Big Idea Seminar Series
Spotlight Session 2




Early Childhood Education

Exploring ways to engage budding scientists in scientific investigations in various contexts:
Partnerships among classrooms, families, and the community

Dept. of Child, Youth and Family Studies &
Ruth Staples Child Development Laboratory

Why Science in Early Childhood?

- Young children are
  - capable of learning science concepts, inquiry and reasoning skills (NRC, 2012; NSTA, 2014) and distinguishing concrete from abstract ideas (Carey, 1985).
  - curious about the world and need multiple and extended opportunities to explore, observe, and investigate their world (NAEYC, 2013; NRC, 2007; NSTA, 2014).

Four Strands of Science Learning

- Understanding scientific explanations
- Generating scientific evidence
- Reflecting on scientific knowledge
- Participating productively in science

Michaels, S., Shouse, A. W., & Schweingruber, H. A. (2008). *Ready, Set, Science!: Putting Research to Work in K-8 Science Classrooms.* Board of Science Education, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

Effective Approaches to Teaching Children Science

Approach 1*

- Observe and describe child's behavior
- Comment on and ask questions about what the child did and said
- Implicitly model and play in parallel

Approach 2**

- Observe and describe child's behavior
- Comment on and ask questions about what the child did and said
- Teach science concepts and vocabulary
- Explicitly guide through scientific problem-solving processes

Early Childhood Teacher Education Program

- Infused across teacher education curriculum
  - Progression from awareness to application and refinement
  - Development of the Preschool Child
  - Curriculum Planning
  - Math, Science, Nature Integrated Methods for ECE
  - Student Teaching in ECE

Worlds of Wonder: Math, Science, and Nature Integrated Methods for Early Care and Education Objectives

- Develop an understanding of cognitive development and learning for young children in the domains of math, science, and nature
- Understand the importance of relationships for learning
- Identify key experiences for learning in the domains of math, science, and nature
- Develop skills in assessing children's conceptual development in the domains of math, science, and nature

Course Objectives, Cont'd.

- Plan, implement, and evaluate developmentally appropriate activities for young children in the domains of math, science, and nature
- Become familiar with research and theory on young children's learning in the domains of math, science, and nature
- Gain a holistic, developmental, and relational perspective on development and learning of young children

Building a culture that values nature and EE

- Shared values expressed through daily activities, relationships, and design of environments
- Faculty members identified core values
- Acculturation process in professional socialization
  - "This is valued in the profession"
  - How do we know it's happening?
- Selection of curricular foci, assigned readings

How to use natural settings for EE

- Previous research – an identified need (Ernst & Tornabene, 2012; Simmons, 1994, 1998)
- Our approaches
  - Master Teacher modeling
  - Students expected to be prepared to implement any activity outdoors (curriculum class, student teaching)
  - Students prepare a curriculum unit focusing on nature
  - Outdoors 2-3 times per day, every day (wind chill above 0^0 F)
  - Specific guidance to focus on natural phenomena (student teaching)

Complementary Guidelines

- *ECEE Guidelines for Excellence*
- *Guidelines for Preparation and Professional Development of Environmental Educators*
- State-Level Early Learning Guidelines
- Nebraska Nature Supplement to Early Learning Guidelines

Selected Themes from Guidelines for the Preparation & Professional Development of EEs

Exemplary EE Practice (3.1)

- EE used as a tool for meeting curriculum standards
- Partner with community members/organizations providing EE
- Model responsible, respectful, and reasoned behavior
- Model the process of inquiry & environmental investigations

Planning for instruction (4.3)

- Design EE that integrates across curricular content
- Demonstrate how EE will help learners meet standards
- Use resources & training offered by national, state, & local EE programs & organizations
- Use internet to access information about the environment and educational resources

Technologies that assist learning (4.5)

- Use variety of tools for environmental observation, measurement; instruct learners in safe & proper use

Settings for instruction (4.6)

•Plan for learner safety

•Identify, create, & use diverse settings for EE, including the school yard, field settings, community settings, museums, etc.

Knowledge of instructional methodologies (4.2)

•Select EE topics based on learners' interests

•Use a variety of teaching methods & strategies

Knowledge of learners (4.1)

•Select EE topics & materials that are developmentally appropriate

Create a climate for learning about and exploring the environment (5.1)

- Imbue instruction with a sense of the importance and excitement of the content
- Provide opportunities that increase learners' awareness & enthusiasm
- Incorporate opportunities for firsthand experiences exploring the world

An Established Culture Which Focuses on Science and Nature

The environment, both in the indoor classroom and in our outside classroom support endless discoveries in science and nature!

Nebraska ELG:
Demonstrates initiative and curiosity in exploring the environment.

Nebraska ELG:
Child begins forming a basic understanding of simple cause and effect relationships. Child shows interest in scientific concepts related to space and time.

Teaching Strategies GOLD #27
Demonstrates knowledge of Earth's environment.
Describes the weather communicates the awareness of seasons.

The indoor classroom reflects the same opportunities as the outdoor classroom

Using Art materials to connect to Science

Weaving using natural materials.

Teaching Strategies GOLD # 26
Demonstrates knowledge of the physical properties of objects and materials

Melting Ice

Teaching Strategies GOLD # 27
Demonstrates knowledge of Earth's environments.

SNOW ICECREAM

Children use all 5 senses to explore and understand surroundings.

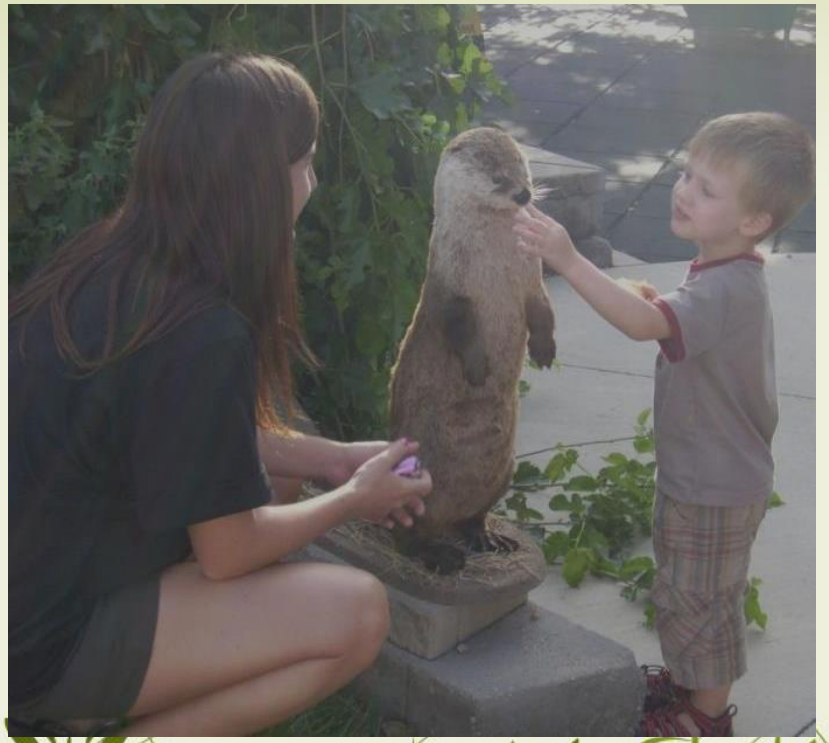
Using tools to connect math and science

MUD DAY CELEBRATION

Total emersion of science in a one day event

Parent, Child, Teacher, and Community Experts Partnerships

Mammal Night



Unique materials to connect children and families to the natural world.

MATERIALS
•tootsie rolls
•broken up mints
•oatmeal
•cranberries

•ROLL in a ball…
AND WALLAH-

SCAT, POOP,
ANIMAL WASTE

Birding Festival

Intentional Modeling of the Culture with Student Teachers

- Orientation-Exposure to nature
- Nature Based Curriculum
- Master Teacher/Student Reflection-encourage creative thinking with natural materials

Growing Up Wild

Nature Based Early Childhood Curriculum from
The Council for Environmental Education and Project Wild

Partnership with Lindsay Rogers-
Wildlife Education Specialist
Project WILD State Coordinator

Each semester pre-service teachers are trained in Growing Up Wild.

The play-based training encourages teachers to explore topics related to nature. Builds confidence in their experiences with natural things.

Which symbol demonstrates your feelings towards the importance of children learning in the natural outdoor environment?

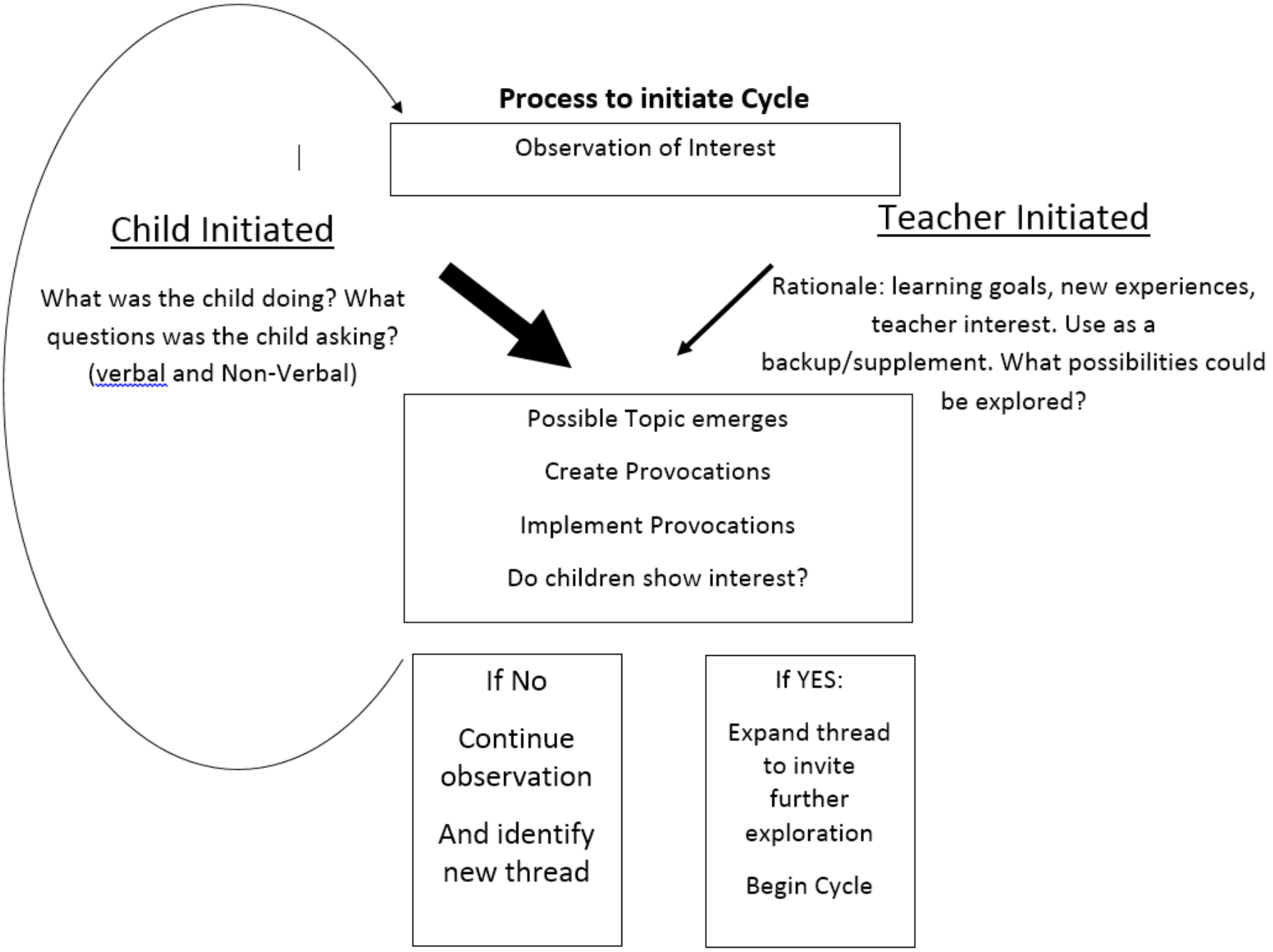
Which symbol describes your current confidence in teaching environmental education topics?

Which symbol illustrates your comfort level with implementing and planning in all learning domains in the outdoor classroom?

Modeling

- Respect for Living Things

- Emergent Curriculum
- Cycle of Inquiry
- Teaching Strategies GOLD
- Reflective Practice—influence from Master teachers to use natural materials


Process to initiate Cycle
Observation of Interest
Child Initiated
What was the child doing? What questions was the child asking? (verbal and Non-Verbal)
Teacher Initiated
Rationale: learning goals, new experiences, teacher interest. Use as a backup/supplement. What possibilities could be explored?
Possible Topic emerges
Create Provocations
Implement Provocations
Do children show interest?
If No
Continue observation
And identify new thread
If YES:
Expand thread to invite further exploration
Begin Cycle

Thread : Children are showing interest and are engaged with materials and topic.

Observe

What are the children doing? Questions, notes, audio, photos. Ideas for extending children's learning.

Raw Documentation

Reflect

Using reflective practice to make interpretations/make sense of observations. What worked/what didn't work and why. Brainstorm planning ideas for extending children's learning experiences.

Planning

Identify provocations from observations and reflective thinking

Web possibilities

Plan for resources, goals, and procedures for the investigation

Lesson Plan

Action plan

Implement Provocations

Investigate

Document

Tell the story of the provocation. Panel is the evaluation it focuses on what was learned.

Panel for Portfolio

REFLECTION

ADAPTED FROM THE CYCLE OF INQUIRY

Goldhaber's Cycle of Inquiry
Gandini & Edwards (2001)

Objectives for Development & Learning

Social–Emotional

1. Regulates own emotions and behaviors
   a. Manages feelings
   b. Follows limits and expectations
   c. Takes care of own needs appropriately
2. Establishes and sustains positive relationships
   a. Forms relationships with adults
   b. Responds to emotional cues
   c. Interacts with peers
   d. Makes friends
3. Participates cooperatively and constructively in group situations
   a. Balances needs and rights of self and others
   b. Solves social problems

Physical

4. Demonstrates traveling skills
5. Demonstrates balancing skills
6. Demonstrates gross-motor manipulative skills
7. Demonstrates fine-motor strength and coordination
   a. Uses fingers and hands
   b. Uses writing and drawing tools

Language

8. Listens to and understands increasingly complex language
   a. Comprehends language
   b. Follows directions
9. Uses language to express thoughts and needs
   a. Uses an expanding expressive vocabulary
   b. Speaks clearly
   c. Uses conventional grammar
   d. Tells about another time or place
10. Uses appropriate conversational and other communication skills
    a. Engages in conversations
    b. Uses social rules of language

Cognitive

11. Demonstrates positive approaches to learning
    a. Attends and engages
    b. Persists
    c. Solves problems
    d. Shows curiosity and motivation
    e. Shows flexibility and inventiveness in thinking
12. Remembers and connects experiences
    a. Recognizes and recalls
    b. Makes connections
13. Uses classification skills
14. Uses symbols and images to represent something not present
    a. Thinks symbolically
    b. Engages in sociodramatic play

Literacy

15. Demonstrates phonological awareness
    a. Notices and discriminates rhyme
    b. Notices and discriminates alliteration
    c. Notices and discriminates smaller and smaller units of sound
16. Demonstrates knowledge of the alphabet
    a. Identifies and names letters
    b. Uses letter–sound knowledge
17. Demonstrates knowledge of print and its uses
    a. Uses and appreciates books
    b. Uses print concepts
18. Comprehends and responds to books and other texts
    a. Interacts during read-alouds and book conversations
    b. Uses emergent reading skills
    c. Retells stories
19. Demonstrates emergent writing skills
    a. Writes name
    b. Writes to convey meaning

Objectives for Development & Learning, continued

Mathematics

20. Uses number concepts and operations
    a. Counts
    b. Quantifies
    c. Connects numerals with their quantities
21. Explores and describes spatial relationships and shapes
    a. Understands spatial relationships
    b. Understands shapes
22. Compares and measures
23. Demonstrates knowledge of patterns

Science and Technology

24. Uses scientific inquiry skills
25. Demonstrates knowledge of the characteristics of living things
26. Demonstrates knowledge of the physical properties of objects and materials
27. Demonstrates knowledge of Earth's environment
28. Uses tools and other technology to perform tasks

Social Studies

29. Demonstrates knowledge about self
30. Shows basic understanding of people and how they live
31. Explores change related to familiar people or places
32. Demonstrates simple geographic knowledge

The Arts

33. Explores the visual arts
34. Explores musical concepts and expression
35. Explores dance and movement concepts
36. Explores drama through actions and language

English Language Acquisition

37. Demonstrates progress in listening to and understanding English
38. Demonstrates progress in speaking English

What knowledge and characteristics do the Oaks have about animals in the outdoor classroom?

As we observed the children this week, we noticed that they have a love for animals, especially animals that they see every day on or near the playground. We wanted to find out children's prior knowledge about animals, how they move, what they eat (diet), and where they live (habitat).

Children were able to communicate with one another about the characteristics of living things by describing the behaviors and appearance of birds. Children are beginning to understand concepts about living things, **Objective 25 of Teaching Strategies GOLD: Demonstrates knowledge of the characteristics of living things.**

On a nature walk, we started talking about familiar animals that we've seen on our playground. Some of the animals children shared knowledge of included squirrels and birds. When discussing how animals move Teacher Korrine considered out loud, "I wonder what animals we could see in the sky."

"Bugs,"Emmett said.
Celia said, "Spiders and birds."
Teacher Korrine, "You're right, some birds can fly in the air."
Celia said, "They eat worms!"

Teacher Korrine introduced the idea that birds also eat seeds. She explains that people can help take care of birds by providing seeds in the winter months.

On January 30th, the Oaks revisited the previous day's conversation. Teacher Korrine had made a frozen bird feeder prior to the start of our activity so that the children could hang one bird feeder and make another. The group went outside to hang the frozen bird feeder, Teacher Korrine asked, "How will the birds get to all the food we froze?"

Emmett said, "They break it with their noses."
"Yeah," said Eddie.

Children showed knowledge of some aspects of birds in their immediate environment. They told about worms as a food source and explored other food sources for birds through the activity of creating bird feeders. A misunderstanding that was brought to surface was the idea that birds have noses like people. In our upcoming provocations, children will explore birds more closely and investigate the parts of a bird to have a deeper, more accurate understanding of birds.

How do birds get their food?

How do birds get their food?

Children showed a misunderstanding of birds' bodies. In a previous provocation, children identified that birds used their noses to get food. To help children explore birds' ability to acquire their food, we've created a provocation to use their fine motor skills and investigate how birds gather and pick up food and items for making a nest with their beaks.

On February 7, 2012, Teacher Korrine introduced the term "beak" to the children. Children were able to identify a beak given a picture of a bird. To explore how a beak works, the Oaks experimented with using tongs to pick up objects and move them from one container to the other. The objects included larger items such as cotton balls and bottle caps and smaller, more difficult objects to pick up such as noodles, feathers, and beads. The children quickly realized that the tongs had to "pinch" an item to pick it up. They also noted that it was difficult to use the tongs to pick up the small materials. Teacher Korrine talked with children about how birds use their beaks to pick up items to create a nest. Children had seen nests in the outdoor classroom. They showed interest in how birds created a nest.

Teacher Korrine: "Birds use their beaks to pick up things.
Emmett: "It's hard to get things"
Teacher Korrine: "How do birds get their food?"
Emmett: "Beaks!"
Eje: "Their wings help them."

Children demonstrated **Objective 25 of Teaching Strategies GOLD: Demonstrates knowledge of the characteristics of living things.**

How will the Oaks create a nest?

How will the Oaks create a nest?

The Oaks took the first and last five minutes before family block to watch the Decorah Eagles in Iowa on Ustream. Oaks went outside and collected materials to create a nest like the one they had seen the video footage. The Oaks have noticed that the eagles take turns caring for the eggs. They observed that there are three white eggs.

While watching the Decorah Eagles in Iowa on the Ipad…

"Look at the nest. What do you notice about it?"-Teacher Korrine
"It's big!"-Eje
"It has a lot of sticks."-Celia

The children work to make their own nest by collecting materials in the forest.

"Celia come here! There's leaves!"-Meijing
"Yay! We need six."-Celia
"1, 2, 3, 4, 5, 6."-Meijing and Celia

They were using scientific inquiry skills by representing their thinking through dramatizing and making models. Teaching Strategies GOLD Objective 24.

At the end of the session, children show concern that the parents are sitting on

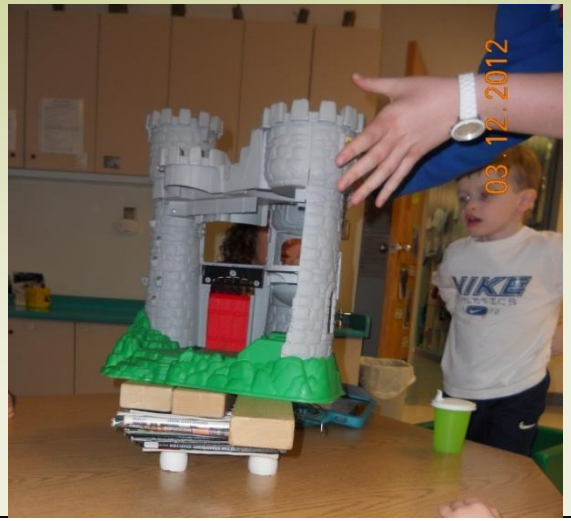
the eggs and will break them. The Oaks identify their next question for exploration.

Why don't eggs break when Mommy birds sit on them?

Why don't eggs break when Mommy birds sit on them?

Why don't eggs break when Mommy birds sit on them?

On Tuesday, the Oaks learned about how strong eggshells are. We conducted an experiment by predicting how many objects we could stack on the eggshells, before they would crack. First, we took turns staking books on the shells. However, we realized that books were not heavy enough to break the eggs, so the children found objects in the classroom to stack. After stacking things like books, blocks, trucks and even a large castle, we were wondering if the eggs would ever crack! Then, we decided to set Eje on top of the eggshells to see if he could crack them! Teacher Ellie sat him on top of the pile and after 3-5 seconds, the eggshells finally broke



"How many objects do you think we can stack on top of the eggs before they crack?"

"Twelve"-Eddie
"Six"-Meijing
"Ten!"-Eje

"What else could we put on top of the shells, besides books?"-Teacher Ellie

"A block! Big block!"-Eje
"Okay, let's try it Eje. Find one block to put on top."-Teacher Ellie

"We need more teacher!"-Emmett
"Ben, find block"-Teacher Ellie
"Ben added a really big block friends!"-Teacher Korrine

"These eggshells are very strong. We added books, blocks, a truck and even a castle but the shells still haven't cracked. Let's add Eje on top to see if they will crack!"

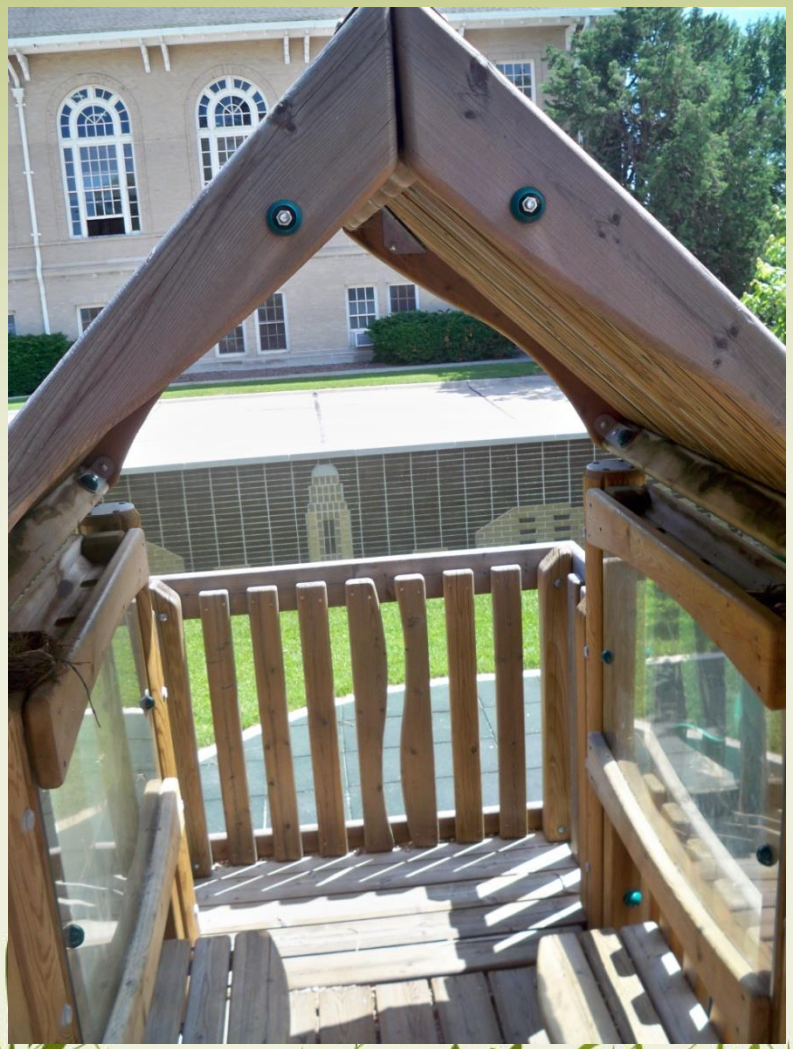
The children used a variety of materials in this activity. They knew that big blocks would work better than small blocks because they were heavier. They also learned about the physical properties of eggshells by getting the chance to touch them, smell them and observing the shells after they cracked and turned into little pieces.

Sample Lesson Plan
Demonstrates Intentional use of science content materials in the classroom

TIMES OF THE DAY	Provocation	Materials Needed	Teaching Strategies GOLD	Content Facts & Terms	Teaching Through Play
Focused Activity	Using tools and technology to investigate rocks	M:rocks and balance scales T: use scientific inquiry to find objects that are heavier than the rocks W: Put rocks in sensory table with water to see if they sink or float TH: use magnify glasses to investigate F: Using ramps and inclines to roll rocks	#28 uses tools and other technology to perform tasks	Scale: a tool used to measure the weight of an object Incline: a surface where one end is higher than the other Magnify glass: A tool to see things close up with	M:Children will use balance and scale to measure the weight of rocks T: Children will use balance scales to compare the weight of the objects against rocks W:Children will make predictions and test hypothesis if rocks sink or float TH: Children will use magnify glasses to identify the surface of various rocks F: Children will use ramps and inclines to explore gravity with rocks

A child lead activity provides connections to meeting science and many other domains.

“Where should a bird build its nest anyways?” Owen, 3



Child initiated question from their observations and natural experiences leads to intentional teaching opportunities.

A plan to protect the nest.

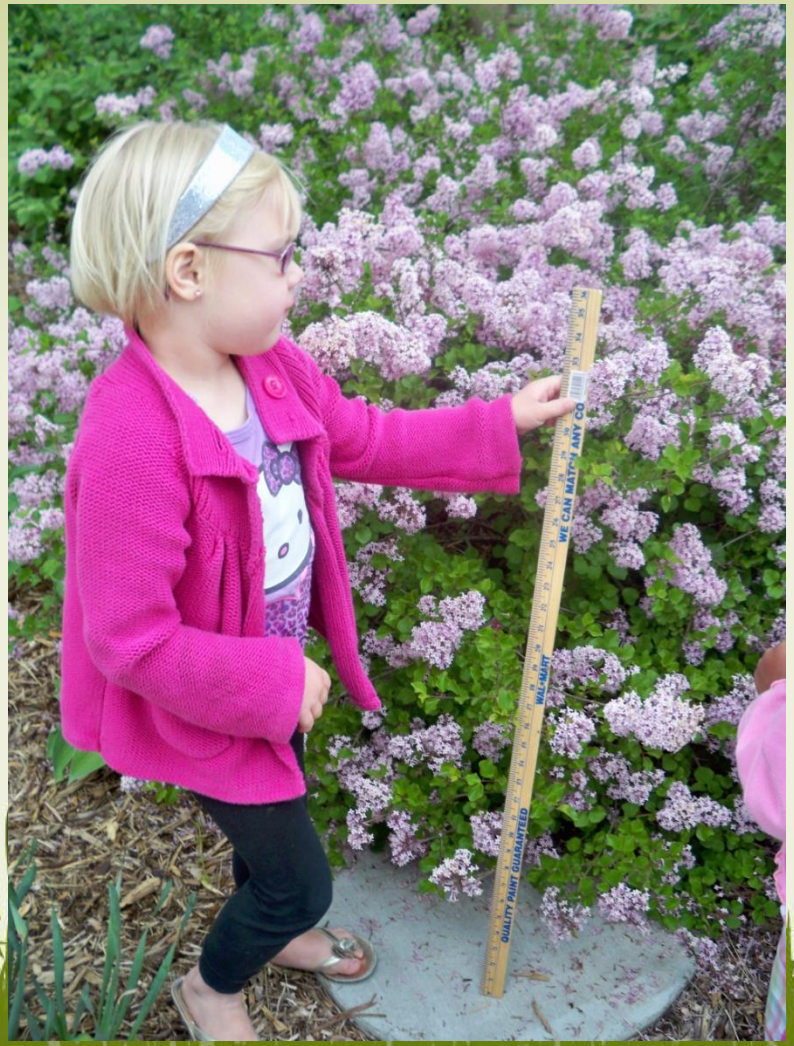
"The nest is really not in a good place. I wonder what that silly momma bird was thinking?" Meg

"We need to have nest protectors." Grant, 5

"And the protector needs a badge so everyone knows we are protecting the nest. It should be a star" Andrew, 5

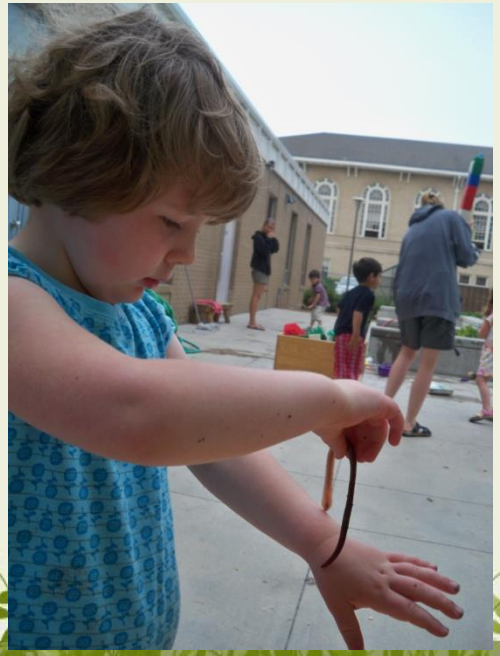
“A bird should build its nest in a tree.” Sofia, 4
“But I can still reach this tree so not right here. It needs to be higher” Meg, 4

Measuring out natural landscapes to indentify the best place for a bird to build a nest. Children came to the conclusion that it needed to be taller than heads and also taller than the length of two yard sticks.



“The tree has to be strong in case the bird builds a heavy nest.” Daniel, 4 yrs.

We need to see if worms are in the ground for the bird to eat.” Matreyi, 4



These worms are perfect for the birds. They are thick. Sally, 5

“I Have a Hippopotamus!”

“Teacher Jenny! I have a hippopotamus.” –Ruby (Age 4)

“You do, let me see!” Teacher Jenny

“No silly, you don’t see a hippopotamus you listen to it.” R

“Ok, now I am really curious, tell me more.” J

“I think that if I dig really deep I will find worms.” R

“Ohh, you think that if you dig deep you will find worms…tell me more.” J

“I need to find worms, so I will dig deep and then their home will be deep.” R

“Okay would you like to hear my hypothesis?” J

“Sure, is it the same as mine?” R

“Kind of, I think that if I find a muddy spot there will be worms.

Should we go test our hypothesis?” (hippopotamus)

Questions?

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Discussion

1. Why do we care about promoting science literacy?
2. What are the key big ideas discussed in our Spotlight Session?
3. What are the resources needed to engage the community in science literacy?
4. What are the gaps or barriers?
5. Where do we collectively go from here?