GH10053 A Gryphon House Book

Early Childhood Education

Not just for sciEntists!

Easy Explorations for Young Children

Leonisa Ardizzone, EdD

SCIENCE: Not Just for Scientists! EASY EXPLORATIONS FOR YOUNG CHILDREN

Leonisa Ardizzone, EdD

DEDICATION

for Rafaella

ACKNOWLEDGMENTS

I gratefully acknowledge the support and guidance of these people:

My parents, Ron and Marie, who made me the explorer I am; two exceptional science teachers, Ms. Bell and Ms. Eisner, who set me on my scientific path many moons ago;Ms. Lucille Schmeider and Dr. Mildred Brammer, former science professors who continue to believe in me; my numerous progressive education colleagues from twenty-plus years in the field; my dear friend/editor/ sounding board, Anne Gehris, who read and reviewed my manuscript; my partner, Chris Clavelli; my daughter, the eternally curious Rafaella; the people of Washington Heights and beyond who supported my experiment in place-based science education, Storefront Science; the children who attend classes with me, especiall my Early Explorers who unwittingly tested so many of the ideas represented in this book; and to Stephanie Roselli and the folks at Gryphon House, Inc., for giving my ideas a home.

BULK PURCHASE

Gryphon House books are available for special premiums and sales promotions as well as for fund-raising use. Special editions or book excerpts also can be created to specifications. For details, contact the Director of Marketing at Gryphon House.

DISCLAIMER

Gryphon House, Inc., cannot be held responsible for damage, mishap, or injury incurred during the use of or because of activities in this book. Appropriate and reasonable caution and adult supervision of children involved in activities and corresponding to the age and capability of each child involved are recommended at all times. Do not leave children unattended at any time. Observe safety and caution at all times.

SCIENEE Not just for sciEntists!

Easy Explorations for Young Children

Leonisa Ardizzone, EdD

Photography courtesy of Shutterstock.com



GRYPHON HOUSE, INC. Lewisville, NC

COPYRIGHT

©2014 Leonisa Ardizzone

Published by Gryphon House, Inc. P. O. Box 10, Lewisville, NC 27023 800.638.0928; 877.638.7576 (fax) Visit us on the web at www.gryphonhouse.com.

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or technical, including photocopy, recording, or any information storage or retrieval system, without prior written permission of the publisher. Printed in the United States. Every effort has been made to locate copyright and permission information.

Cover photograph courtesy of Shutterstock.com © 2014.

LIBRARY OF CONGRESS CATALOGING-IN-PUBLICATION DATA

Ardizzone, Leonisa, 1968- author.
Science--not just for scientists! : easy explorations for young
children / Leonisa Ardizzone, EdD.
pages cm
Includes bibliographical references and index.
ISBN 978-0-87659-484-1
1. Science--Juvenile literature. 2. Science--Methodology--Juvenile
literature. 3. Science--Study and teaching. I. Title. II. Title:
Science, not just for scientists!
Q163.A783 2014
500--dc23

Table of Contents

Introduction
CHAPTER ONE: PATTERNS
Patterns in Nature
Patterns in Our Neighborhood
Patterns in the Sky: Clouds
Patterns in the Sky: Solar System
Patterns in the Sky: Constellations
Patterns We Create
CHAPTER TWO: CAUSE AND EFFECT
How High?
What Color Is Your Water?
Where Will I Grow Best?
Rolling Downhill
Chain Reactions
CHAPTER THREE: SIZE AND SCALE
Big, Small, and In-between
Who Can Live Here?
Exploring Measurement
Solar System Walk
Incredible Shrinking Food
CHAPTER FOUR: CHANGE AND GROWTH
Tracking Our Shadows
Chemical Change

Sprouts!
Yum! Butter!
Teeny Tiny Yeast
CHAPTER FIVE: ENERGY
Energy Path
What Form Am I?
Get Wired!
Here Comes the Sun
Clay Play
CHAPTER SIX: SYSTEMS
Water, Water Everywhere74
My Body
How Do We Get from Here to There?
Exploring an Ecosystem
I Love My Bicycle
CHAPTER SEVEN: HOW THINGS WORK
Take It Apart!
Build a Model
Simple Machines
Tinker Time
Suspension Bridge
Resources
Index

INTRODUCTION WHY SCIENCE MATTERS

You wake up to the alarm clock on your smartphone. You press a remote control that turns on the television. You fall out of bed and review your email while pulling up a favorite tune on your desktop. You amble to the kitchen where you pour a cup from your automatic coffeemaker and pop some vitamins to keep yourself healthy.

All the luxuries we have gotten used to—the fridge, the phone, the Internet don't seem like luxuries at all. They're so common now that we forget that forward-thinking scientists made all these things possible. The science that you might have dreaded in high school has made your life longer, easier, and healthier.

Science is the force behind innovation, advancement, and progress. Science is the reason we have cured diseases, improved communication, easily traveled to other countries, and even voyaged to heavenly bodies. Clearly, science isn't just about facts we learn in a classroom.

Science is a habit of mind that involves problem solving, critical thinking, and analytical assessment. As citizens, we are asked each day to make decisions from the seemingly mundane—what vegetables to buy—to the more complex whether to follow a treatment a doctor has suggested—that require some level of scientific understanding. The more informed we are, the better the decisions we make about what we eat, where we live, how we live, what we consume, and so on. Using a scientific mind-set, we are better able to analyze our choices. We are better observers who can see connections, understand where things come from, and predict what effects our choices will have.

At the core of scientific thinking is a quest for truth and understanding. This quest drives innovation. On the path to truth and innovation lie wonder, discovery, and analysis, all three of which are innate to children. This habit of

mind—the practice of thinking through problems and questions—must start with young children. Focus on cultivating their developing scientific minds.

Educators and parents will have an easier time integrating science into their students' and children's lives by remembering a few premises:

- Start with open-ended investigation. Just as scientists start with an inquiry (not an answer), provide children with an open-ended question, a problem to solve, or a design challenge. Give them materials to explore and offer guidance as they investigate. Let them work toward a solution or the development of even more questions.
- Develop children's observation skills. To prepare students for these open-ended investigations, be sure they understand the primary tool of science: observation. This second premise comes quite naturally to children, but observation must be expanded beyond what children see. They can easily record or verbally share their visual and aural observations. Dependent upon the task, they can feel, smell, and taste. These three senses can be useful even if only asking children to imagine what something might feel like, taste like, or smell like.
- Repeatedly expose children to the practices and concepts of

science. This will increase understanding and enhance the cultivation of the scientific mind. Children absorb a lot, but often they don't grasp concepts on the first pass. Lay a solid foundation with repeat practices—enhancing and diving deeper each time.

- Connect content to children's reality and interests. Base activities on what is happening in the community; what plants and animals are found locally; and what the children are reading, watching, or talking about. Ask them what they are interested in, and collect their ideas. Base activities and learning units on their input.
- Allow ample time for questioning, exploration, and analysis. Reward curiosity by encouraging children to ask questions and explore content.
 Help them analyze their observations and organize their findings. Teach

them to sort by a variety of variables such as color, use, sound, or texture. Focus on the process and learn alongside children. For example, if a child wants to know more about roller coasters, don't be afraid of physics. Instead, get some building materials and investigate with her the forces that make roller coasters run.

The importance of science and science education must not be understated. Science plays an important role in global society. Looking toward the future, the demand for science and technology skills in employment is increasing; workers and consumers alike need to understand complex systems and applications of technology. Capitalize on and promote the inherent love of science that children have. Wonder and exploration make life more interesting! The things we don't understand become our inspiration for knowing more.

The important thing is not to stop questioning. Curiosity has its own reason for existing.

-Albert Einstein



ALLOW INQUIRY TO HAPPEN

Because the process of science centers on questioning, it is really important to let inquiry happen. What does that mean? Sometimes when working with children, we want to make sure they are learning something or getting enough information. In a true inquiry space, the process is less about the answers and more about the questions. This can be challenging. A room full of children asking why would make anyone want to respond with a concrete explanation. Take heart in knowing that, eventually, answers will emerge, but the questioning process is just as important, if not more so. A few pointers on questioning:

- Ask open-ended questions. When observing an object or starting an exploration, keep things simple. Use questions such as, "What do you notice?" "What does it remind you of?" "How is this object used?" "Who do you think invented this?" "What does it have in common with _____?" and "Where might this animal live?" For younger children, open-ended questions can be challenging. To get things flowing, ask some yes-or-no or compare/ contrast questions, such as, "Do you have a tail like the rat?" "Is this shell smooth or bumpy?" and "How are these two insects the same?" This is especially useful with children who are just learning to express their ideas and opinions about what they observe.
- Don't stifle their thinking. Children will surely come up with some outrageous ideas during the inquiry process. Rather than saying, "No, that's not right," ask them why they think that, and see where additional questioning can lead.
- Turn questions back to children. If a child asks you a question, turn it back to her: "Why do you think that happens?" gives her the chance to engage her scientific thinking.
- Don't be afraid to say, "I don't know." Instead of this phrase being an end to learning, use it as an opening to deeper exploration. If you get stumped, ask the children, "How can we investigate that further?" Then, work together to find ways to gather more information. This could include additional research, reading books, or inviting a guest speaker to talk with the children.

Let tangents happen. While we may want children to focus on the task at hand, sometimes their tangents can lead to very interesting learning. Creating a truly constructivist and play-based learning experience means allowing children to share their thinking and giving them time and space to direct their own learning.

How to Use This Book

This book is meant to be a guide and an inspiration. Adapt the lesson ideas to your comfort level and the abilities and interests of the children. The focus is on process and cultivating scientific thinking. The chapters are organized around themes drawn from *A Framework for K–12 Science Education: Practices, Crosscutting Concepts, and Core Ideas:* patterns, cause and effect, size and scale, change and growth, systems, energy, and how things work. Each chapter provides an introduction to the theme and activities for you to incorporate. Do the activities in any order. Use those that you are most comfortable with or, better yet, those that the children are most interested in. I encourage you to step outside your comfort zone and teach something you've never taught before!

If you feel you don't know enough content, don't worry. Share in the process of learning. Help the children to see the world differently; think creatively and critically; analyze, categorize, and make meaning. Embrace the process of science. Remember, no matter where you are or who you are working with, science can be done. Science isn't facts and figures. It is wonder and exploration. It is asking why and how and generating methods to uncover truth and understanding.

CHAPTER ONE Patterns

If you take time to observe a young child playing, at some point you will see him organizing and grouping his toys. Children make collections and may call them *families*. They may sort items by shape, size, or color. They may categorize objects to create an orderly system and then find things in the room that "match." They are, in essence, practicing classification and creating patterns. Patterns are everywhere, and very young children seem to intuitively find them and point them out.

In the early childhood curriculum, patterns play an important role and are typically explored through math and the arts. However, patterns are an exceptional way to bring more science into your classroom or home. Patterns are abundant in both nature and the human-built world. A walk down the street or a stroll in the forest presents numerous examples of how humans and nature tend toward order and are oriented in patterns. From the simple the shape of an elm leaf or of windows—to the complex—the number of pine needles in a bundle or the whorls of fingerprints—patterns are everywhere and provide a gateway into cultivating the scientific mind.

Why are we drawn to patterns, and what functions do they serve? First, patterns help us make sense of the world. They break and sort information into meaningful "chunks," allowing children to generate new understandings. For children, this sorting and organizing helps their awareness of the world and how things work, enabling them to make meaning. Second, understanding patterns sets the groundwork for an awareness of and appreciation for ordering. Understanding order, systems, and increasingly more complex patterns aid in the development of critical thinking. In a busy world where we are bombarded with information, patterns allow us to discern the important from the unimportant, laying the groundwork for informed decision making. And finally, patterns are the basis for our system of classification of living and nonliving things. For example, rocks are organized into three groups and living things into five kingdoms. Why does classification matter? It organizes phenomena, allowing for a systematic method of seeing similarities and differences among living and nonliving things.

Playing with patterns is powerful pedagogy. Together, children and adults can create parallels, analogies, and relationships to understand how the world works and how systems exist. Scientists are continually looking for patterns this is how they answer some of the most complex questions they pose. These patterns arise through data and observations—of the universe, of animal behavior, or of cells in a Petri dish. Collecting information and seeing what patterns emerge is an important part of scientific practice. As children apply this practice, they will develop their own scientific minds. Ultimately, through making observations, asking questions, creating groupings, and drawing conclusions, children will not only see that they can control their learning but also develop

skills and habits of mind that will serve them for years to come.

Since patterns are accessible for children and tie into topics already part of the early childhood curriculum, adding a science dimension is not difficult. The following activities are designed to tap into the innate patternunderstanding and patternmaking ability of children. They will use scientific thinking and process to make decisions and defend and explain those choices.

The activities do not have to be done in sequence. Use the activity that fits the interest levels of the children you are working with. There is no time frame: The activities can be done for one week or an hour or as a standing exploration in a corner or a table in your classroom or home, allowing children to return to their exploration whenever they would like. Give the children plenty of time and space to explore, and join them in their discoveries!



16

ESSENTIAL QUESTION: What patterns do we observe in the natural world?

OBJECTIVES:

- Children will explore patterns by examining and classifying objects from nature.
- They will create collections based on characteristics they observe.

MATERIALS:

flowers insects (preserved in resin or glass) leaves magnifying glasses pebbles pinecones preserved plants and animals rocks shells

Patterns in Nature

METHODS:

 Place the specimens on a large table where the children can observe. Alternatively, you can create collection boxes, and place them on tables for the children to work with in small groups. You could also create the collection together by gathering samples on a walk in your local environment or by having the children bring in something from home.



- 2. Ask the children, "What are all these things?" Give them all time to name what they see.
- 3. Give them magnifying glasses, and encourage them to see details.
- 4. When possible, let them feel the objects and describe the textures. Elicit details from them: "a rock" could become "a gray, sparkly rock."
- 5. Encourage them to compare items to other objects in the group, in the room, or at home.
- 6. Have the children make groups of two to five items based on characteristics the items have in common. You may have to guide them with a characteristic. Groupings can be based on color, texture, shape, habitat, sound, smell, function, and so on. Take photos of their groupings for display.





- 7. Have them explain their groupings: "All of these have lines running through them." "All of these are fuzzy." "All of these live in water." Discuss and reflect on their observations and groups. If possible, take video or audio recordings of the children explaining their groupings.
- Continue making groupings using a variety of characteristics. Use their descriptions whenever possible, but also lead them.
- Guide the children to the connections between two groups—for example, "These two groups are based on color, and these two are based on texture."
- 10. Guide the children to understand that objects may belong in more than one group. For example, a bunch of pine needles is both spiky and green. A seashell is spotty and smooth. Begin a discussion of how objects have many characteristics and therefore can be grouped in different ways. For children who are ready for a challenge, help them complete a Venn diagram to illustrate how two disparate groups may create a third group with characteristics in common.
- 11. To check for understanding, you can have the children play Name that Characteristic! Two to three children can create a grouping, and the other children have to guess what the items have in common.

Patterns in Our Neighborhood

METHODS:

- 1. Show the children pictures of shapes. For very young children, just seeing the pictures and hearing the names is fine. They do not need to know their shapes before going on the walk.
- Prepare the children for a neighborhood walk. Explain to them that they will be observers, hunting for shapes, forms, and patterns. Give them clipboards, a Field Guide for Neighborhood Walk, a Field Guide to Shapes, and a pencil or crayon.



ESSENTIAL QUESTION: What patterns do we see in our neighborhood?

OBJECTIVES:

- Children will explore patterns by examining their local environment.
- They will begin to identify shapes and forms.
- They will generate questions about their observations.

MATERIALS:

binoculars cameras clipboards Field Guide for Neighborhood Walk Field Guide to Shapes paper pencils or crayons



- 3. Take a walk. This could be as simple as a stroll around the block or school or a short walk down the street.
- 4. As you walk, ask the children to notice the structures around them. Look at sidewalk slabs, windows, bricks, fences, doors, and so on. Ask the children to recall the shapes you talked about earlier. Do they see any of those shapes in the structures? What patterns do they see?
- 5. When they see something interesting, allow them to stop to record what they see. For example, if a child says he sees a circle, he can write, "Circle on school," or he can simply draw a picture. The key is that the children notice details around them, not that they accurately record everything they notice. **Tip:** If you have a camera, take pictures of what they point out and make prints for later use.
- Upon returning from the neighborhood walk, ask the children to share their data. Talk with them about the shapes and patterns they noticed. Create charts with their findings—for example, how many rectangles, how many windows, and so on.
- Give the children the photos you took, and let them create groupings and patterns of the photos of what they saw on the walk.

Table 2.1						
FIELD GUIDE TO SHAPES						
Name						
Shape	Shape Name	How Many Do	Where?			
		You See?				
•						
$\overline{}$						

VARIATIONS:

- Have the children identify living and nonliving things on a walk. What evidence do they see of these things? How do they know if something is living or nonliving?
- Create a scavenger hunt for the children to do on a walk. Give them a checklist of things to look for. When they are comfortable with the scavenger hunt, they can create their own lists for friends or family members to complete.

Table 2.2				
FIELD GUIDE FOR NEIGHBORHOOD WALK				
Name				
Date and time of observations:				
Count or draw what you see:				
Trees	Other Plants	Animals		
List, draw, and describe the shapes and sizes of what you see:				
Draw specific structures and specimens here:				

Patterns in the Sky: Clouds

METHODS:

- Take the children outside and observe the clouds. Provide them with paper, markers or crayons, and clipboards. Encourage them to draw their observations. Continue this for as many days as you would like. Try to do it at the same time each day. Date each drawing for later use.
- 2. After they have observed the sky for a few days, help them organize their drawings in date order and ask them to describe what they see. Do the clouds look the same every day? Are they different shapes or different colors? What characteristics do they have? Are they tall, short, fluffy, silky, and so on? Help them to see that their scientific observations are leading to the establishment of a pattern.
- 3. On another day, present a cloud chart to the children, or take a look at a website that features photos of different types of clouds, such as http://cloudappreciationsociety. org. Encourage the children to try to match their cloud observations to the pictures.
- 4. As they make the connection between their own observations and the types of clouds on charts, ask them to make predictions of what clouds they may see over the next few days.

ESSENTIAL QUESTION: What patterns exist in the sky?

OBJECTIVE:

Children will examine clouds to identify similarities and differences.

MATERIALS:

clipboards digital camera images of types of clouds markers or crayons paper ESSENTIAL QUESTION: What patterns exist in the sky?

OBJECTIVE:

Children will notice details of planets and the moon.

MATERIALS:

markers or crayons paper photos of the moon and planets

Patterns in the Sky: Solar System

METHODS:

- Show the children a picture of the moon. Ask them what it is. Have them describe what they see. Encourage them to describe it in as much detail as possible. To help them use their observation skills, ask them what they think it would smell, taste, feel, and sound like.
- 2. Show them pictures taken from space of Earth and of other planets in our solar system. Ask some open-ended questions:
 - Where are these things?
 - How can we take pictures of them?
 - What lives there?
 - Have you ever visited there?
- 3. Ask them to describe each planet in terms of all their senses:
 - What do you think it tastes like?
 - What does it smell like?
 - Do you think it has a sound? What sort of sound does it make?
 - What do you think it feels like?
 - Create a chart to record their observations.
- 4. Ask them to notice particular similarities and differences among the planets and moon, such as color, size, and so on.
- 5. Using the photos, create a "map" on the floor or wall of the solar system. The aim here is for them to see that the planets are interrelated and that they create a pattern.



ESSENTIAL QUESTION:

What patterns exist in the sky?

OBJECTIVE:

Children will notice details of constellations.

MATERIALS:

images of constellations, such as the Little Dipper, the Big Dipper, and Andromeda markers or crayons paper

Patterns in the Sky: Constellations

METHODS:

- 1. Give the children blank sheets of paper and a single marker or crayon. Ask them to make dots on the page in any way they choose.
- 2. Ask them to exchange sheets with a neighbor (only if they want to) and then connect the dots to make images of animals, people, seashells, trees, or anything else they wish.
- 3. When they are finished, ask them to share their dot-to-dot pictures. Ask them to discuss how they made their choices. Why did they pick those animals or people? Was it hard or easy to connect the dots?
- 4. Show children pictures of the night sky. Ask them what they see. Ask them to share what they know about stars.
- 5. Ask them how they think people can remember the names of all these stars. People looked at the stars and saw pictures there. That is how they kept track of the stars in the sky. Ask volunteers to trace a figure in the stars like the ones they created on paper. Introduce the word *constellation:* "a pattern created by linking stars together into a picture."
- 6. Show them pictures of the most commonly understood constellations, such as the Little Dipper, the Big Dipper, Andromeda, and so on, so they can see how "sky pictures" were created. A useful site for images of several constellations can be found at http://stars.astro.illinois.edu/ sow/const.html.

SCIENCE IS EASY! obsERVE. EXPLORE. arvalyzE. REPEat.

Children are natural scientists, drawn to wondering, exploration, discovery, and analysis. Science: Not Just for Scientists! gives you simple ideas to open up the world of discovery to young children. Through open-ended explorations, you will discover how to cultivate children's natural curiosity by asking simple questions: How? When? Where? And the most famous of all children's questions: Why?

The hands-on activities will empower children to question, experiment, and develop abstract reasoning skills. Children will explore patterns, cause and effect, size and scale, change and growth, energy, and how things work. Easy to follow, step-by-step activities lead children and their caregivers through a new world of discovery. It's simple and fun to investigate: Patterns in Our Neighborhood Who Can Live Here? Big, Small, and In Between Simple Machines The Water Cycle Energy Path and so much more!

> Leonisa Ardizzone, EdD, has been a science educator for more than twenty years. After completing her doctorate at Columbia University, she was assistant professor at Adelphi University and Fordham University. She served as the

executive director of the Salvadori Center, which does professional development for teachers in architecture and engineering. She is the owner of Storefront Science, a science exploration program in New York City. Every day, she helps children "explore outside their doors."



\$12.95 ISBN: 978-0-87659-484-1 A Gryphon House Book www.gryphonhouse.com

