

SAMPLER

Animals Two by Two

INVESTIGATIONS GUIDE



FOSS PATHWAYS™

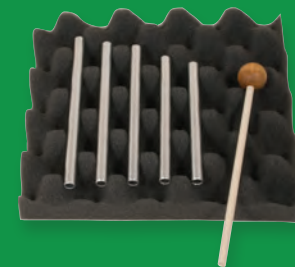
Developed at
The Lawrence Hall of Science

PreK–5 science that meets the challenge of our time

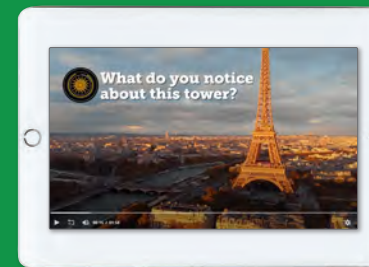
Welcome to new FOSS® Pathways™. Now as never before, the world needs scientific thinkers—to view the world thoughtfully, approach challenges analytically, and embrace opportunities enthusiastically. For educators to help unlock this potential in their students, they need powerful tools that work for the needs of today. A program that engages students of all backgrounds and experiences. Fully leverages modern digital technology. And does it all in the hours available.

A major advancement from a proven leader

FOSS®, a longtime leader in science education, has stepped forward to meet that challenge with the newly streamlined FOSS Pathways™. Pathways was designed to provide teachers with everything they need to meet standards in the time they have allotted to teach science. In these pages, you will see how Pathways:



Aligns to national science standards using three-dimensional teaching, learning, and assessment



Incorporates the digital tools for a flexible multimedia experience



Lends flexibility to teach in the class time allotted for science



Utilizes a multimodal approach to resonate with every student



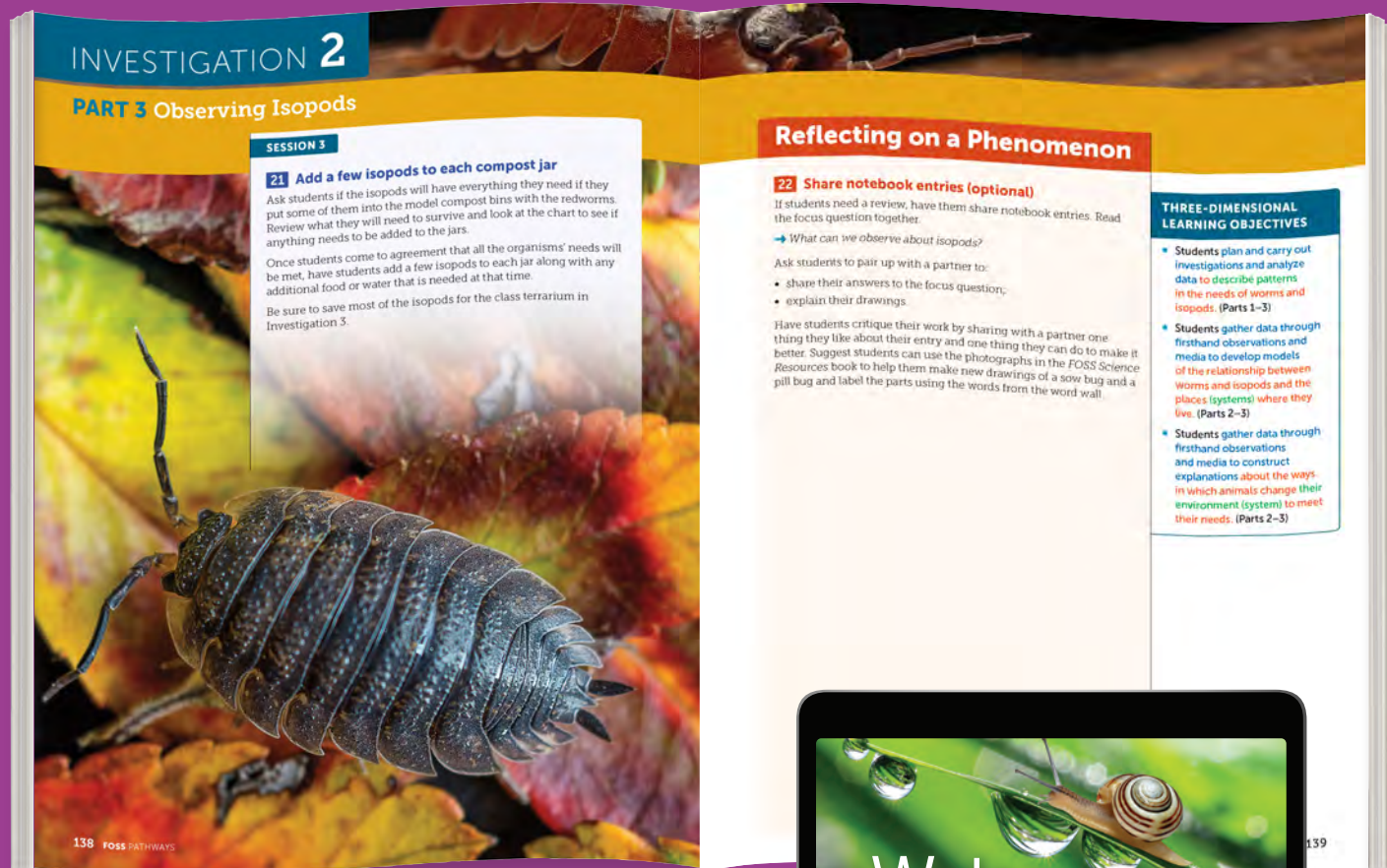
Immerses students in figuring out local and relevant phenomena and engineering problems



Provides unmatched teacher support to teach phenomena-based science

How Pathways develops the scientific thinkers of tomorrow

New FOSS Pathways supports today's demand to develop scientifically literate thinkers and problem solvers in a multitude of ways.



A logical progression

Students develop core ideas in a relevant and coherent learning progression that allows them to construct an explanation of the phenomena they have experienced.

Support for students

Comprehensive support and multimodal instructional experiences engage learners of all languages and cultures, taking advantage of prior experiences so all students can reason scientifically.



Evidence of learning

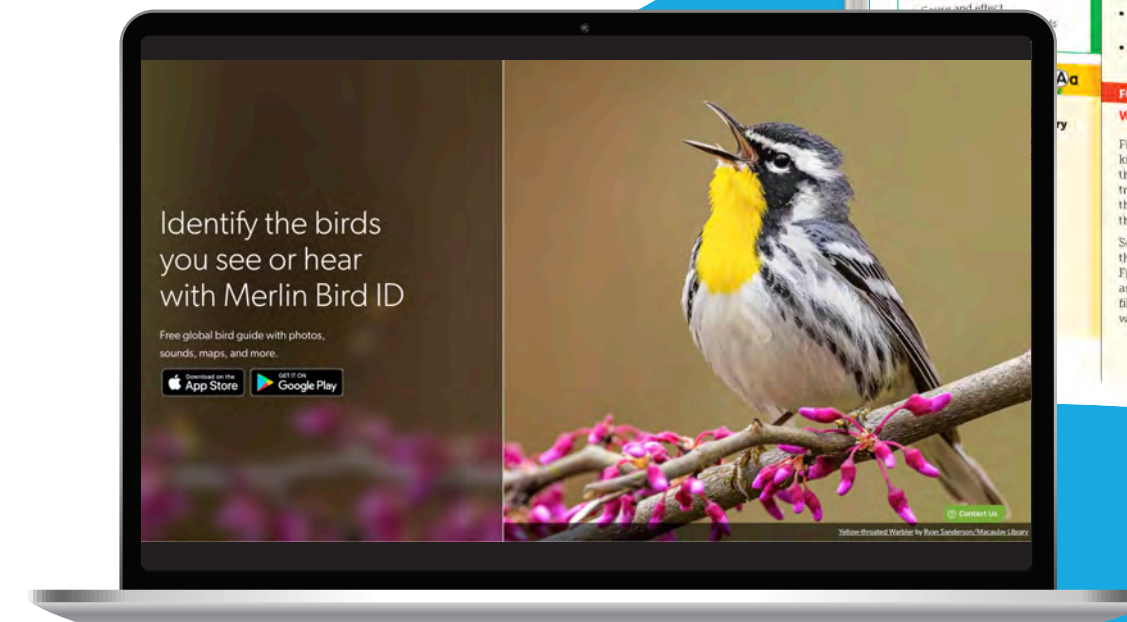
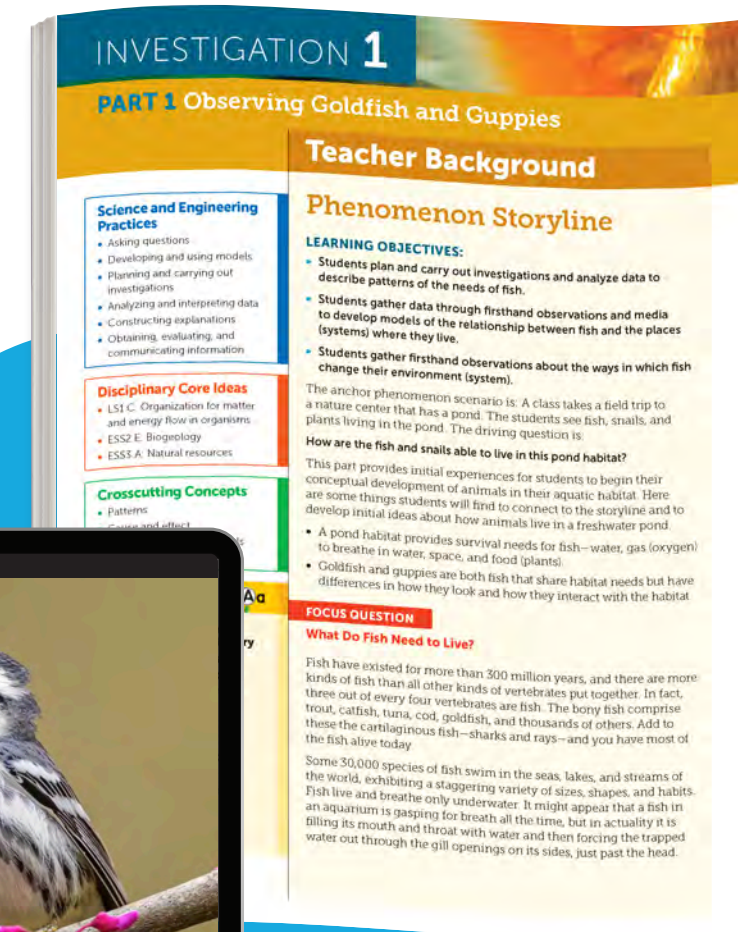
Research-based and field-tested assessments accurately measure student learning and progress. A variety of formative assessment tools provide evidence of students' use of the three dimensions and their knowledge of phenomena.

Support for teachers

Phenomena-based instruction is facilitated by appropriate educative support. This includes explicit background information needed for teachers to engage students in making the connection between the anchor phenomenon being investigated and the core ideas being exposed.

Rich digital resources

Digital resources for students and teachers are provided through FOSSweb on ThinkLink™. These multimedia materials are purposefully designed to enhance the learning experience and lend the flexibility to keep active science teaching viable if classroom circumstances change.



How FOSS Pathways aligns with today's standards

In this Sampler, pages 9-19 and 21-39 are provided from the teacher *Investigations Guide*. As you review, you will begin to witness the numerous ways that FOSS Pathways supports the development of tomorrow's scientists, engineers, and informed citizens. You'll see examples for:



Investigations driven by local, relevant phenomena and real-world problems

Instruction led by multimodal experiences that cognitively engage students to figure out phenomena



Identification of performances to meet targeted learning goals and elicit evidence of students' use of all three dimensions

Instructional support for teachers that provides an explicit connection between the phenomenon, three-dimensional learning, and multimodal learning experiences



Clear integration of ELA/ELD skills and practices, with ties to standards and resources for engaging multilingual students

Cross-curricular activities that give students a choice and voice to differentiate instruction



► Images on this page include actual components, resources and/or materials provided in FOSS kits.

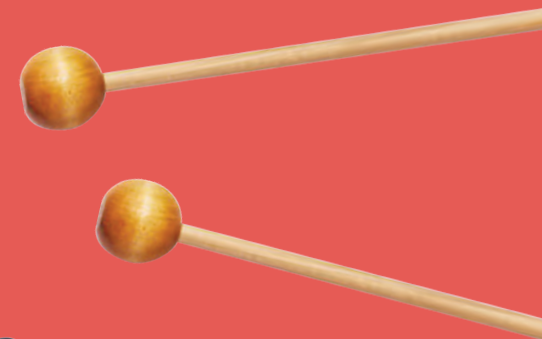
How FOSS aligns to NGSS Performance Expectations

Grade K NGSS Performance Expectations FOSS Animals Two by Two Module

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.

K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.



Animals Two by Two Investigations

Investigation 1: Designing Aquariums

- Part 1: Observing Goldfish and Guppies
- Part 2: Observing Water Snails

Investigation 2: Worms and Isopods

- Part 1: Observing Redworms
- Part 2: Redworm Habitats
- Part 3: Observing Isopods

Investigation 3: Designing Terrariums

- Part 1: Animals and Plants Living Together

Investigation 4: Schoolyard Birds

- Part 1: Comparing Birds
- Part 2: Changes Caused by Animals

Animals Two by Two

► Start here to begin your review of the Grade K Animals Two by Two Investigations Guide.

Introduction

The **Animals Two by Two Module** provides students with firsthand experiences to help them develop an understanding of what animals need to survive and the relationship between their needs and where they live. Appropriate classroom habitats that serve as model systems are established for some organisms, and students provide what the animals need to live and grow. In several investigations, animals are studied in pairs.

- Anchor phenomenon 1—A pond habitat for animals
- Anchor phenomenon 2—Animals living in a compost bin
- Anchor problem 3—A classroom land habitat for animals
- Anchor phenomenon 4—Pencil-sized holes in a tree trunk

Throughout the module, students engage in science and engineering practices by asking questions, planning and carrying out investigations, observing, recording, and interpreting data to build explanations, and obtaining information from photographs. Students use models and engage in argument from evidence. They gain experiences that will contribute to an understanding of the crosscutting concepts of patterns; cause and effect; systems and system models; and structure and function.

CONTENTS

- Introduction
- Module Matrix
- Conceptual Flow of Module
- FOSS Pathways Teaching Schedule
- FOSS Investigation Organization
- The Elements of the FOSS Instructional Design
- Diversity, Equity, and Inclusion
- Establishing a Classroom Culture

The NGSS Performance Expectations bundled in this module include:

Life Sciences
K-LS1-1 *

Earth and Space Sciences
K-ESS2-2 *
K-ESS3-1 *

* The two other FOSS modules for grade K also address these performance expectations.

NOTE

The three modules for grade K in FOSS Pathways are:

- Trees and Weather
- Materials and Forces
- Animals Two by Two

Module Matrix

At a Glance

Phenomenon and Storyline	Driving Question and Focus Questions	Content and Disciplinary Core Ideas	Practices and Crosscutting Concepts	NGSS PEs
<p>INV. 1 Designing Aquariums</p> <p>Phenomenon 1—A pond habitat for animals: A class takes a field trip to a nature center that has a pond. The students see fish, snails, and plants living in the pond.</p> <p>Storyline: Students engage firsthand with fish and design model pond habitats. Students observe the structures and behaviors of goldfish and guppies. They feed the fish and enrich the aquarium in which the fish live. They compare the structures and behaviors of the goldfish to those of another fish, guppies. Students compare photos of fish and read about fish in different habitats. They add plants (elodea) and two kinds of water snails to the aquariums and predict how the system will change. Students monitor the aquariums for 10 weeks.</p>	<p><i>Driving question:</i> How are the fish and snails able to live in this pond habitat?</p> <p>FOCUS QUESTIONS:</p> <p>What do fish need to live?</p> <p>What do water snails need to live?</p>	<p>LS1.C: Organization for matter and energy flow in organisms ESS2.E: Biogeology ESS3.A: Natural resources</p> <ul style="list-style-type: none"> • Fish are animals and have basic needs—water with oxygen, food, and space with shelter. • Fish have structures that help them live and grow—to find food, sense their habitat, and move from place to place. • Different kinds of fish have similar but different structures and behaviors. • Fish can change their environment by eating plants and causing their water to turn green with algae. • Snails are animals and have basic needs—water, air, food, and space with shelter. • Different kinds of snails have some structures and behaviors that are the same and some that are different. • Snails can change their environment by eating plants and algae. 	<p>Science and Engineering Practices</p> <p>Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations Obtaining, evaluating, and communicating information</p> <p>Crosscutting Concepts</p> <p>Patterns Cause and effect Systems and system models Structure and function</p>	<p>K-LS1-1: Use observations to describe patterns of what plants and animals (including humans) need to survive.</p> <p>K-ESS3-1: Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.</p>
<p>INV. 2 Worms and Isopods</p> <p>Phenomenon 2—Animals living in a compost bin: Students open the lid of the garden compost bin to add food scraps. They are surprised to observe some small animals, smaller than snails, in the bits of food and soil in the bin.</p> <p>Storyline: Students engage with organisms found in a compost bin habitat. Students have firsthand experiences with redworm structures and behaviors. They construct model compost jars and provide for the needs of the worms. Students observe how the worms change the plant material in their habitat into soil. Students compare photos and read about worms and their activities in soil.</p> <p>Students have firsthand experiences with isopods. Students observe and compare the structures and behaviors of two kinds of isopods and find out what they need in their habitat. They learn to identify which are pill bugs and which are sow bugs. They compare photos and read about isopods.</p>	<p><i>Driving question:</i> How are the small animals able to live in the compost bin?</p> <p>FOCUS QUESTIONS:</p> <p>What can we observe about worms?</p> <p>What do worms need to live?</p> <p>What can we observe about isopods?</p>	<p>LS1.C: Organization for matter and energy flow in organisms ESS2.E: Biogeology ESS3.A: Natural resources</p> <ul style="list-style-type: none"> • Worms are animals and have basic needs—water, food, air, and space with shelter. • Worms have identifiable structures. • Worm behavior is influenced by conditions in the environment. • Worms change plant material into soil. • Isopods are animals and have basic needs—water, air, food, and space with shelter. • Different kinds of isopods have some structures and behaviors that are the same and some that are different. • Pill bugs and sow bugs eat dead and decaying plant matter and help to enrich the soil. 	<p>Science and Engineering Practices</p> <p>Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations Engaging in argument from evidence Obtaining, evaluating, and communicating information</p> <p>Crosscutting Concepts</p> <p>Patterns Cause and effect Systems and system models Structure and function</p>	<p>K-LS1-1: Use observations to describe patterns of what plants and animals (including humans) need to survive.</p> <p>K-ESS2-2: Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.</p> <p>K-ESS3-1: Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.</p> <p><small>NOTE: The other two FOSS modules for grade K also address these three performance expectations focusing on plants and humans.</small></p>

Module Matrix

At a Glance CONTINUED



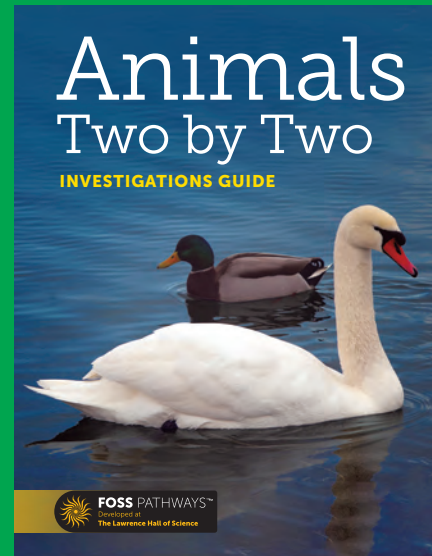
Phenomenon and Storyline	Driving Question and Focus Questions	Content and Disciplinary Core Ideas	Practices and Crosscutting Concepts	NGSS PEs
<p>INV. 3 Designing Terrariums</p> <p>A problem to solve 3—A classroom land habitat for animals: Students have designed a model pond habitat and a model compost bin habitat. They now want to design a model land habitat for animals.</p> <p>Storyline: Students revisit the class aquariums and observe what has changed and then extend their understanding of anchor phenomenon 1, a classroom water habitat for animals. In the second anchor phenomenon, students focused on land animals and plants. Now students build a class terrarium to observe how several animals live together with plants. They put the two kinds of isopods into a terrarium, then add objects from the natural environment to create an appropriate habitat for the animals. They also review the needs of plants.</p>	<p>Driving question: <i>What do animals need to survive in a classroom land habitat?</i></p> <p>FOCUS QUESTION: What do animals need to live on land?</p>	<p>LS1.C: Organization for matter and energy flow in organisms ESS3.A: Natural resources</p> <ul style="list-style-type: none"> Plants grow from seed and need water, light, and space. Plants provide food, shelter, and moisture for land animals. A terrarium is a system that can provide for the needs of plants. Pill bugs and sow bugs are land animals and have basic needs—water, food, air, and space with shelter. A terrarium with plants is a habitat that can provide for the needs of isopods and other small garden animals. 	<p>Science and Engineering Practices Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations Obtaining, evaluating, and communicating information</p> <p>Crosscutting Concepts Patterns Systems and system models</p>	<p>K-LS1-1: Use observations to describe patterns of what plants and animals (including humans) need to survive.</p> <p>K-ESS3-1: Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.</p>
<p>INV. 4 Schoolyard Birds</p> <p>Phenomenon 4—Pencil-sized holes in a tree trunk: Students hear a loud tapping noise coming from a tree in the schoolyard. They look up at the tree trunk and see a bird fly away. Then they notice pencil-sized holes on the tree trunk.</p> <p>Storyline: Students go bird watching in the schoolyard to observe and compare the structures and behaviors of common birds. Students read about birds, their needs, and their habitats. The reading provides examples of how birds change their environment to meet their needs.</p> <p>Students make final observations of the model systems they set up and observed in previous investigations—classroom aquariums, terrarium, and compost-bin jars. Students engage in argument about how animals change their surroundings using information gathered from their firsthand investigations, readings, and ideas presented in a video.</p>	<p>Driving question: <i>What caused the holes in the tree trunk and why?</i></p> <p>FOCUS QUESTIONS: How do bird structures differ from one kind of bird to another? How do animals change their environment?</p>	<p>LS1.C: Organization for matter and energy flow in organisms ESS2.E: Biogeology ESS3.A: Natural resources</p> <ul style="list-style-type: none"> Birds are animals that have basic needs and live in different habitats. Different kinds of birds have similar but different structures and behaviors. Plants and animals can change their surroundings. Woodpeckers drill holes in trees to get food (insects and sap). 	<p>Science and Engineering Practices Asking questions Planning and carrying out investigations Analyzing and interpreting data Constructing explanations Engaging in argument from evidence Obtaining, evaluating, and communicating information</p> <p>Crosscutting Concepts Patterns Cause and effect Systems and system models Scale, proportion, and quantity Structure and function</p>	<p>K-LS1-1: Use observations to describe patterns of what plants and animals (including humans) need to survive.</p> <p>K-ESS2-2: Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.</p>

FOSS Pathways includes:

Investigations Guide

The *Investigations Guide* is a spiral-bound guide containing everything you need to teach the module. FOSS active investigation lesson plans include:

- Three-dimensional learning objectives
- Relevant and local phenomena storylines with driving questions
- Sense-making discussions
- Embedded assessment and “What to Look For” guidance
- Vocabulary reviews
- English language support strategies
- ELA strategies and connections



Science Resources Student Book

The *FOSS Science Resources* student book contains readings developed to reinforce, extend, or apply core ideas covered during FOSS active investigations. Readings give students opportunities to:

- Use text to obtain, evaluate, and communicate information
- Use evidence to support their ideas during sense-making discussions and focus question responses
- Integrate information from multiple sources
- Interpret graphs, diagrams, and photographs to build understanding

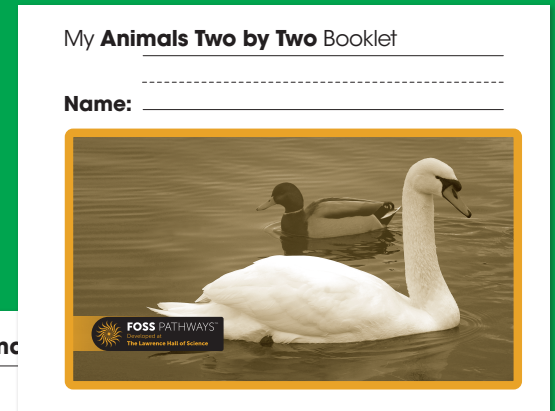
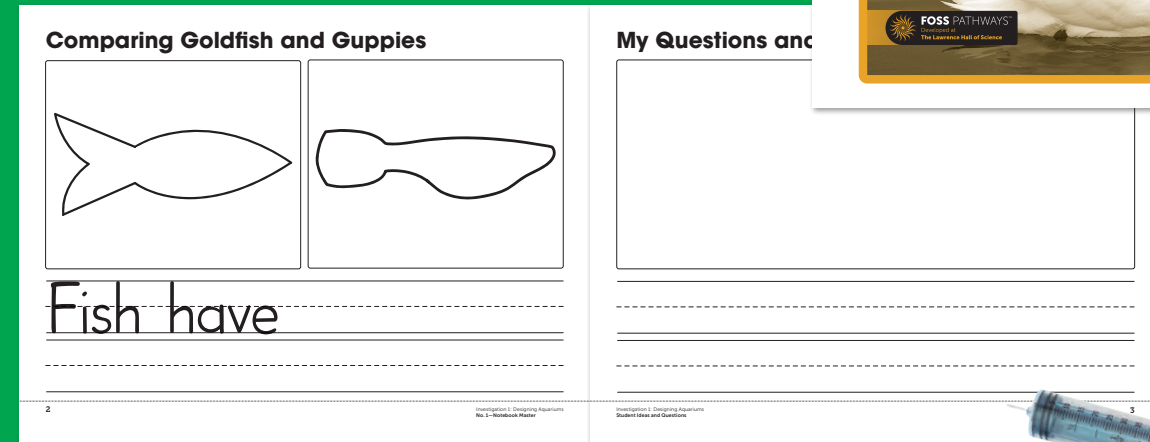
Available in print and as an interactive eBook in English and Spanish.



► Images on this page include actual components, resources and/or materials provided in FOSS kits.

Consumable Booklets

FOSS Booklets contain the Science Notebook Masters in a convenient booklet along with additional pages for writing and/or drawing opportunities and anchor phenomena explanations. There is one copy included in the kit. Additional copies are sold separately.



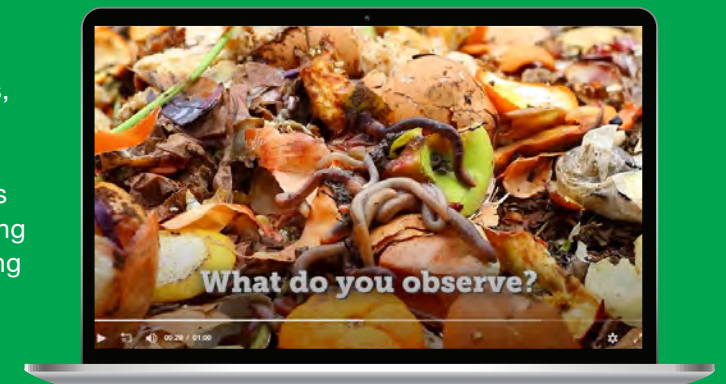
Equipment Kit

FOSS provides the equipment needed for all the investigations, including metric measuring tools. Our high-quality, classroomtested materials are long-lasting and packaged by investigation to facilitate preparation and clean up. There is enough permanent equipment in each kit for 24 students. Consumable materials are supplied for three uses. Convenient grade-level and refill kits are available.



Technology

Online resources include duplication masters, the *Investigations Guide*, teaching slides, FOSSmap online assessment, streaming videos, virtual investigations, and tutorials, as well as a library of teacher resources, including access and equity, three-dimensional teaching and learning, and environmental literacy.





**SCAN HERE FOR A
TOUR OF FOSSWEB!**

FOSSweb

FOSSweb digital resources are delivered on School Specialty's curriculum platform called ThinkLink.

- Supports single sign-on and class management with Google classroom and learning management systems.
- Provides access to both teacher and student digital resources, including duplication masters, teaching slides, FOSSmap online assessment, streaming videos, and online activities.

Teaching Slides

Downloadable and editable slides from FOSSweb can be used to facilitate each part of each investigation. Teaching slides are available as Google slides in English and Spanish.



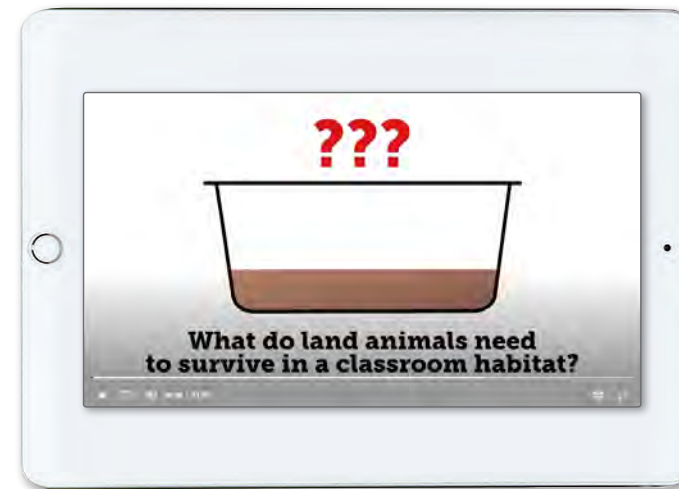
Streaming Videos

New engaging content videos in English and Spanish were developed to specifically support FOSS investigations.



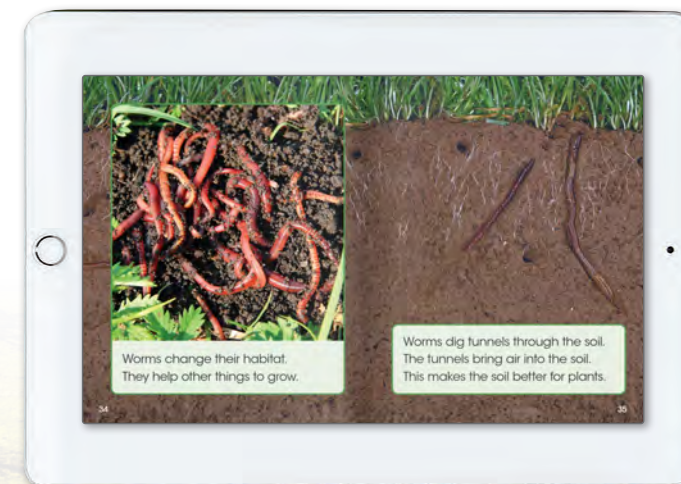
Online Activities

New engaging simulations developed to address core ideas in FOSS, and interactive virtual investigations and tutorials offer additional content support for students.



Interactive eBooks

Keep your students engaged while teaching literacy skills with interactive *FOSS Science Resources* eBooks. The eBooks include integrated audio with text syncing and links to online activities and videos that bring the photos to life.

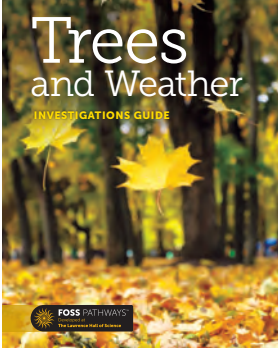
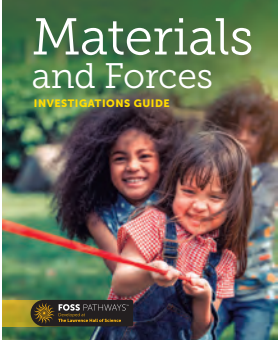
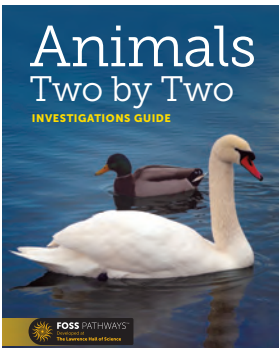


FOSSmap Online Assessment

Students in grades 3–5 can take summative assessments online with automatic coding of most responses. Student- and class-level reports help you identify the need for instructional next steps.

Grade Level Planning Guide

FOSS Pathways Modules Grade K

FOSS Module	Module Overview/Bundled Performance Expectations	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts
 <p>Earth Science</p>	<p>The Trees and Weather Module provides students with experiences to develop an understanding of what plants need to survive in their environment. Systematic investigation of trees over the seasons will bring students to a better understanding of trees at school and in the community. Students will observe day-to-day changes and patterns in weather over the year as well as the impact weather has on living things.</p> <p>NGSS PEs: Life Sciences: K-LS1-1 Earth Sciences: K-ESS2-1 K-ESS2-2 K-ESS3-1 K-ESS3-2 Physical Sciences: K-PS3-1</p>	<p>LS1.C: Organization for matter and energy flow in organisms ESS2.D: Weather and climate ESS2.E: Biogeology ESS3.A: Natural resources ESS3.B: Natural hazards PS3.B: Conservation of energy and energy transfer</p>	<ul style="list-style-type: none"> Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Using mathematics and computational thinking Constructing explanations Engaging in argument from evidence Obtaining, evaluating, and communicating information 	<ul style="list-style-type: none"> Patterns Cause and effect Systems and system models Structure and function Stability and change
 <p>Physical Science</p>	<p>The Materials and Forces Module provides experiences that heighten students' understanding of the physical world as they perform tests to observe properties of materials such as wood, paper, and fabric. They learn about different materials to engineer a shade structure. Students observe and compare pushes and pulls, the speed and motion of moving objects, and collisions.</p> <p>NGSS PEs: Physical Sciences: K-PS2-1 K-PS2-2 K-PS3-1 K-PS3-2 Earth Sciences: K-ESS2-2 K-ESS3-3 ETAS: K-2-ETS1-1 K-2-ETS1-2 K-2-ETS1-3</p>	<p>PS2.A: Forces and motion PS2.B: Types of interactions PS3.B: Conservation of energy and energy transfer PS3.C: Relationship between energy and forces ESS2.E: Biogeology ESS3.C: Human impacts on Earth systems ETS1.A: Defining and delimiting engineering problems ETS1.B: Developing possible solutions ETS1.C: Optimizing the design solutions</p>	<ul style="list-style-type: none"> Asking questions and defining problems Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations and designing solutions Engaging in argument from evidence Obtaining, evaluating, and communicating information 	<ul style="list-style-type: none"> Patterns Cause and effect Systems and system models Scale, proportion, and quantity
 <p>Life Science</p>	<p>The Animals Two by Two Module provides young students with opportunities to observe differences in structure and behavior and to learn about basic needs of animals.</p> <p>NGSS PEs: Life Science: K-LS1-1 Earth Sciences: K-ESS2-2 K-ESS3-1</p>	<p>LS1.C: Organization for matter and energy flow in organisms ESS3.A: Natural resources ESS2.E: Biogeology</p>	<ul style="list-style-type: none"> Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations Engaging in argument from evidence Obtaining, evaluating, and communicating information 	<ul style="list-style-type: none"> Patterns Cause and effect Systems and system models

FOSS® Pathways™ is an engaging PreK–5 science program developed at the Lawrence Hall of Science for the Next Generation Science Standards (NGSS). This sampler will introduce you to the major components of the program and show examples from FOSS Pathways Animals Two by Two Investigations Guide.

Recommended Scope and Sequence FOSS Pathways

GRADE	PHYSICAL SCIENCE	EARTH SCIENCE	LIFE SCIENCE
PK	Observing Nature		
K	Materials and Forces	Trees and Weather	Animals Two by Two
1	Sound and Light	Changes in the Sky	Plants and Animals
2	Solids and Liquids	Water and Landforms	Insects and Plants
3	Motion	Water and Climate	Structures of Life
4	Energy	Soils, Rocks, and Landforms	Senses and Survival
5	Mixtures and Solutions	Earth and Sun	Living Systems

Learn more at FOSSPathways.com

Scan the QR code and explore additional
FOSS Pathways Samplers today.



Developed at:

**The Lawrence
Hall of Science**
UNIVERSITY OF CALIFORNIA, BERKELEY

Published & distributed by:

 **Delta Education**

