiry Preschool

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Child (to mother): Why does Daddy, James (brother), and me have blue eyes and you have green eyes?

Mother: Tells her she got her eyes from Daddy, says goodnight, then leaves the room.

Child: (calls mother back 5 minutes later): I like Pee Wee Herman, and I have blue eyes. Daddy likes Pee Wee Herman, and he has blue eyes. James likes Pee Wee Herman, and he has blue eyes. If you liked Pee Wee Herman you could get blue eyes, too.

Mother: Tells her it would take more than liking Pee Wee to make her eyes blue. Realizes child doesn't understand, then explains that God gave her green eyes and they can't be changed.

Child: Could you try to like Pee Wee Herman so we could see if your eyes turn blue?

Take a moment to think about what this conversation reveals about the child's thinking. Is she engaging in science? How?

From Callanan & Oakes (1992)

Some inquiry science skills

- observing (using senses and simple tools)
- describing (verbally or through pictorial representations)
- comparing (noting similarities and differences)
- questioning
- predicting (noting expected outcomes)
- experimenting (trying an action to discover an unknown)
- reflecting (integrating new info into one's knowledge base)
- cooperating (working together and sharing findings)

* From a synthesis of pre-K science standards and curricula reviewed by Greenfield and colleagues, 2009.

What preschoolers bring to inquiry

- enthusiasm
- curiosity
- motivation to explain

- impressive and growing language skills
- foundational knowledge of science concepts
- critical reasoning skills

Learners benefit from science experiences*

- improved vocabulary (French, 2004)
- growth in use of complex grammar (Peterson & French, 2008)
- fosters early knowledge about variables (Brenneman et al., 2007)
- and understanding of science content (both groups)

Very little science happens

- Less than 15% of teachers' activity during children's choice time had *anything* to do with science
- Less than 5% was planned science (Tu, 2006)
- Children are only present in science areas about 15% of the time during free play (Nayfeld, Brenneman, & Gelman, in press)

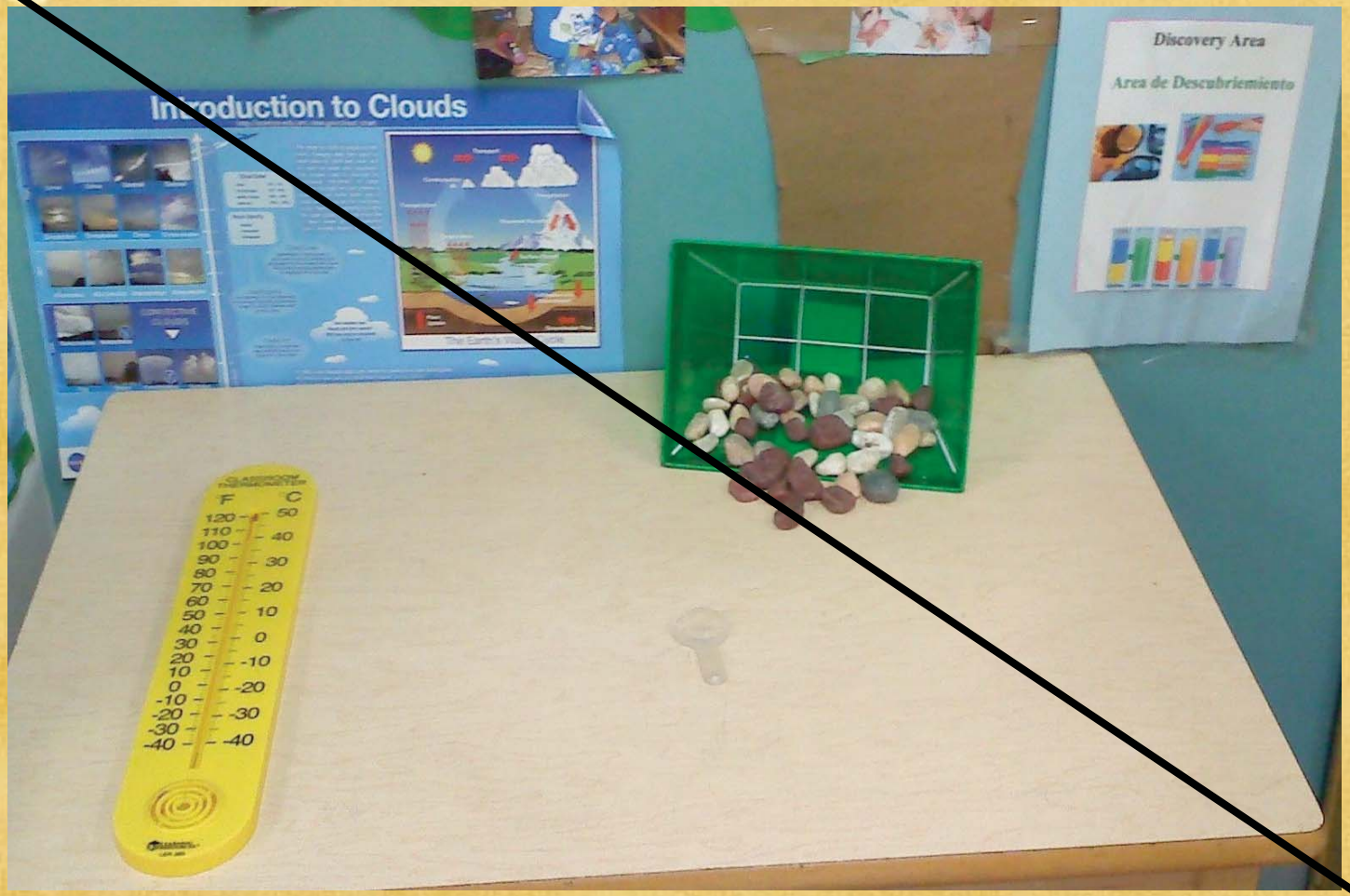
Why?

- so much to do, so little time…
- language and literacy tend to take precedence
- lack of pre- and in-service education about science and about young children's capacity to learn it
- teachers say they are not sure how to plan science activities and to build on spontaneous science learning opportunities

Our responsibilities and challenges

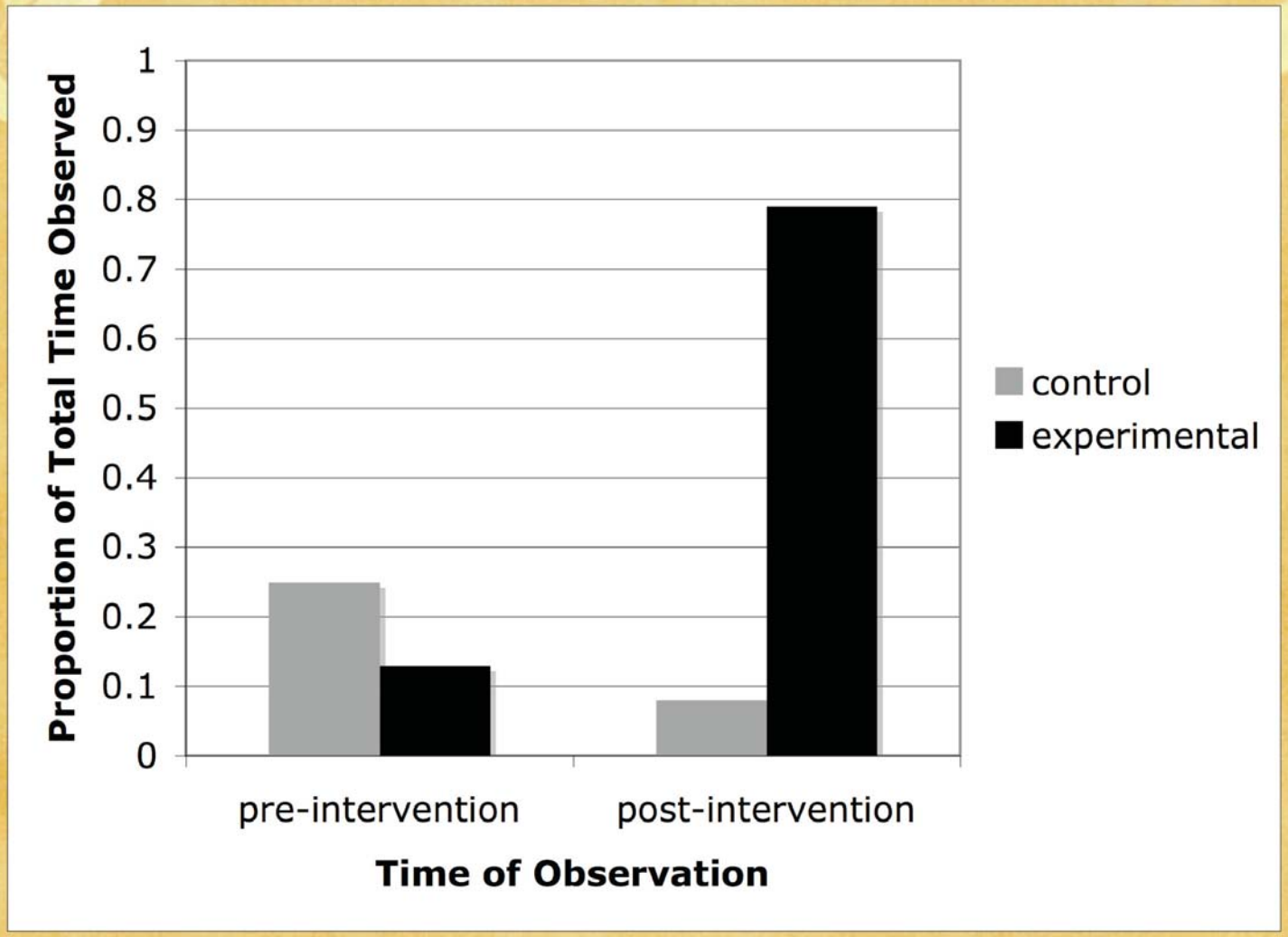
- *Provide materials that encourage exploration and questions throughout the classroom*

What does this discovery area help children discover?



What sense would they get from this sensory table?

“Marketing” the science area



Nayfeld et al., in press

Science materials matrix

Kinds of Science Materials & Classroom Areas	Interesting objects to observe - natural & human-made	Collections to sort, match, and compare	Observation and measurement tools	Materials that change or can be changed (to explore cause&effect)	Materials to read about and represent science
Art					
Manipulatives					
Dramatic Play					
Blocks					
Library/Listening					
Sensory Table					
Outside					

* Categories based on the Preschool Rating Instrument for Science and Mathematics (**PRISM**; Stevenson-Boyd, Brenneman, Frede, & Weber, 2009)

Questions about science tools & materials - on a table and elsewhere

- Available throughout the classroom and playground?
- Arranged in a logical way that invites exploration and questions?
- Introduced as part of meaningful experiences?
- Do children ever see ME interacting with these materials?

Our responsibilities and challenges

- Provide materials that encourage exploration and questions throughout the classroom
- *Plan learning experiences that are conceptually connected*

PrePS* teachers plan conceptually connected experiences and extended explorations because…

- Easier to assimilate new information when it is similar to old information
- Depth of knowledge more important than breadth
- Supports development of competent, confident learners

* Preschool Pathways to Science - Gelman, Brenneman, Macdonald, & Román, 2009

Our responsibilities and challenges

- Provide materials that encourage exploration and questions throughout the classroom
- Plan learning experiences that are conceptually connected
- *Look for spontaneous opportunities to support scientific thinking*

From Videatives, Inc.

Our responsibilities and challenges

- Provide materials that encourage exploration and questions throughout the classroom
- Plan learning experiences that are conceptually connected
- Look for spontaneous opportunities to support scientific thinking
- *Help children answer their own questions through inquiry*

Help children answer their own questions

Provide time for children to share their questions and ideas

Introduce research tools

Provide science tools

Plan an investigation

Our responsibilities and challenges

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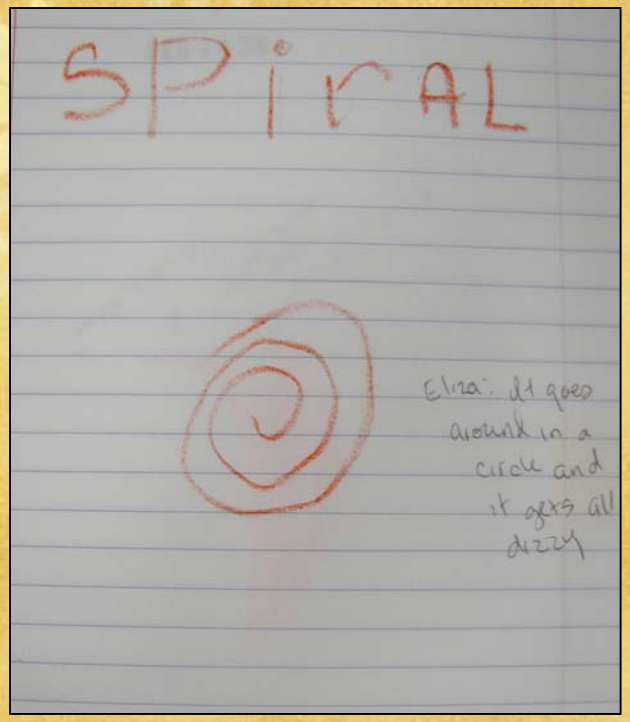
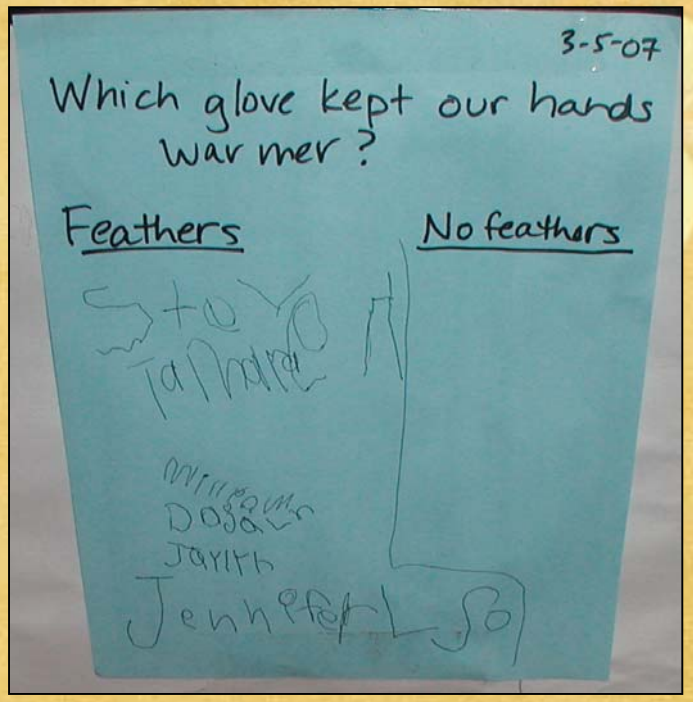
- Look for spontaneous opportunities to support scientific thinking
- Help children answer their own questions through inquiry
- *Provide opportunities for communicating scientific and mathematical ideas verbally and through drawing, writing, graphing…*





Examples from PrePS

"On Day 1, zero came with water, and on Day 10 (actually day 3, but 10 seeds sprouted) it grew, and on Day 7 more grew with water. And on Day 1 without the water, zero, and on Day 3 without the water, zero, and on Day 7 without the water, there was none, zero, too."

from Brenneman (2009)

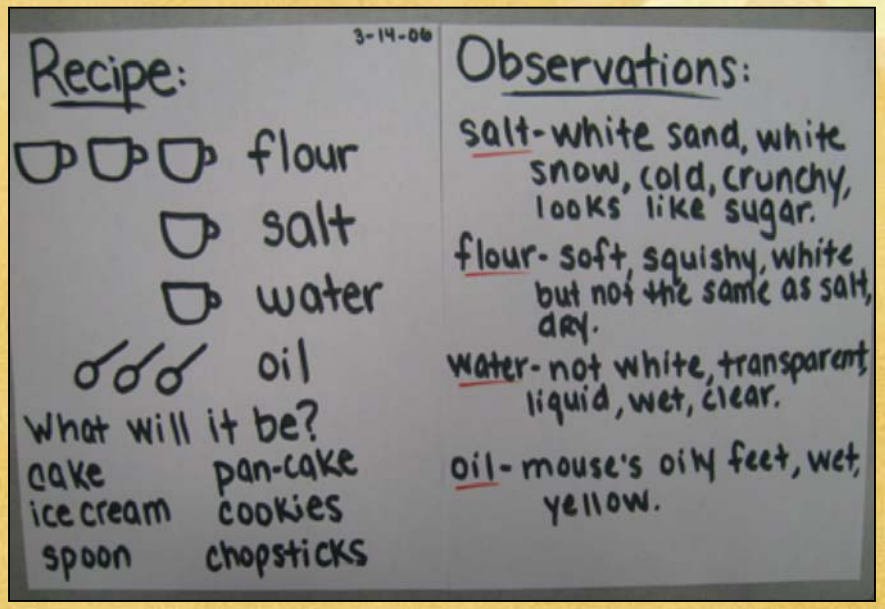
Our responsibilities and challenges

- Provide materials that encourage exploration and questions throughout the classroom
- Plan learning experiences that are conceptually connected
- Look for spontaneous opportunities to support scientific thinking
- Help children answer their own questions through inquiry
- Provide opportunities for communicating scientific and mathematical ideas verbally and through drawing, writing, graphing…
- *Ask open-ended questions and plan open-ended activities that encourage children to describe, compare/contrast, predict, and explain*

Start with a typical activity…

…then expand it

1. Exploring ingredients
2. Following a recipe
3. What would happen if…
   Let's try it!



- How are inquiry skills supported?
- Math? Literacy?
- Note the ways that adults can model important science practices during each activity.
- What else could you do with the play dough?

Mystery object - part 1

1. Look at the object.
2. What do you know about it just by looking?
3. What do you think it is?

Mystery object - part 2

1. Pick up your object and explore it.
2. Do you notice anything new?
3. Talk with your group about this thing. Does it remind you of any other things in the world?
4. What could you do with this thing?
5. What do you think it is?

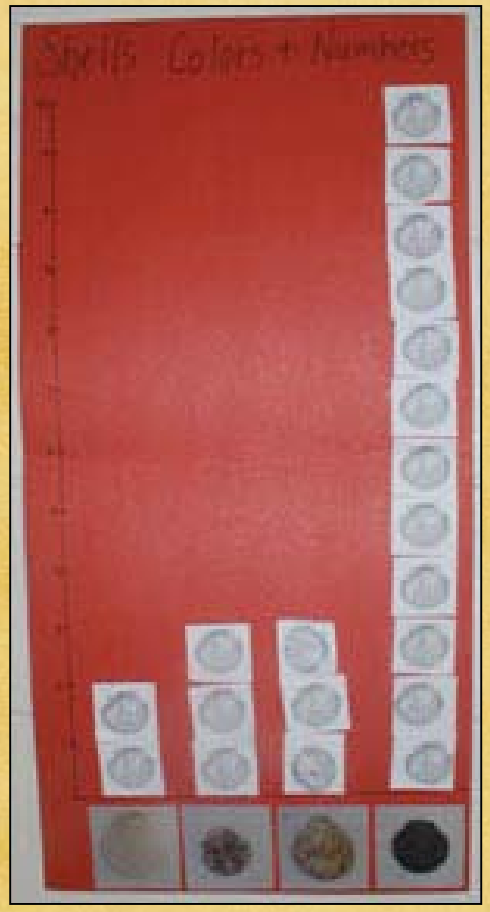
During part 2, you were

- *making observations* using multiple senses
- *comparing and contrasting* the object with other things you know about
- *collaborating* and sharing ideas
- *questioning* and *acting to explore an unknown*
- *exploring a big science idea* -- form and function
- engaged in deeper thinking and learning, *not focused on one right answer*
- having more fun?

With children…

- What do you notice about this thing?
- Colors, shapes, textures, parts…
- Does it remind you of anything?
- What could you do with it?
- Kids might come up with more ideas than you do!

Science provides opportunities for children to show off their thinking, not just facts they know.



Expect to be impressed…

from Gelman et al., 2009

…and to have a lot of fun!

I love doing this stuff!

-- Joey P., satisfied consumer

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Science is a collaborative effort. Many thanks to the colleagues and funding agencies who join me in working to support young science learners.

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