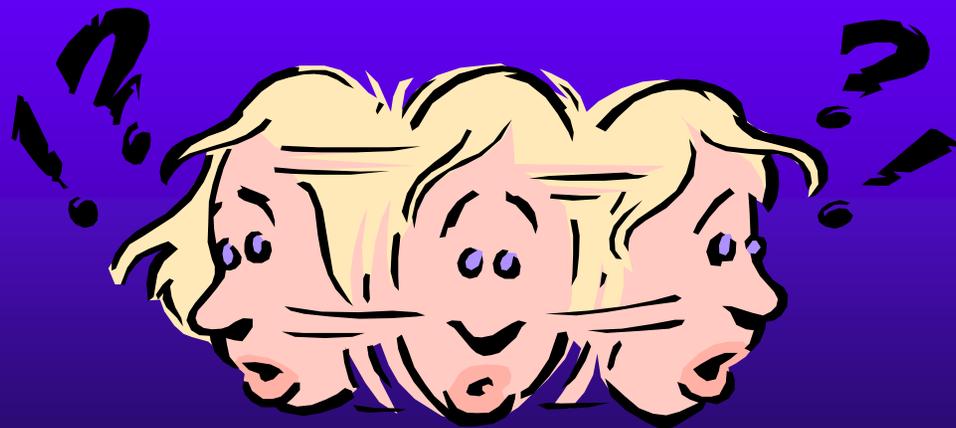




# Inquiry Science

What Is It?



# What is Inquiry?

- ◆ Inquiry is the art and science of asking questions about the natural world and finding the answers to those questions. It involves careful observation and measurement, hypothesizing, interpreting, and theorizing. It requires experimentation, reflection, and recognition of the strengths and weaknesses of its own methods. \*

\* Excerpted from an article by Mary Hebrank, August 21, 2000,  
[www.biology/duke.edu/cibl](http://www.biology/duke.edu/cibl)





# Theories of Learning

- ◆ Behaviorist – teachers impart knowledge to students, monitor practice, review, and test.
- ◆ Constructivist – teachers provide the materials and learning environment that help students construct their own knowledge. Teachers must be skilled in challenging student thinking by asking questions, etc.



# Theory of Teaching

- ◆ Inquiry science is a way of teaching. It follows the constructivist theory of teaching. Basically, teachers help students construct their own learning.
- ◆ Teachers are facilitators of student learning.
- ◆ Students are encouraged to discover important concepts. Constructivists believe students will “own” their knowledge when they are involved in discovery.



# Differences Between Inquiry-based and Traditional Learning Methods

	INQUIRY	TRADITIONAL
Teacher Role	Guide/facilitator	Director/Transmitter
Student Role	Problem Solver	Direction Follower
Student Participation	Active	Passive
Student Involvement	Increased Responsibility	Decreased Responsibility
Curriculum Goals	Process Oriented	Product Oriented
Principle Learning Theory	Constructivism	Behaviorism



# Common Misconceptions About Inquiry

- ◆ Inquiry equals Hands-on - Hands-On does not necessarily mean inquiry and vice versa
- ◆ Inquiry teaches science process, not content - Inquiry *uses* science processes to teach content
- ◆ Inquiry is the sole approach for teaching science - Inquiry is one approach in a balanced science program
- ◆ Inquiry is unstructured or chaotic - Inquiry can be noisy but it is productive noise. Inquiry must be carefully planned or it is unproductive.



# Examining Two Lessons

## ◆ Magnet Lesson

- ◆ Important Science Concept?
- ◆ Hands-On?
- ◆ Discovery?
- ◆ Challenging?
- ◆ Student Choice?
- ◆ Inquiry – Yes or No?

## ◆ Balance Lesson

- ◆ Important Science Concept?
- ◆ Hands-On?
- ◆ Discovery?
- ◆ Challenging?
- ◆ Student Choice?
- ◆ Inquiry – Yes or No?



# Examining Six Lessons From Science Texts

- ◆ Building A Beak – SRA Real Science
- ◆ Animals In The Ocean – Harcourt School Publishers
- ◆ Sorting Rocks – Macmillan McGraw-Hill
- ◆ Desert Leaves – Scott Foresman
- ◆ Day and Night – Houghton Mifflin
- ◆ Float or Sink – Houghton Mifflin

# ACTIVITY

## Building a Beak

### Find Out

Do this activity to see how beaks help birds get food.

### Process Skills

Modeling

Predicting

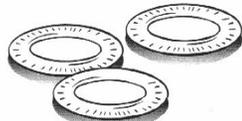
Observing

Communicating

### WHAT YOU NEED



nuts



paper plates



birdseed



tweezers



yarn



clothespin



teaspoons



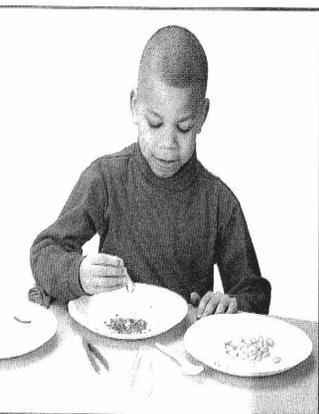
tongs



Activity Journal

### WHAT TO DO

1. Put birdseed on one plate. Put nuts on another plate. Put a piece of yarn on the third plate.



2. Imagine that each of the tools is a bird's beak.

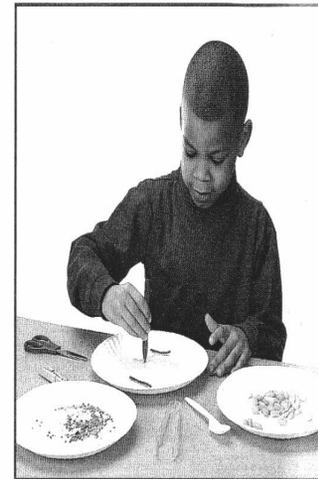
**Predict** what each beak will pick up.

3. Use each beak to try to pick up the birdseed.

**Write** what happened.

4. Use each beak to try to pick up the nuts. **Write** what happened.

5. Use each beak to try to pick up the yarn. **Write** what happened.



### WHAT HAPPENED

1. How are the tools like beaks?
2. What did each tool pick up best?

### WHAT IF

**Look** at the beaks of birds near your school or home. From the shape of their beaks, tell what they can eat.

Important  
Science Concept?  
Hands-On?  
Discovery?  
Challenging?  
Student Choice?  
Inquiry – Yes or No?

# Animals in the Ocean

You need



- ocean animal picture cards

## Step 1

Observe the animals.  
How are they alike?  
How are they different?



## Step 2

Classify the animals  
into groups.



## Step 3

Tell how the animals  
in each group are  
alike. Tell how the two  
groups are different.

### **Inquiry Skill**

When you classify  
animals, you group them  
by ways they are alike.

Important  
Science Concept?  
Hands-On?  
Discovery?  
Challenging?  
Student Choice?  
Inquiry – Yes or No?

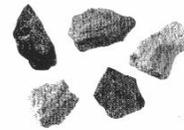
# Explore Activity

## How can you classify rocks?

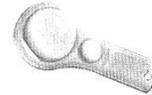
### What to do

- 1** Observe the rocks with the hand lens. Feel them.
- 2** Draw two sorting rings.
- 3** Make your own rule for each ring. Use the rule to **classify** the rocks.
- 4** **FURTHER INQUIRY** Classify the rocks again using a different rule.

### What you need



rocks



hand lens



paper



Macmillan  
McGraw-  
Hill

Important  
Science Concept?  
Hands-On?  
Discovery?  
Challenging?  
Student Choice?  
Inquiry – Yes or No?

# Guided Inquiry

**Investigate** How do desert leaves hold water?

**Materials**



desert leaf shapes



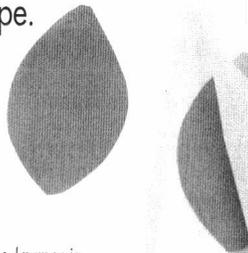
water

**What to Do**

1 Wet the leaf shapes.



2 Fold the waxed paper over one leaf shape.

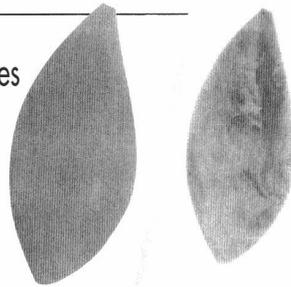


The waxed paper is like a waxy cover on a desert leaf.

**Process Skills**

**Predict** means to tell what you think might happen.

3 Put both leaf shapes in a sunny place.



4 **Predict** Which leaf shape holds water longer?

	Predict	What happens?
		
		

**Explain Your Results**  
**Infer** Why might a desert leaf have a waxy covering?

**Go Further**

What other question do you have about leaves? Plan a test to find the answer.

Important  
Science Concept?  
Hands-On?  
Discovery?  
Challenging?  
Student Choice?

Inquiry – Yes or No?

# Day and Night

## Steps

- 1 **Use Models** Tape your school picture on your clothes. The picture stands for your school on Earth.
- 2 **Infer** Have a partner shine a flashlight on the picture. The flashlight is the Sun. Infer whether it is day or night at school.
- 3 Turn until your school faces away from the Sun's light. Observe whether it is day or night.



## Think and Share

1. When was it day at school? When was it night?
2. **Predict** What will happen if you keep turning? Try it.

## Investigate More!

**Experiment** Mark on a globe where you live. Then use a flashlight and turn the globe to model day and night where you live.

Important  
Science Concept?  
Hands-On?  
Discovery?  
Challenging?  
Student Choice?  
Inquiry – Yes or No?

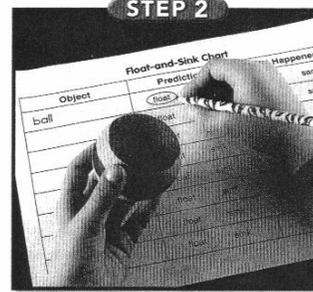
## Float or Sink

### Steps

- 1 Pour water into a tub.
- 2 **Predict** Choose an object. Decide if it will float or sink. Write your prediction.
- 3 **Observe** Put the object in the water. Watch what happens.
- 4 **Record Data** Write what happened. Test other objects.

### Think and Share

1. Compare your prediction with what you observed.
2. **Infer** What is the same about the objects that floated?



### Investigate More!

**Experiment** Take a ball of clay. Change its shape to make it float. Draw the shape you made.

Important  
Science Concept?  
Hands-On?  
Discovery?  
Challenging?  
Student Choice?  
Inquiry – Yes or No?



# Characteristics of Inquiry

- ◆ **Inquiry is asking questions.** But not just any questions, *good* questions. Questions that are *accessible*. Questions that *can be answered* in part or in whole. Questions that lead to meaningful tests and explorations.
- ◆ **Inquiry is what scientists *do*.** They usually do it in a formal and systematic way, and in the process, contribute to the collective body of information we call knowledge.



# Characteristics of Inquiry

- ◆ **In experiencing science as inquiry, students learn how to *be* scientists.** Thus, students learn more than just a body of concepts and facts, they learn the processes involved in establishing those concepts and facts.
- ◆ **Inquiry provides students with concrete, active learning experiences.** Students take the initiative. They develop problem-solving, decision-making, and research skills that enable them to become lifelong learners.



# Characteristics of Inquiry

- ◆ **During inquiry, a teacher may pose a question or cajole students into posing their own questions.** These questions are often open-ended, offering students the opportunity to direct their own investigations and find their own answers (not just the *one right* answer), and in all likelihood, they lead to *more questions*.
- ◆ **Inquiry allows for the integration of curricula.** As students explore, they will tend to ask questions that will involve both science and math, social studies and language arts, technical and artistic skills.



# Characteristics of Inquiry

- ◆ **Inquiry involves communication.** Students must ask coherent, meaningful questions. And they should report their results, orally or in writing. In this way, they both teach and learn from each other.
- ◆ **Inquiry allows students at different developmental states to work on similar problems and even collaborate in finding solutions to those problems.** Each student gets to bring his or her own special talents into play.



# Characteristics of Inquiry

- ◆ **Inquiry allows teachers to learn about their students – who they are, what they know, how their minds work.** These insights will enable teachers to be more effective facilitators in their students' pursuit of knowledge.
- ◆ **Inquiry requires students to take responsibility for their own education.**

# Resources

- ◆ Go to <http://www.learner.org/resources/series129.html#> Excellent site!!!!Videos that teach what inquiry is.
- ◆ The Having of Wonderful Ideas by Eleanor Duckworth  
Excellent book on inquiry and easily read
- ◆ FOUNDATIONS :  
<http://www.nsf.gov/pubs/2000/nsf99148/htmstart.htm>
- ◆ Best Practices link on inquiry:  
<http://wblrd.sk.ca/~bestpractice/inquiry/index.html>
- ◆ <http://www.educ.msstate.edu/wctp/>



# RESOURCES

- ◆ Inquire Within: Implementing Inquiry Based Science Standards by Douglas Llewellyn
- ◆ <http://head-www.harvard.edu/ECT/HomePage.html>
- ◆ Doing What Scientists Do: Children Learn to Investigate Their World by Ellen Doris This book teaches about observation which is one process of inquiry. It is *not* the entire process of inquiry but it is a good place to start.

