Making Science Matter

Teaching and Learning Science in the Pre-Kindergarten Classroom

mdek12.org

Dr. Kevin L. Gaylor, Ed.D.

State Director, K-12 Science Content

MISSISSIPPI DEPARTMENT OF EDUCATION

VISION

To create a world-class educational system that gives students the knowledge and skills to be successful in college and the workforce, and to flourish as parents and citizens

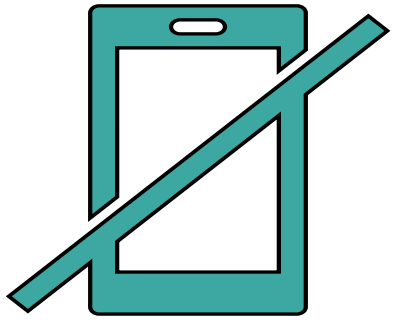
MISSION

To provide leadership through the development of policy and accountability systems so that all students are prepared to compete in the global community

State Board of Education STRATEGIC PLAN GOALS

1. **ALL** Students Proficient and Showing Growth in All Assessed Areas
2. **EVERY** Student Graduates from High School and is Ready for College and Career
3. **EVERY** Child Has Access to a High-Quality Early Childhood Program
4. **EVERY** School Has Effective Teachers and Leaders
5. **EVERY** Community Effectively Uses a World-Class Data System to Improve Student Outcomes
6. **EVERY** School and District is Rated “C” or Higher

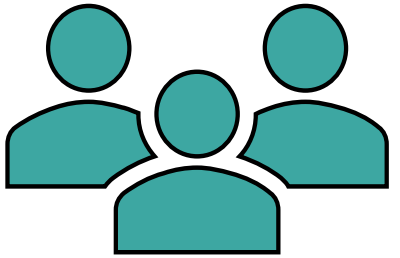
Session Norms



BE ATTENTIVE

BE OPEN-MINDED

BE RESPECTFUL



BE ENGAGED

"Encourage children of all ages to experience the world fully, describe what they see, ask questions, repeat the experience, and think about the why of it. Like learning to count or to read, learning how to "do" science is a lifelong process. By exposing children to science early, we encourage them to ask questions, seek answers, and give voice to their ideas."

- Adapted From Peggy Ashbrook's *Science is Simple*

Session Goals

- Discuss challenges to quality science instruction in Pre-Kindergarten
- Identify the essential science process skills
- Discuss the three dimensions of science teaching and learning
- Explain the importance of using phenomena in the Pre-Kindergarten science lessons
- Explore strategies designed to engage students with sense-making in science and engineering (Discrepant Events)

Making Science Matter

Challenges to Teaching Science in Pre-Kindergarten

Challenges to Teaching Science in Pre-Kindergarten

- Defining what science is
- Understanding science content
- Identifying what Pre-K students already know
- Creating time and space for science instruction
- Understanding expectations of science standards

https://www.3plearning.com/blog/4-challenges-teaching-science-primary-school/

Challenges to Teaching Science in Pre-Kindergarten

Defining What Science Is

- Exploration and discovery of our environments
- Making observations
- Asking questions and recognizing problems
- Designing investigations
- MAKING SENSE OUR ENVIRONMENTS

Challenges to Teaching Science in Pre-Kindergarten

Understanding Science Content

- Experience science
- Explore science concepts
- Search for reliable sources of information
- Seek the help of accessible experts
- Work with content teachers

Challenges to Teaching Science in Pre-Kindergarten

Uncovering What Students Know

- Identify misconceptions about science concepts
- Make science concepts relatable to student experience
- Allow students to have voice about their experiences
- Allow students to form their own conclusions

Challenges to Teaching Science in Pre-Kindergarten

Creating Time and Space for Science

- Strategically plan for science engagement
- Identify science concepts in reading
- Have a science focus for a day, week, etc.
- Relate science concepts to daily experiences
- Include science terms as part of essential vocabulary
- Use visuals to help facilitate science thinking and talk

Challenges to Teaching Science in Pre-Kindergarten

Understand Science Standards and Expectations

- Become familiar with MS Pre-Kindergarten standards
- Become familiar with national standards (NGSS)
- Align Pre-Kindergarten standards with kindergarten standards.
- Refer to National Framework for K-12 Science

Activity Time: A Probing Activity

How to Identify What Students Know.

- Put a pile of paper clips in the middle of a table.
- Ask the student what they think will happen if you hold a magnet of the pile of paper clips. Ask them how do they know (they are making a prediction).
- Now ask them how can they test their thoughts (designing experiment).
- Record what happens
- Place the magnets in a paper cup, a glass cup, a metal tumbler. Ask what they think will happen.

Making Science Matter

Engaging Science Process Skills in Pre-Kindergarten

Engaging Science Process Skill

- Science process skills to help break down “doing” science into logical steps
- Science process skills to help generate questions about our environments
- Science process skills involve critical and logical thinking
- Science process skills give way to answered questions and engineered solutions.

Engaging Science Process Skill

The Basic Science Process Skills

- Making observations
- Sorting and classifying
- Making measurements and calculations
- Making inferences
- Making predictions
- Communicating (experiences, findings, and claims)

Engaging Science Process Skill

The Integrated Science Process Skills

- Hypothesizing
- Experimenting
- Identifying/Controlling Variables
- Collecting, Analyzing, Interpreting Data
- Defining Operationally
- Constructing Models

Engaging Science Process Skill

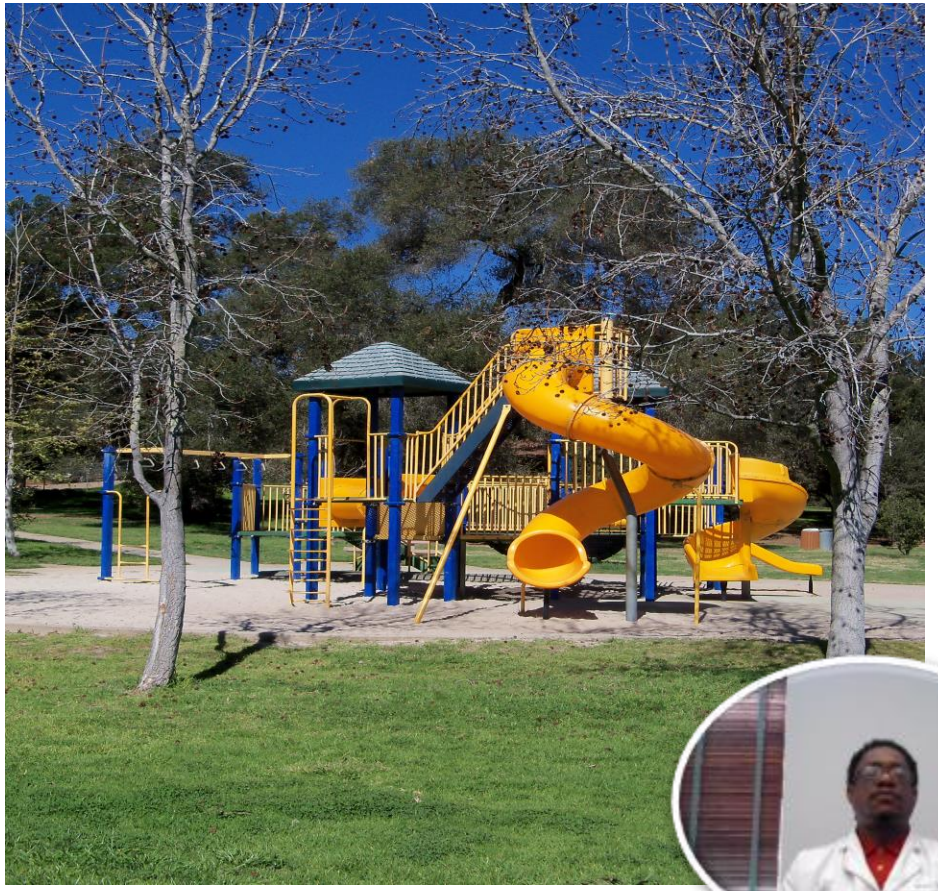
As an instructor, you integrate the science process skills to help learners…

- Carry out focused and objective observations
- Ask appropriate questions and make inferences and predictions
- Properly test their thinking and ideas
- Communicate claims and findings with confidence and evidence

Activity Time: Making Observations

How to Engage Students with Science Process Skills. A Characteristic Walk

- Choose a characteristic (color, shape, etc.)
- Give students something that represents what you want them to observe. A piece of paper the color you want them to look for.
- Go on a walk with students and have them find items that are that color, shape, etc.
- This activity helps students to sort and classify.
- When you get back to class, make a chart of all the different things that were observed that met the criteria.



Making Science Matter

3Dimensions of Teaching and Learning in Pre- Kindergarten

- A three-dimensional approach dispels the step-by-step model of science teaching and learning
- A three-dimensional approach gives students agency and deepens understanding of science concepts
- A three-dimensional approach focuses on making sense of one's environment
- A three-dimensional approach aims to increase science literacy

Dimension 1: The Science and Engineering Practices

- Helps students understand how scientific knowledge is developed
- Gives them an appreciation of the wide range of approaches that are used to investigate, model, and explain the world
- Helps students to understand the work of scientists and engineers
- Increases curiosity and interest in continued study in the sciences.

1. Asking questions and defining problems
2. Developing and using models
3. Planning an carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Dimension 2: The Crosscutting Concepts

- They bridge disciplinary boundaries
- They provide a lens for analysis of topics and systems
- They should become common in practice and across all grade levels
- They should be practiced and taught explicitly

1. Recognizing patterns
2. Cause and effect: mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: Flows, cycles, and conservation
6. Structure and function
7. Stability and change

Dimension 3: The Disciplinary Core Ideas

- Have broad importance across multiple disciplines or be a key organizing concept of a single discipline
- Key tools for understanding complex ideas
- Relate to the interests and life experiences of students or be scientific or technological knowledge;
- Be teachable and learnable over multiple grades

- Life Science
  - Hierarchical Organization
  - Reproduction and Heredity
  - Ecology and Interdependence
  - Adaptations and Diversity
- Physical Science
  - Organization of Matter and Chemical Interaction
  - Motions, Forces, and Energy
- Earth and Space Science
  - Earth's Structure and History
  - Earth and the Universe
  - Earth Systems and Cycles
  - Earth's Resources

Making Science Matter

Engaging Phenomena in Pre-Kindergarten Science

Engaging Phenomena in Pre-Kindergarten Science

- Phenomena bridges conceptual thinking to real-world application and experience
- Phenomena promotes figuring out why and problem-solving as opposed to ”getting the right answer”
- Phenomena promotes conceptual thinking and learning that is transferable
- Phenomena provides authentic student-centered, nearly individualized, learning.
- Phenomena does not have to be mind-blowing; rather, observable and relevant to students

Engaging Science Process Skill

Types of Phenomena

- Anchor Phenomena are used at the beginning of a lesson or unit
- Investigative phenomenon can be explained in days
- Everyday phenomenon is typically used for very short period
- Scenario phenomenon are used best for assessments
- Analogous phenomena are used when local phenomena are not available

Engaging Science Process Skill

Types of Phenomena

Other Tips and Ideas

- Use discrepant events
- Find the science connections in reading books
- Invite community science, shareholders, to speak
- Capture interesting things in your environment
- Create a space for living things (fish tank, small plants that will grow, etc.)
- Join NSTA and MSTA to find and share resources
- **DO SCIENCE DAILY!!!**

Question and Answers

Dr. Kevin L. Gaylor, Ed.D.

K-12 Science Content Director

kgaylor@mdek12.org

mdek12.org

MISSISSIPPI DEPARTMENT OF EDUCATION