Let’s Investigate!
Fully Integrating the Preschool Curriculum
Through Investigation and Explicit Instruction
in Literacy, Science, and Math

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Curriculum Integration and Literacy

All curriculum areas are interrelated, including literacy, mathematics, science, and social studies.

In the preschool setting, it is natural and appropriate to integrate the curriculum and help children build relationships between the knowledge and skills that cross over in all subject areas.

According to the National Research Council (2001), the following three principles are present in an environment that encourages building relationships while learning:

1. Children are provided with experiences that help them build on and extend what they already know.
2. Children learn basic skills in mathematics, science, and literacy. This includes learning skills for gathering information and ways to acquire information about their social and natural worlds.
3. Children develop problem-solving skills in meaningful ways by learning strategies that help them reflect, question, predict, draw conclusions, and evaluate.


Literacy plays an important role in the implementation of each of the three principles. For example:

1. Stories, songs, rhymes, and meaningful discussions are all wonderful ways to begin science and mathematics investigations, to help children build on and extend what they already know.
2. Explicit literacy instruction can take place during shared and guided reading and writing experiences while children work with the teacher to gather information during exploration, discovery, and investigation.
3. Important future reading comprehension skills are developed as children investigate their world and are guided to reflect, question, predict, draw conclusions, and evaluate—these thinking processes will transfer when children read text in the future.
Purposeful Inquiry

Investigation supported by vocabulary, knowledge, materials, and guidance.

Four Key Elements:

• Look and Ask
• Try It and Try Again
• Think About It
• Make Meaning

Watch for opportunities for literacy development as you investigate today. Note where you might incorporate the development of vocabulary, book knowledge, concepts of print, decoding skills, phonological awareness, or writing skills.
Example: What Do Plants Need?

Objectives
- Identify plants as living things.
- Recognize that plants need sunlight to grow.
- Compare and contrast objects and materials.
- Collect, describe, and record information through discussion and charts.

Materials
- “Watch It Grow Cha Cha” from Dilly’s Music and Movement CD
- Oral Language Card 56
- 2 identical houseplants that need ample sunlight
- watering can
- cardboard box
- chart paper, marker

Investigation Question: Do plants need sunlight?

Look and Ask
Create shared context by singing and dancing to the “Watch It Grow Cha Cha.” Discuss the song and the Oral Language Card. Pose the investigation question.

Try It and Try Again
1. Display two identical houseplants. Have children describe what they see. Explain that plants are living things that need water and good soil to grow. Water the plants so children can see the water soak into the soil. Explain that the plant’s roots below the soil take in (absorb) the water and send it to the rest of the plant.
2. Place a plant in a sunny window. Place a box over the other plant. Tell children that they will continue to water the plants, but one plant will receive sunlight and the other will not. Check the plants every time children water them, and take photos of them. As children observe, ask questions such as: Which plant has the greenest leaves? Which plant seems stronger? Which seems weaker? Which plant seems healthier? What makes you think so?
3. Post the photos on a two-column chart titled Plant with Sunlight and Plant in a Box.

Think About It
Have children compare and discuss the chart columns. Guide children to draw the conclusion that plants need sunlight. Remind children that plants also need good soil and water.

Make Meaning
Pose the following question and discuss it with children: If you kept a plant in a dark corner of your living room at home, and it did not seem healthy even though you watered it, what could you do to help it grow?
Station 1: Sensory Stations

Objectives
• Use senses to gather information.
• Use knowledge to solve problems.
• Discuss and draw.
• Make predictions.

Materials
• Bruno’s Buzz: My Five Senses by Beth Alley Wise
• smelling materials (cotton balls soaked with different scented oils in plastic tubs with holes in the lids)
• seeing materials (found objects from nature, magnifying lenses)
• touching materials (variety of textured objects)
• listening materials (musical or music-making toys)
• tasting materials (fresh fruit or vegetable chunks)
• chart paper, marker

Investigation Question: When we investigate, what do we use to find information?

Look and Ask
Create shared context by reading My Five Senses. Tell children that investigators are people who search to learn things they didn’t know before. Then pose and discuss the investigation question.

Try It and Try Again
1. Set out the smelling materials, and model their safe use. Explain that to find out something new, investigators often smell objects. Assign times for small groups of children to explore the Sensory Station. As children visit the station, have them predict the scent in each container. Record their ideas on a chart. After all children have visited the station, reveal the scents that were in each container.
2. Repeat the process with each Sensory Station, creating an appropriate chart for each one. As you observe children, ask questions such as: As you investigate today, which body part is helping you learn something that you never knew before? What do you do with that body part? What sense are you using? What do you know that you never knew before?

Think About It
Discuss the chart made for each Sensory Station, and invite children to answer the investigation question. Guide children to understand that we use all five of our senses to gather information about the world, and that we often use more than one sense at a time.

Make Meaning
Ask children: Is it important for you to see, smell, touch, listen to, and taste objects in your world? What makes you think so? Close by reminding children that they should use their senses safely and ask for help from grown-ups when they explore new things.
Station 2: Boats Afloat

Objectives
- Compare and contrast objects and materials.
- Collect, describe, and record information through discussion and charts.
- Understand changes in materials and cause-and-effect relationships.
- Count to ten and beyond.

Materials
- “Out to Sea” Flapboards
- pictures of a variety of boats
- heavy-duty aluminum foil
- pennies
- tubs of water
- index cards, tape
- chart paper, marker

Investigation Question: What kind of boat design will hold the most pennies before sinking?

Look and Ask
Create shared context by reading and discussing “Out to Sea.” Then discuss pictures of boats, noting if the boats are mainly designed for speed or weight capacity. Pose the investigation question.

Try It and Try Again
1. Have each child construct a boat from a sheet of 8” x 8” aluminum foil.
2. Have children place their boats in tubs of water. Guide children to add one penny at a time, helping them count as they place the pennies. Stop counting when each boat sinks. While testing boats, ask questions such as: Which boats float best? Which boats hold the most pennies? Does it matter where you place pennies? Should you stack them or spread them out as you add them?
3. As children retrieve boats from the water, have each one write his or her name on an index card and how many pennies it took to sink the boat. Record data on a class chart by attaching the index cards.
4. Over time, invite children to construct new boats and test them, trying to increase the number of pennies each time. Create at least one more photo chart.

Think About It
Compare and discuss the data chart. Have children name similar characteristics of boats that held more than 20 pennies, such as wide bottoms, tall lips, and evenly and widely spaced pennies.

Make Meaning
Display a picture of a boat that is made to hold heavy cargo, such as a barge. Help children understand that like their successful boats, this real boat has a wide bottom and cargo is carefully loaded so the boat can hold as much weight as possible without sinking.
Station 3: Go! Go! Go!

Objectives

- Test observations, draw conclusions, and form generalizations.
- Observe and discuss properties of objects and materials.
- Understand order and positions of objects.
- Compare lengths.

Materials

- *I Love Trucks!* by Dayle Ann Dodds
- wide cardboard wrapping-paper tube
- 6 thick books
- small toy truck or car
- yarn and scissors
- chart paper, marker

Investigation Question: What will happen when we send a toy car or truck through a wrapping-paper tube propped on a stack of six books? Will the same thing happen each time we take away each book, one at a time?

Look and Ask

Create shared context by reading and discussing *I Love Trucks!* Talk about vehicles with wheels, and talk about speed as vehicles go down hills. Pose and discuss the investigation questions.

Try It and Try Again

1. Prop one end of a cardboard tube on a stack of six books. Let children place a toy vehicle in the top of the tube and send it down.
2. Help children measure with yarn the distance from the end of the tube to where the vehicle stopped. Cut the yarn and tape it to a six-column chart under the heading *6 books*. Ask: Will the vehicle travel the same distance if we take away a book?
3. Repeat the process with a stack of five books, four books, three books, two books, and one book, adding to the chart. Did the children begin to predict that the vehicle would travel a shorter distance each time a book was removed?

Think About It

Compare and discuss the six columns on the chart. Help children draw the conclusion that the toy vehicle traveled faster and farther when going down a “tall hill” and slower and less far as the hill became shorter.

Make Meaning

Ask children: If you were riding your bike, would you go faster and farther down a long hill or a short hill? Talk about safety and the need to watch where you are riding and to know how your vehicle might act when you go down hills. Also remind children to ask for help from grown-ups when they explore new things.

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Station 4: Ice-Melting Contest

Objectives
- Test observations, draw conclusions, and form generalizations.
- Observe and discuss properties of objects and materials.
- Compare sizes between objects.
- Understand changes in materials and cause-and-effect relationships.

Materials
- *The Snowy Day* by Ezra Jack Keats
- “Our Snowman” poem
- same-size ice cubes
- small paper cups
- paper towels
- chart paper, marker

Investigation Question: How can we melt ice quickly in our classroom?

Look and Ask
Create shared context by reading and discussing “Our Snowman” and *The Snowy Day*. Talk about the ways that snow can melt in nature. Then pose the investigation question and tell children that they will melt ice to answer the question.

Try It and Try Again
1. Provide each child with an ice cube in a paper cup and a paper towel. Give children the following instructions: *You can take the ice cube anywhere in the classroom (except near electrical equipment) and work to melt it as fast as you can*. When the ice cube has melted, say, *Mine melted! Then watch your friends as they melt theirs.*
2. Start the activity at a signal, and invite children to melt the ice cubes. Encourage creative thinking and experimentation, even allowing children who think of it to suck on the ice to melt it.

Think About It
When all the ice cubes have melted, talk about the different ways children melted the ice cubes. Record children’s ideas on a two-column chart with the headings *Fastest Methods* and *Slowest Methods*. Guide children to draw the conclusions that ice needs things like heat, motion, and breaking it into smaller pieces to melt quickly.

Make Meaning
Ask children: *If you wanted to melt ice on your steps at home, what could you do?* As children relate what they learned to answer the question, remind them about safety and asking for help from grown-ups.
Station 5: Color Mixing

Objectives
• Test observations, draw conclusions, and form generalizations.
• Identify colors.
• Mix colors.
• Manipulate materials with simple equipment.
• Understand changes in materials and cause-and-effect relationships.

Materials
• Bruno Bee Mail Poster
• dry erase markers
• white coffee filters
• red, blue, and yellow food coloring
• small cups of water
• eye droppers
• chart paper, marker

Investigation Question: What happens when we mix red and yellow? What happens when we mix red and blue? What happens when we mix blue and yellow?

Look and Ask
On the Bruno Bee Mail Poster, write Name these colors. Then draw red, yellow, and blue squares on the poster. Create shared context by reading aloud and discussing the poster. Have children identify the colors. Say: We can mix these colors to make new ones. Pose the investigation questions, and tell children that they will mix colors themselves to find the answers.

Try It and Try Again
1. Have children help you add red, blue, and yellow food coloring to separate small cups of water. Place an eye dropper in each cup.
2. Provide each child with a coffee filter. Guide children to add drops of colored water to the filter to create the following combinations: red and yellow to make orange, red and blue to make purple, and blue and yellow to make green.
3. Encourage children to discuss the changes in design and color as they add colored water.

Think About It
Display the completed coffee-filter designs. Talk about the mixed colors. Then record children’s findings on a chart of “color equations.”

Make Meaning
Ask children: If you were painting and you wanted to paint with green, but you only had red, yellow, and blue paint, what could you do? After children relate what they learned to answer the question, pose questions about other color combinations.
Involving the Family

Family Investigation Nights
Example: Wagon Wash

Objectives

- Participate in an investigation, think about it, and discuss what happened.
- Solve problems through active exploration and interaction with peers and adults.

Materials

- PVC pipe, connectors, caps
- 1 threaded hose adapter and hoses
- large sponges, string
- hand tools
- old towels and laundry baskets
- children's wagons and tricycles
- camera/film (optional)

Investigation Question: How can we use these supplies to build a wagon wash?

Gather families around the materials, and pose the investigation question. Explain that families will work together to build a wagon wash for children’s wagons and tricycles. Give families time to design and build a wagon wash for the class. As you help and observe, talk about the problem solving and reasoning that is taking place. Take the structure outside, attach the hoses, and turn on the water. Invite families to drive their wagons and tricycles through the wash. If possible, take photographs. When done, guide families to connect the experience to the real world by asking questions such as:

How is a real car wash like your wagon wash? If you were going to build a real car wash, what are some things you would need to do? What else would you need to build it?

At-Home Data Gathering
Example: Water Data

Objective

- Observe, describe, and discuss the natural world.

Investigation Question: How can we find out how much water we use at home?

Pose the investigation question to children. Discuss ideas like We can count the number of times we flush the toilet or We can count the number of glasses of water our family drinks each day. As a group, choose one to investigate such as We can find out how much water we use for a bath or shower. Then ask: What is the best way to gather data about the water? How can you record it? Have the group talk about ideas and choose one, such as We can count the minutes that the water runs to take a shower or fill the bathtub. Provide children with at least a week to gather and record their data at home. Tell children to ask an adult to help them time the running water. When everyone is ready, have them present their data and findings with the class.

Home and Back Book and Journal
See attached example for Maggie Investigates.
Dear Family,

We have been talking about things in the world that make us curious and how we can investigate them. Today your child brought home *Maggie Investigates*, a book to share with you.

1. Please read the book together. Use the illustrations to talk about how Maggie uses her senses to investigate. Point out Maggie’s notebook and how she uses a computer and books to learn more about the things that make her curious. At the end of the story, make a list of some things that you and your child might enjoy investigating together.

2. Help your child choose something to investigate. As you examine together, ask your child to describe what he or she sees, hears, feels, and smells. Then look in books or on the internet together to gather more information.

3. Have your child use the Journal Page to draw a picture showing what you investigated together. Encourage your child to write or dictate notes about his or her observations.

Please have your child bring the Journal page to school tomorrow.

Thank you.

Sincerely,

(Teacher’s Name)
Here is a picture of what I investigated.
Maggie Investigates

The InvestiGator Club
Prekindergarten Learning System

Directions: Photocopy pages 240–241 onto one sheet of paper, front and back. Cut along the dotted lines and fold to make a book. Staple along the inside fold.
Draw something to investigate.

Rose
Background for Grown-Ups

What Do Plants Need?
Plants use sunlight to turn carbon dioxide from the air and water into food. Plants need all of these to remain healthy. This process is called photosynthesis, which means “to put together using light.” When the plant gets enough of these things, it produces a simple sugar (the plant’s food), which it uses immediately or stores in a converted form of starch. Chlorophyll, an important green pigment in plants, helps photosynthesis occur.

Sensory Stations
The senses are physical and neurological responses to stimuli in the environment. Senses allow us to perceive the world around us and take in information that helps us survive. Some scientists believe that humans actually have nine senses: sight, sound, taste, touch, smell, pain, balance, thirst, and hunger.

Boats Afloat
When an object, like a boat, is placed in a fluid, like water, it will sink or float. If it floats, the object experiences an upward force equal to the weight of the water it displaces (pushes away). This force that causes something to float is called buoyancy. Therefore, a foil boat with a wider bottom displaces more water than a boat with a narrow bottom of equal length. The larger amount of water displaced creates a greater force or more buoyancy. Thus the wider-bottomed boat will be able to hold more pennies.

Go! Go! Go!
Many principles of physics contribute to the speed and distance of a vehicle traveling downhill. Some important principles include the following: velocity (the rapidity or speed of motion; specifically, the distance traveled per unit of time) and momentum (the property that allows moving things to overcome resistance and keep moving in the same direction).

Ice-Melting Contest
Ice begins to melt when it reaches just above 32 degrees Fahrenheit (0 degrees Celsius). Water molecules in ice are more strongly attached to each other in a solid form. As ice warms, the heat makes the molecules move faster and away from each other. When warm enough, the molecules cannot cling to each other like they did when they were ice. As the molecules break away from each other, melting happens.

Color Mixing
A primary color is often defined as a color that cannot be created by mixing other colors. Primary colors can be mixed to produce most other colors. Traditionally, the colors red, yellow, and blue are considered the primary colors. A secondary color is a color made by mixing two primary colors.

Recommended Reading

The InvestiGator Club Prekindergarten Learning System
By Joellyn Cicciarelli and Beth Alley Wise

Building Structures with Young Children
By Ingrid Chalufour and Karen Worth
NAEYC Publications

Discovering Nature with Young Children
By Ingrid Chalufour and Karen Worth
NAEYC Publications

The Power of Mindful Learning
By Ellen Langer
Perseus Books (April 1997)

The Power of Story: Teaching Through Storytelling
(2nd Edition)
By Rives Collins and Pamela J. Cooper
Allyn & Bacon (September 1, 1996)

Young Investigators: The Project Approach in the Early Years
By Judy Harris Helm and Lilian Katz
NAEYC Publications