

NGSS Support Guide

Publisher	Kit Title
3 rd Grade	Structures of Life

Background

In 2013 the Washington State Legislature adopted the *Next Generation Science Standards* as the 2013 Washington State Science Learning Standards. The *Next Generation Science Standards* are built upon a “three-dimensional” vision of science learning that exists at the intersection of the *Science and Engineering Practices*, the *Crosscutting Concepts*, and the *Disciplinary Core Ideas*. The Office of the Superintendent of Public Instruction established a multi-year transition timeline and plan to achieve full implementation by the Spring of 2018. Informed by this transition plan, regional LASER science materials centers decided to bring together experienced teachers to provide guidance to those who shared their instructional materials about how best to begin moving to this new paradigm of science learning while still using their existing instructional materials. This guide is one product of that work.

What this Guide Is

The writers of this guide want to help you put the kids in the driver’s seat of engaging in science – a key shift in the *Next Generation Science Standards*. They intend this guide to provide you with ideas on how best to build student capacity to work as a scientist or engineer using the *Science and Engineering Practices*; on how best to think about the learning by engaging students in using the *Crosscutting Concepts*; and all while engaging in the content ideas that already exist within this instructional material.

This guide does not align this instructional material to the Next Generation Science Standards, but it assists teachers in aligning instruction and student experiences with the goals of the Next Generation Science Standards. **This guide does not** represent a re-write of the instructional material, neither does it present newly-developed material. It is meant to help you adjust your use of your existing unit toward a more “three-dimensional” implementation.

Directions for Using this Guide

Before teaching this unit, please refer to the Support Guide to review the *Science and Engineering Practices* and *Crosscutting Concepts* for each investigation. The guide highlights what the teacher and student does in each investigation to support the Next Generation Science Standards *Science and Engineering Practices* and *Crosscutting Concepts*. If you need support on using *Science and Engineering Practices* refer to Appendix F and for *Crosscutting Concepts* refer to Appendix G in the *Next Generation Science Standards*. For example, in Investigation 1- the *Science and Engineering Practice* is Analyzing and Interpreting Data. Therefore, the teacher should model recording observations on a class chart and the students will observe and record data. It is strongly recommended that you have an understanding of the shifts envisioned by the NGSS by familiarizing yourself with the [Framework for K-12 Science Education](#). If

you would like more information on the Disciplinary Core Ideas that are the focus of this kit, please read [Life Science Core Idea 1.B](#) as well as [Life Science Core Idea 2.D](#).

Heads-Up/Things you might need in order to use this guide

A Core Idea question from the *Framework for K-12 Science Education* has been selected as a Best Fit for this unit. This question can be used as a target for the duration of the unit. You will notice 2 additional investigations that have been added to this kit – Bones (Investigation 5) and Owl Pellets (Investigation 6). These investigations were added to deepen and extend student learning on the Crosscutting Concepts of Systems and Systems Models, as well as Structure and Function. The focus on these investigations should not be for students to memorize the names of bones, but rather to connect the concepts of Structure and Function and/or Systems explored earlier in the unit to other organisms. These new Investigations are supported by the reading material in the FOSS Science Resources student books (Labelled Investigation 4 in the books).

For More Information

If you have questions about this guide or its content, please direct your inquiry to your Regional Science Coordinator or Science Materials Center.

NGSS Transition Support Guide – FOSS Template

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Investigation 1	Classroom Instruction	Science and Engineering Practice	Crosscutting Concept	Helpful Modifications
Origin of Seeds		Analyzing and Interpreting Data Students make observations and/or measurements to produce data to serve as the basis for an explanation of a phenomenon.	Structure and Function Different materials have different substructures, which can sometimes be observed.	Core Idea – from NRC Framework How can there be so many similarities among organisms yet so many different kinds of plants and animals? (LS-4)
1.1 The seed search	What the student does	1.1 Students represent data in a histogram to reveal patterns that indicate relationships (all fruit have seeds of some type) (p.13).	1.1 Students observe the structures of various fruits and compare their seeds (type, size and number).	1.1 Do not just tell students that beans are a fruit (p. 13). Instead, allow students to discover the properties of fruit (all have seeds) by exploring the provided fruits. Begin the lesson with a probing question like, “Is it a fruit or a vegetable?” Give students a list of fruits and ask them to sort them into 2 columns- <i>Fruit</i> and <i>Vegetable</i> . Discuss and elicit students’ ideas about the criterion used to call something a fruit. Question: “How do you know that something is a fruit?” Explore this

				question thoroughly before, during, and after the exploration through facilitated discourse.
1.2 The sprouting seed	What the student does	1.2 Students record their observations of sprouting seeds (p. 22)	1.2 N/A	1.2 Do not just tell students that seeds are living (p. 22). Use the investigative question or science probe, "Are Seeds Alive?" (Keely, Vol. 3) to open the lesson with discourse. If seeds are alive, then what do we need to do to get them to start growing?
1.3 Seed soak	What the student does	1.3 Students measure, record and compare weight and size of seeds before and after soaking, and interpret to explain physical changes (p. 30).	1.3 Students separate the subsystems of a soaked seed (seed coat, cotyledon, embryo), then draw and label the bean subsystems as a visual model.	1.3 N/A
Throughout the investigation:	What the teacher does	<ul style="list-style-type: none"> Teacher models how to obtain, and record data. Teacher asks probing questions to facilitate interpretive thinking. Teacher facilitates class discourse to analyze observations/data and develop conceptual understanding of results. 	<ul style="list-style-type: none"> Teacher provides a guiding question, asks probing questions of students throughout investigation and inquiry, and facilitates class discourse to deeply explore the topic of seeds and their subsystems. Teacher uses the specific language of systems, i.e. system, subsystem or substructure, function. 	<ul style="list-style-type: none"> Integrate literacy connections through Science Resources book, notebook entries, and speaking and listening strategies.

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Investigation 2	Classroom Instruction	Science and Engineering Practice	Crosscutting Concept	Helpful Modifications
Growing Further		<p>Analyzing and Interpreting Data</p> <p>Make observations and /or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.</p>	<p>Stability and Change</p> <p>Change is measured in terms of differences over time and may occur at different rates.</p>	
2.1 Germination	What the student does	<p>2.1</p> <p>Students observe and record the progression of germination of different seeds to understand that seeds germinate and develop at different rates (p.11-12).</p>	<p>2.1</p> <p>Students observe and compare rates of germination in different seeds.</p>	<p>2.1</p> <p>Use the investigative question, “What do seeds need to live and grow?” to guide thinking and experimentation.</p> <p>Have students sort seedlings by seed type. Students then order the seedlings into a progression of least (seed the same size) to most change (root, stem, and leaf). Students record the patterns of change through sketching and compare to see how patterns of change among different plant seeds are the same and different.</p>

<p>2.2 Hydroponics</p>	<p>What the student does</p>	<p>2.2</p> <p>N/A</p>	<p>2.2</p> <p>Students observe and compare rates of germination in different seeds.</p>	<p>2.2</p> <p>Now that the seeds have germinated, begin by eliciting student ideas about what the baby plants need to grow and develop. As a class, create a list of these elements and the purpose of each. Students will include soil in the list; however the purpose of soil is to hold nutrients and to support the plant. Ask students to discover which other element could serve those same purposes (water).</p> <p><i>Opportunity for Scientific Investigation:</i> Pose the question, “Will plants grown in water be taller/healthier/greener etc... than those grown in soil?” As a class, develop a way to test the question.</p>
<p>2.3 Life cycle of the bean</p> <p>Throughout the investigation</p>	<p>What the student does</p> <p>What the teacher does</p>	<p>2.3</p> <p>Students observe, measure, and record plant growth to record change over time and to understand that plants can grow in a medium that is not dirt (p. 20-21).</p> <ul style="list-style-type: none"> • Teacher models how to obtain, and record data. • Teacher asks probing questions to facilitate thinking. • Teacher facilitates discourse to analyze observations/data and develop conceptual understanding of results. 	<p>2.3</p> <p>Students analyze their plant growth data to understand and describe how plants change over time.</p> <ul style="list-style-type: none"> • Teacher provides a guiding question, asks probing questions of students throughout investigation and inquiry, and facilitates class discourse to deeply explore the topic of growth, life cycles and reproduction. 	<p>2.3</p> <p><i>Opportunity for Engineering:</i></p> <p>Instead of telling students how to build a supporting bean pole structure, present the problem to the students and ask each group to engineer a support structure using available materials (constraints).</p>

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Investigation 3	Classroom Instruction	Science and Engineering Practice	Crosscutting Concept	Necessary Modifications
Meet the Crayfish		Constructing Explanations Construct and explanation of observed relationships.	Cause and Effect Cause and effect relationships are routinely identified, tested and used to explain change.	Core Idea – Driving Question Are crayfish territorial, or do they enjoy interacting in a group?
3.1 Meet the crayfish	What the student does	3.1 Students represent crayfish subsystems using a labeled visual model (p. 13).	3.1 Students observe crayfish in different situations and record their response to stimuli. What causes them to react in this way?	3.1 Have students actually draw from observation a visual model of the crayfish to experience scientific recording of specimens (instead of giving the copy to label). This visual model should be larger than life to record as much detail as possible. Take a photograph of a crayfish on centimeter grid paper. Print copies for students. Students can measure and label the dimensions of the subsystems in order to reason about the proportions in relation to each other. You could photo a different crayfish for a group. Compare and order crayfish by length, width etc... They may also determine and compare the area of the crayfish body as well as specific subsystems (CCSSM 3.MD.C.6). What differences among species exist? Why?

3.2 The crayfish habitat	What the student does	3.2 N/A	3.2 N/A	3.2 <i>Opportunity for Engineering:</i> Instead of telling students how to put together the crayfish habitat, collaboratively develop a list of the needs and wants of crayfish. Ask the students to engineer the perfect habitat for the class crayfish using available materials.
3.3 Crayfish and home	What the student does	3.3 Students develop an explanation for one crayfish behavior in response to stimuli.	3.3 Students observe the effect of stimuli on crayfish behavior.	3.3 Use a Claims-Evidence-Reasoning format to make sense of crayfish response to each stimulus. Students make a claim about why their crayfish responds with a given behavior, provides evidence for the claim from observation and reasoning, and explains how that evidence supports their claim.
3.4 Crayfish territory	What the student does	3.4 Students record crayfish behavior regarding territoriality.(p. 27-29).	3.4 Students record and begin to construct an argument to explain the cause of the crayfish's behavior.	3.4 Structure a Claims-Evidence-Reasoning discussion to answer the driving question.
Throughout the investigation:	What the teacher does	<ul style="list-style-type: none"> Teacher models how to obtain, and record data. Teacher asks probing questions to facilitate interpretive thinking. Teacher facilitates class discourse to analyze observations/data and develop conceptual understanding of results. 	<ul style="list-style-type: none"> Teacher provides a guiding question, asks probing questions of students throughout investigation and inquiry, and facilitates class discourse to deeply explore the topic of social interaction in crayfish. 	

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Investigation 4	Classroom Instruction	Science and Engineering Practice	Crosscutting Concept	Necessary Modifications
Snail Investigations	Note: this investigation can be skipped in the interest of time.	Planning and carrying out investigations Plan and conduct an investigation collaboratively to produce data as the basis for evidence.	Structure and Function Subsystems have shapes and parts that serve functions.	Driving Question- How are crayfish and snails the same? Different? Why do these similarities and differences exist?
4.1 Land snails at home	What the student does	4.1 N/A	4.1 N/A	4.1 <i>Opportunity for Engineering:</i> Instead of telling students how to put together the snail habitat, collaboratively develop a list of the needs and wants of snails. How will the list be the same as the crayfish and why? How will it be different and why? Ask the students to engineer the perfect habitat for the class snails using available materials.
4.2 Comparing crayfish and snails	What the student does	4.2 N/A	4.2 Students compare crayfish and snail subsystems and their functions using a VENN diagram (p. 16-18).	4.2 Draw and label visual models of the snail and its subsystems. What function does each part of the snail perform?

<p>4.3 The snail pull</p>	<p>What the student does</p>	<p>4.3</p> <p>Students plan and carry out an investigation around how much weight a snail can pull. They gather data to answer the question (p. 22-23).</p> <p>Students weigh snails and washers as part of data gathering (p.23).</p>	<p>4.3</p> <p>What is it about the structure of a snail that allows it to pull more than its own weight?</p>	<p>4.3</p> <p>Have students collaboratively design an inquiry experiment to test how much weight a snail can pull. The question may be, "Can a snail pull less than its own weight, more than its own weight, or the same amount as its weight? Have them follow the whole experimental process of question, prediction, materials, labeled setup, procedure, data and conclusion.</p>
<p>4.4 Choose your own investigation</p>	<p>What the student does</p>	<p>4.4</p> <p>Students design an investigation to explore a question of their choice (p. 26-29).</p>	<p>4.4</p> <p>Will vary based on student selection.</p>	<p>4.4</p> <p>Will vary based on student selection.</p>
<p>Throughout the investigation:</p>	<p>What the teacher does</p>	<ul style="list-style-type: none"> • Teacher models how to obtain, and record data. • Teacher asks probing questions to facilitate interpretive thinking. • Teacher facilitates class discourse to analyze observations/data and develop conceptual understanding of results. 	<ul style="list-style-type: none"> • Teacher provides a guiding question, asks probing questions of students throughout investigation and inquiry, and facilitates class discourse to deeply explore the topic of. 	

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Investigation 5	Classroom Instruction	Science and Engineering Practice	Crosscutting Concept	Necessary Modifications
Bones	Note that this investigation has been added to the Structures of Life Kit. Bess Beetles has been removed.	Developing and Using Models Develop and/or use models to describe and/or predict phenomena.	Systems and System Models A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.	Develop a driving question with your students that connects the study of systems in the crayfish and snails to the human body, and eventually rodent bodies. (i.e. Are all organisms made up of systems? Or, how are seeds, crayfish and the human body all similar? How are they all different? Or, what function do shells, exoskeletons, and bones all serve in living things?)
5.1 Counting Bones	What the student does	5.1 Students sketch a simple model to record their observations while counting their bones.	5.1 Students identify subsystems of the body (p. 12) and identify the number and location of the bones located in that subsystem.	5.1 Start with an investigative question, "How many bones do you think are in the human body? How can we find out?" Ask students to make claims and provide evidence or reasons for their claims. While students are counting their bones (p. 12), have them sketch a simple model of the bones that they are feeling, and then record their data in the table as shown on p. 13.

<p>5.2 Mr. Bones Puzzle</p>	<p>What the student does</p>	<p>5.2 Students use the Mr. Bones puzzle to construct a complete skeletal system.</p>	<p>5.2 Students connect paper skeletal subsystems to create a complete model of the human skeletal system.</p>	<p>5.2 To activate prior knowledge (and assess student knowledge) give students an unlabeled diagram of the skeleton. Have students work in pairs to label as many bones as they can. Have students refer to their model sketches from 5.1 to assist the construction Mr. Bones. Instead of telling students if their puzzle models are correct, provide a variety of resources for the students to use as they self-evaluate and revise their puzzles such as: books, posters, websites, and 3-D models of the skeletal system.</p>
<p>5.3 Owl Pellets</p>	<p>What the student does</p>	<p>5.3 Students use a visual model to help them identify subsystems of a rodent skeletal system.</p>	<p>5.3 Students use a visual model to represent where the bones are located in relation to each other and how they are connected.</p>	<p>5.3 Rather than having students glue bones onto Student Sheet #8, students could actually construct a rodent skeleton on a blank piece of cardstock. Or, they could glue the bones on their actual locations on the rodent skeletal system sketch.</p>
<p>Throughout the investigation:</p>	<p>What the teacher does</p>	<ul style="list-style-type: none"> • Teacher supports visual models • Teacher models how to obtain, and record data. • Teacher asks probing questions to facilitate thinking and reasoning . • Teacher facilitates discourse to analyze observations/data and develop conceptual understanding of results. 	<ul style="list-style-type: none"> • Teacher provides a guiding question, asks probing questions of students throughout investigation and inquiry, and facilitates class discourse to deeply explore the topic of skeletons and their subsystems. 	<ul style="list-style-type: none"> • Connect the study to the Core Idea question. Consider having students develop a Claims-Evidence-Reasoning explanation based on the Core Idea question.