



ECHOS[®]

Early Childhood
Hands-On Science

FROST
SCIENCE

ECHOS Overview



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PHILLIP & PATRICIA FROST MUSEUM OF SCIENCE
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The Phillip and Patricia Frost Museum of Science is supported by the Miami-Dade County Department of Cultural Affairs and the Cultural Affairs Council, the Miami-Dade County Mayor and Board of County Commissioners of Miami-Dade County. This project is supported by the Building Better Communities Bond Program and the City of Miami. Sponsored in part by the State of Florida, Department of State, Division of Arts and Culture, the Florida Council on Arts and Culture, and the National Endowment for the Arts. The museum is accredited by the American Alliance of Museums, is an affiliate of the Smithsonian Institution and a member of the Association of Science and Technology Centers.

ECHOS Overview

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The Phillip and Patricia Frost Museum of Science (Frost Science) is a leading science museum and an Affiliate of the Smithsonian Institution dedicated to sharing the power of science, sparking wonder and investigation, and fueling innovation for the future. Located in Downtown Miami and open 365 days a year, Frost Science features the unique combination of an aquarium, planetarium, and science museum. The museum serves the community in a myriad of ways – not only by inspiring people to enjoy science and understand its power to positively impact our world – but by being a champion for science learning and research, community access, environmental conversation, and animal care and rehabilitation.



Early Childhood
Hands-On Science

Dear Educator,

We are delighted that you are bringing Early Childhood Hands-On Science to your classroom! ECHOS® was developed and tested with funding from the U.S. Department of Education's Institute for Education Sciences to meet the need for a comprehensive preschool science curriculum. It is research based, aligned with early childhood standards, and provides a foundation for critical thinking.

The following pages are designed to familiarize you with the ECHOS® instructional methodology and implementation model. You will find an overview of the E-I-E-I-O Learning Framework that provides the underlying structure for each lesson, as well as the preschool science process skills that are embedded throughout the curriculum. You will also find suggestions for setting up a science area in your classroom, and classroom management models to help you think about how to implement the curriculum in your daily, weekly, and monthly schedule.

If you are interested in learning more, visit www.frostscience.org/echos. You may also be interested in the ECHOS® Professional Development Resources Guide, which provides the tools needed to introduce educators to ECHOS through a series of workshops. If you have any questions, please contact echosinfo@frostscience.org.

We hope you find these materials useful for getting started with ECHOS®.

Sincerely,
The Frost Science Education Team

Why Teach Science in Preschool?

- ✓ Young children's capacity to learn science is much greater than previously thought.
- ✓ Some of children's early intuitions about the world can be used as a foundation to build remarkable understanding.
- ✓ Children develop ideas about their role in the world and about how the world works.
- ✓ Contributes to meeting the national challenge to improve early science education.
- ✓ Helps close the achievement gap and build capacity for underrepresented and minority groups to participate in the science workforce of tomorrow.



Instructional Methodology

E-I-E-I-O Learning Framework

The delivery of the ECHOS® science lessons follows a project-designed sequence called the *E-I-E-I-O Learning Framework*, designed to provide teachers with a logical structure to deliver lessons that promote learning by thinking and doing. The suggested teacher behaviors combine guided inquiry-based science experiences and exploration. You can view a short video about the framework at: www.frostscience.org/echos

EIEIO Learning Framework

Framework	Teacher Behavior
Excite... to spark curiosity and wonder	<ul style="list-style-type: none"> • Creates interest • Generates curiosity • Selects topics of interest to children
Introduce... the investigation	<ul style="list-style-type: none"> • Elicits children's prior knowledge about a concept or topic • Uses positive and negative examples to introduce new vocabulary/key concepts • Clarifies and corrects misconceptions
Explore to deepen understanding	<ul style="list-style-type: none"> • Structures learning environment (tools, time, space) for exploration • Encourages children to use senses to investigate • Guides investigation, posing questions • Models how to explore (pose questions, make predictions, look for patterns, record data, check predictions) • Observes and listens actively
Interact as needed to respond to individual strengths and needs	<ul style="list-style-type: none"> • Observes and listens actively • Differentiates and adapts instruction to meet children's individual needs • Encourages interaction between children • Promotes collaborative work
Outcomes observe evidence of learning	<ul style="list-style-type: none"> • Poses questions to elicit descriptions of and feelings about the investigation • Connects children's ideas • Determines need to revisit key concepts

Instructional Methodology

Lessons, *iCards* & Embedded Assessment

Science Lessons

Each ECHOS® science unit contains four science lessons. Teachers introduce one lesson per week to small groups of five children.

Integration Cards (*iCard*)

In addition to the science lessons, correlated activities are introduced in the domains of language/literacy, mathematics and creative arts using ECHOS® *iCards*. Two *iCard* activities are delivered weekly with groups of 10 children. Half the class works with the teacher while the other half works with the teacher assistant and/or parent volunteer.

iCard Picture Walk & Read Aloud Storybooks

Included in the set of *iCards* are two lists of storybooks, chosen specifically for their connection to each unit's key concepts. *Picture Walk* books offer opportunities for children to “read” books by looking at the pictures. Ideal *Picture Walk* books have rich illustrations. When a book has too much text, it can be used to show just the pictures. This helps keep children's attention and allows for interesting discussions about the book. Wordless picture books are also a great choice for a *Picture Walk*. *Read Aloud* books are typically rich with illustrations, vocabulary and proper language structure. The amount of text in a *Read Aloud* storybook should be considered so as to maintain children's attention at various stages of growth.

Embedded Assessment

In the *OUTCOMES* section at the end of each lesson, the teacher gathers the children and asks them to recall what they did, encouraging the children to share their experiences by posing questions to gather descriptions of and feelings about the investigation, connecting the children's ideas, and determining the need to re-teach key concepts. As the children talk, the teacher listens to their responses. As the year progresses, the teacher encourages the children to respond in more complete sentences as well as elaborate on their comments, thus expanding children's language skills.



Instructional Methodology

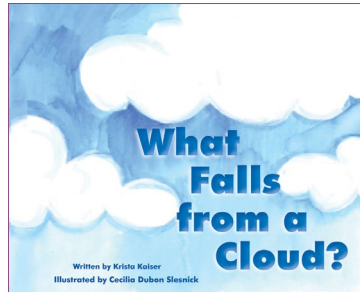
Curriculum & Storybooks

ECHOS® focuses on life science, earth science, and physical science. We recommend that you deliver the curriculum units in a specific order to ensure the scaffolding of science process skills as the units progress.

Science Unit

Rainy Weather

Use senses to explore rain. Observe and draw changing weather conditions. Distinguish between materials that absorb and repel water, and investigate which materials keep us dry. Observe how rain makes puddles or is absorbed into the soil.



Science Storybook

What Falls From a Cloud?

After noticing the clouds in the sky, a sudden change in the color of a cloud changes the weather. People rush in the busy street to stay dry and then the rain stops.

Science Unit

Beginning Botanist

Learn the parts of a plant. Remove a plant from a pot to investigate its roots. Observe water traveling through a straw to learn how the parts of a plant work. Compare and contrast seeds and leaves. Germinate seeds to investigate plant growth.



Science Storybook

A Garden for Iggy

Pia and Pepe discover an iguana in their neighborhood. They bring him food and then plant a garden of lima beans for him.

Science Unit

Feathered Friends

Observe pictures and models to investigate the special bird features that work best in different habitats. Sort animals into categories: birds and not a bird. Use binoculars to find pictures of camouflaged birds.



Science Storybook

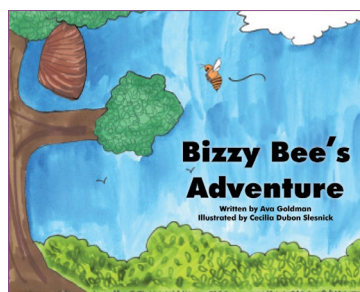
Whose Feather Is This?

A curious girl finds a blue and green feather that has fallen from someone's hat. She goes on a journey with her grandmother to ask the birds whose feather it is.

Science Unit

Busy Buzzing Bees

Make models to learn the parts of a bee. Use dramatic play to investigate how a bee uses a proboscis to sip nectar and antennae to distinguish scents. Use sight, smell and touch to observe honeycombs. Learn how a bee dances to communicate that flowers are near or far.



Science Storybook

Bizzy Bee's Adventure

Two animal friends set off on an adventure in a flowery garden. Bizzy the bee uses her sense of smell to find her way back home to her special beehive.

Science Unit

Discovering Shells

Create a beach model to learn about ocean waves. Observe shells and describe their attributes: rough and smooth, large and small. Classify shells using multiple attributes at the same time. Use clay models to investigate how shells protect mollusks.



Science Storybook

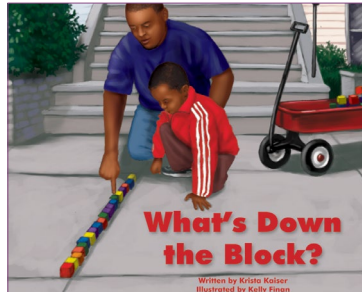
Busy Beach Day

Kayla and Nick head to the beach with their Dad to discover the wonders of seashells and ride their bikes. It's a busy beach day for Kayla and Nick!

Science Unit

Blocks Measure Up

Measure objects using unit blocks. Learn comparison words to describe length and height. Use blocks to compare which objects are long or longer, tall or taller. Build block speedways to investigate the effect of a ramp's height on the distance a toy car will travel.



Science Storybook

What's Down the Block?

A young boy invents a new use for an old toy as. He and his dad take a neighborhood walk to measure things in their neighborhood.

Science Unit

Water Play

Compare containers of various sizes and find out how many cups of water it takes to fill a bottle; chart predictions and results. Conduct an experiment to understand what makes objects sink or float. Predict buoyancy based on weight and shape; record results.



Science Storybook

Summer Splash

During a summer pool day, two children and their Tío Carlos explore how water overflows, and watch as Tío makes one great, big splash. Oh no, overflow!

Science Unit

Astonishing Air

Distinguish between inflated and deflated objects to identify the presence of air. Collect air from different parts of the room to learn that air is all around us. Launch a balloon rocket to observe that air can move things. Explore wind speed and direction.



Science Storybook

Bye-Bye Bubbles

A big brother helps his little sister learn why air is important for balls, balloons and bubbles, and they explore the difference between inflated and deflated objects.

Science Unit

Magnificent Magnets

Test objects' magnetic properties and classify them as magnetic or non-magnetic. Explore magnets and measure their magnetic strength. Learn about the push and pull of magnetic force and conduct an investigation to see how magnets can work through materials and at a distance.



Science Storybook

Why Is This Rock Special?

A girl discovers a special rock in her collection: it can attract magnet toys! She explores other magnet toys, and uses one to help retrieve lost keys.

Instructional Methodology

Science Process Skills by Unit

Standards-based science process skills are embedded in the ECHOS® curriculum. Units are designed and sequenced to allow the gradual introduction of these skills, from basic to complex in the categories of observing, describing, categorizing, predicting, experimenting, and drawing conclusions. The chart below indicates the process skills that are embedded in each unit.

	<i>Rainy Weather</i>	<i>Beginning Botanist</i>	<i>Feathered Friends</i>	<i>Busy Bussing Bees</i>	<i>Discovering Shells</i>	<i>Blocks Measure Up</i>	<i>Water Play</i>	<i>Astonishing Air</i>	<i>Magnificent Magnets</i>
Observing									
Identifies object properties	•	•	•	•	•	•	•	•	•
Uses senses to observe concrete, familiar objects	•	•	•	•	•	•	•	•	•
Differentiates between models and the real thing	•	•	•	•	•		•	•	•
Uses measurement tools to record observations						•	•		•
Uses tools to observe objects or events	•	•	•	•	•	•	•	•	•
Describing									
Describes key attributes of objects	•	•	•	•	•	•	•	•	•
Creates drawings or models depicting objects	•	•	•	•	•		•	•	
Describes changes in objects	•	•			•	•	•	•	
Discusses changes in variables that affect an investigation	•	•				•	•	•	•
Categorizing									
Notifies similarities and differences	•	•	•	•	•	•	•	•	•
Sorts objects into groups using one attribute at a time		•	•		•	•	•	•	•
Establishes own sorting criteria		•			•				
Sorts objects using multiple attributes		•			•				
Provides reasoning for grouping objects		•	•		•		•	•	•
Predicting									
Verbalizes thinking	•	•	•	•	•	•	•	•	•
Recognizes and extends patterns		•			•	•	•	•	•
Makes simple predictions	•	•	•		•	•	•	•	•
Makes predictions based on observations	•	•			•	•	•	•	•
Uses estimation to make quantitative predictions						•	•		
Experimenting									
Investigates models of objects/phenomena	•	•	•	•	•	•	•	•	•
Manipulates materials	•	•	•	•	•	•	•	•	•
Identifies factors that might affect the outcome of an experiment		•				•	•	•	•
Participates in collecting data	•	•		•		•	•		
Interprets data using symbols of graphs	•					•	•		
Performs trial-and-error investigations	•	•		•		•	•	•	•
Drawing Conclusions									
Makes verbal interpretations of observations	•	•	•	•	•	•	•	•	•
Finds patterns from data collected	•					•	•		•
Connects findings from an investigation					•	•	•	•	•

Instructional Methodology

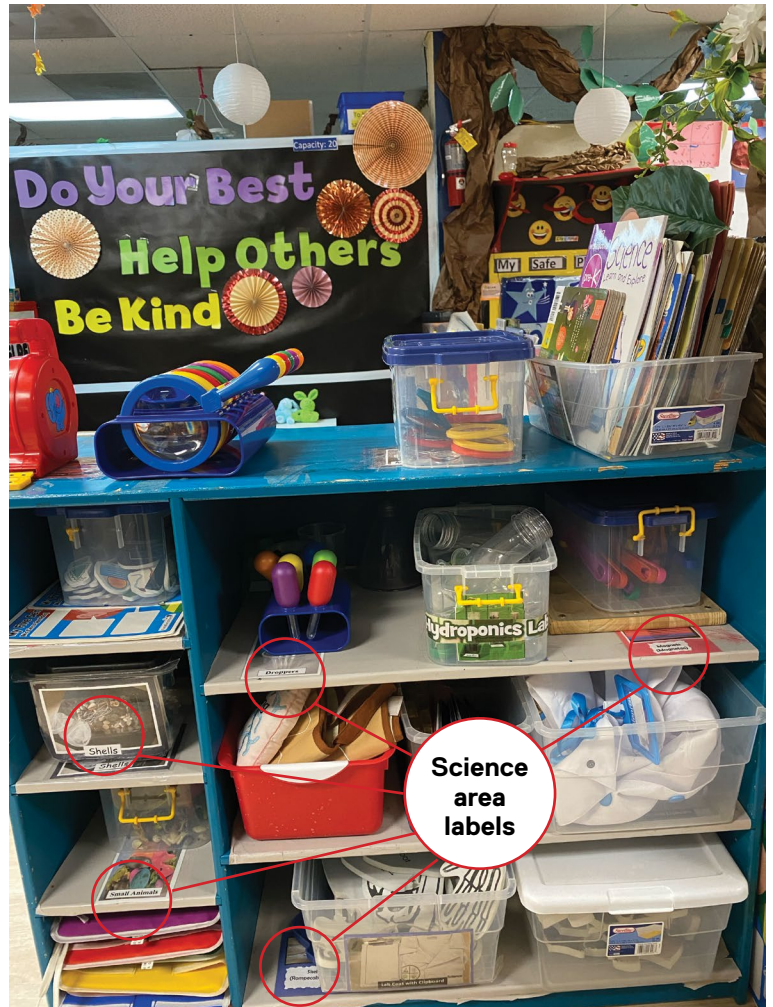
Science Area Development

An ECHOS® classroom should include a designated science area with materials for exploration and access to measurement tools. Traditionally, science areas in preschool classrooms have put science on display (i.e. plants, books) rather than provide tools and a planned environment for the intentional application of science process skills. Also, we strongly encourage labeling items on shelves, bilingually when appropriate, to pair science learning with early language and literacy skills.

The materials used with ECHOS® provide many items that can be safely placed in the science area for further exploration. Many of the iCard activities and lesson templates make great science area activities as well. Below are photos of exemplary science areas developed during classroom implementations of ECHOS®.



Science area with a table for science explorations



Implementation Model

Week at-a-Glance

We have designed the ECHOS® Monthly Planning Chart to help you manage a small group structure and implement one of the nine units in a period of four weeks. Consider dividing your classroom into four color-coded groups and rotating those groups through the activities below. The chart below explains how the specific roles of the teacher and teacher assistant are divided. The charts on the following pages provide examples of how to plan and communicate groupings with your children, as well as how to manage these groups through a typical day and month of ECHOS® implementation.

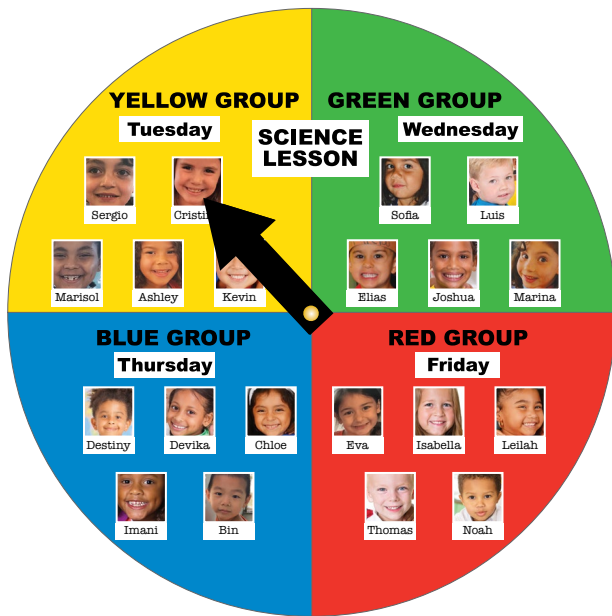
Large Group Time	Two times per week Language and Literacy iCard: Fingerplay and Sing Alongs
Work or Free Choice Time	Four days per week Science Lesson <ul style="list-style-type: none"> • Teacher with 4-6 children • Teacher Assistant monitors children in other areas
Small Group Time	Two times per week One Creative Arts iCard and one Mathematics iCard <ul style="list-style-type: none"> • Teacher with half the class • Teacher Assistant with other half of the class
Story Time	Two times per week Language and Literacy iCard: Picture Walk and Read Aloud <ul style="list-style-type: none"> • Teacher with half the class • Teacher Assistant with half the class



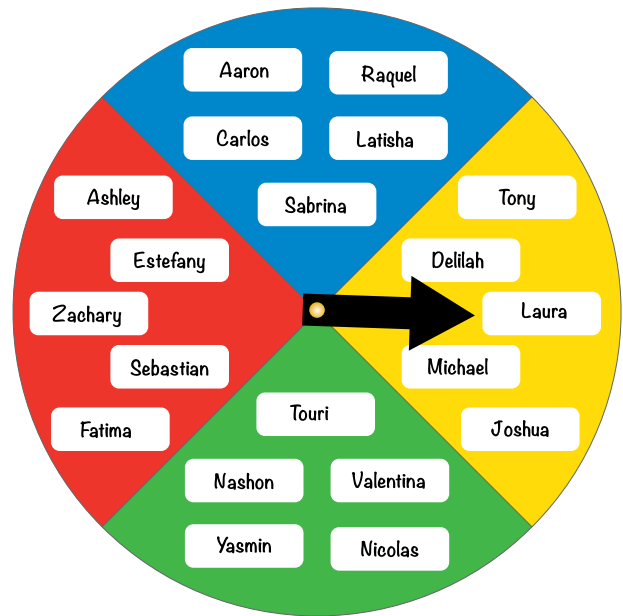
Implementation Model

Planning Board

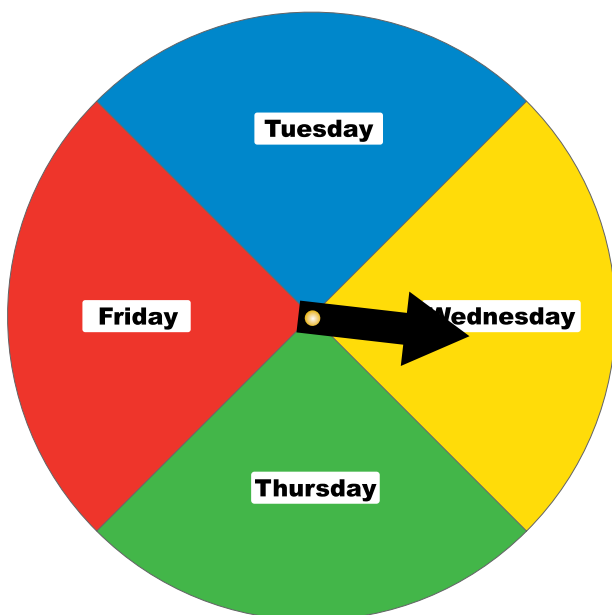
The sample planning boards below identify children in each group and provide children with visual aids for transitions. Teachers can use a planning board to call their group of children to participate in the ECHOS science lesson for that day. In the examples below, the color codes indicate what group will participate in a science lesson. Children can identify their photograph, name or color group on the board and know that today it is their turn to participate in an ECHOS® lesson.



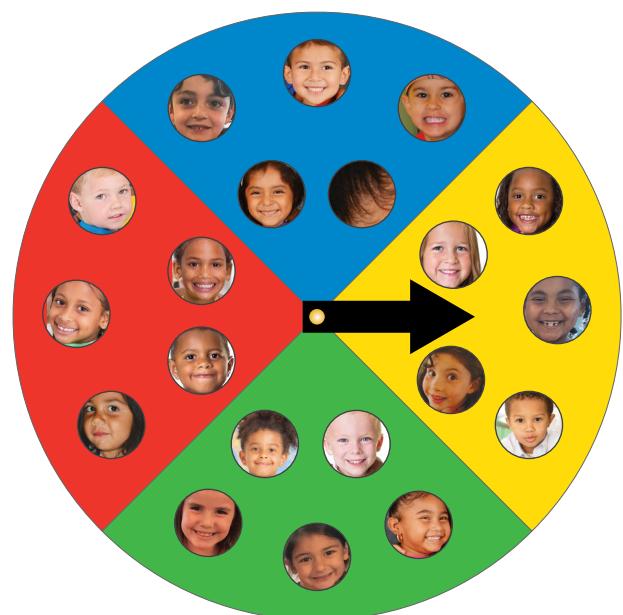
Names and photos



Names only



Groups colors only



Photos only

Month at-a-Glance

	Week 1					Week 2					Week 3					Week 4				
	M	T	W	Th	F	M	T	W	Th	F	M	T	W	Th	F	M	T	W	Th	F
Large Group Time (whole group)																				
iCard L1 Fingerprint																				
iCard L2 Sing Along																				
Work of Free Choice Time (5 per group)																				
Lesson 1																				
Lesson 2																				
Lesson 3																				
Lesson 4																				
Small Group Time (10 per group)																				
iCard M1																				
iCard C1																				
iCard M2																				
iCard C2																				
iCard M3																				
iCard C3																				
iCard M4																				
iCard C4																				
Store Time (10 per group)																				
iCard L3 Picture Walk (one book per week)																				
iCard L4 Read Aloud (one book per week)																				

T= Teacher TA= Teacher Assistant Science Lesson Groups (5 per group) Whole Group

Implementation Model

Day at-a-Glance

Large Group Time

T TA

Sing Along: "Honeybee"

T

5
children

Lesson #1: POLLINATION

TA

5 children 5 children 5 children

Free Play in Areas

Work Time

T

5 children 5 children

iCard C1:
Fingerprint Bee Cards

TA

5 children 5 children

iCard M1: Flower Lotto

Small Group

T

5 children 5 children

Read Aloud:
Bees and Their Hives
by Linga Tagliaferro

TA

5 children 5 children

Picture Walk:
Bees
by Sue Barraclough

Story Time



You can further explore ECHOS at our website
www.frostscience.org/echos

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