Program Overview

OpenSciEd

MIDDLE SCHOOL SCIENCE

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About the Program

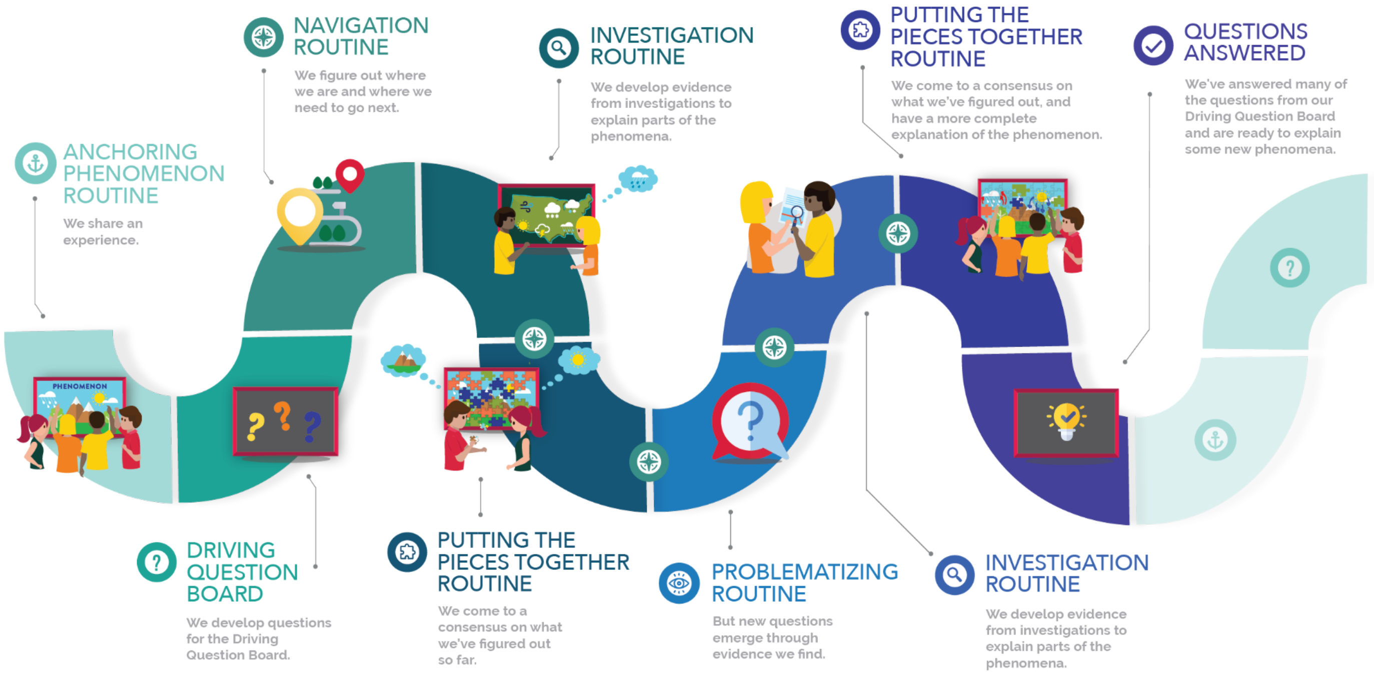
OpenSciEd is a comprehensive middle school science curriculum that empowers students to ask questions, design investigations, and solutions, and figure out the interesting and puzzling world. OpenSciEd empowers students to be the knowers and doers of science and develops a classroom in which the ideas we hear from our peers help to move our thinking forward as we develop our abilities to think, read, write and argue as scientists and engineers.

- **Phenomenon Based** - Centered around exploring phenomena or solving problems
- **Driven by Student Questions** - Storyline based on students' questions and ideas
- **Grounded in Evidence** - Incremental building and revision of ideas based on evidence
- **Collaborative** - WE, the class and the teacher, figure out ideas together
- **Equitable** - Builds a classroom culture that values ideas and learning of all

The OpenSciEd Instructional Model:

The OpenSciEd Instructional model uses a **storyline approach** in which students are presented with puzzling phenomena that elicit a variety of questions that motivate the learning in the unit. In OpenSciEd units, phenomena are carefully selected to anchor a storyline and inspire the development of target disciplinary core ideas, crosscutting concepts, and science and engineering practices. These anchoring phenomena draw students into the storyline by presenting the natural challenge of explaining something or solving a problem. Other phenomena may be introduced at key points in a storyline to maintain interest or push students to delve more deeply.

To help teachers and students advance through a unit storyline, the instructional model takes advantage of five routines—activities that play specific roles in advancing the storyline with supports to help students achieve the objectives of those activities. The routines typically follow a pattern as students kick off a unit of study, surface and investigate different questions they have, put the pieces together from those investigations, and then problematize the next set of questions to investigate.



Built to engage, inspire and empower

Educators can leverage OpenSciEd to bring three-dimensional learning to life for their students, confident that the materials have been tested in classrooms with thousands of students across the country. Data from the field tests show that our materials engage students and support them in developing the skills, knowledge, and mindset they need to be successful in high school and beyond.

OpenSciEd was developed through collaboration between science educators, curriculum developers, science content experts, and researchers. It provides the support all students and teachers deserve.

- Anchoring phenomena explored through diverse interdisciplinary contexts serve as the foundation for compelling, coherent storylines.
- Research-based multimodal learning allows students to develop expertise in all Science and Engineering Practices (SEPs) and a deep understanding of Disciplinary Core Ideas (DCIs) and Crosscutting Concepts (CCCs).

- Simulations and data visualization tools enable students to create and refine models of their ideas of key scientific phenomena.
- Embedded engineering in units focused on problem-solving and technology emphasize that there is not always one right answer, as students balance competing constraints to design the best justifiable solutions.
- Developed utilizing Universal Design for Learning principles to support a diverse student population and emerging multilingual learners.

Middle School Science Course

6th Grade

Unit 6.1 Light & Matter

Anchoring Phenomenon: One-way mirror

Instructional days: 18

Domain: Physical, Life

Unit 6.2 Thermal Energy

Anchoring Phenomenon: Insulated cups

Instructional days: 37

Domain: Physical, Engineering

Unit 6.3 Weather, Climate, & Water Cycling

Anchoring Phenomenon: Hailstorms, large weather system

Instructional days: 42

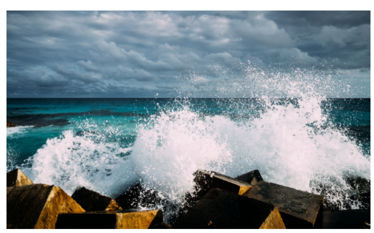
Domain: Earth & Space, Physical

Unit 6.4 Plate Tectonics & Rock Cycling

Anchoring Phenomenon: Earthquake

Instructional days: 26

Domain: Earth & Space



Unit 6.5 Natural Hazards

Anchoring Phenomenon: Tsunami

Instructional days: 21

Domain: Earth & Space, Physical, Engineering

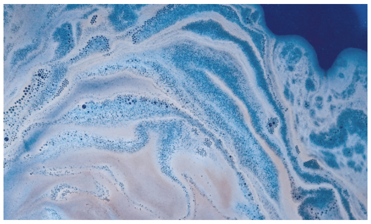
Unit 6.6 Cells & Systems

Anchoring Phenomenon: An injury

Instructional days: 25

Domain: Life

7th Grade



Unit 7.1 Chemical Reactions & Matter

Anchoring Phenomenon:
A bath bomb in water

Instructional days: 25

Domain: Physical, Life

Unit 7.2 Chemical Reactions & Energy

Anchoring Phenomenon:
Heating food in an emergency

Instructional days: 21

Domain: Physical, Engineering

Unit 7.3 Metabolic Reactions

Anchoring Phenomenon:
M'Kenna's illness

Instructional days: 29

Domain: Life, Physical

Unit 7.4 Matter Cycling & Photosynthesis

Anchoring Phenomenon:
Food from plants

Instructional days: 29

Domain: Life, Physical

Unit 7.5 Ecosystem Dynamics & Biodiversity

Anchoring Phenomenon:
Chocolate that impacts animals

Instructional days: 33

Domain: Life, Earth & Space, Engineering

Unit 7.6 Earth's Resources & Human Impact

Anchoring Phenomenon:
Extreme floods or droughts

Instructional days: 33

Domain: Earth & Space, Engineering

8th Grade

Unit 8.1 Contact Forces

Anchoring Phenomenon:
Dropped phone that breaks

Instructional days: 29

Domain: Physical, Engineering, Life

Unit 8.2 Sound Waves

Anchoring Phenomenon:
Sound that makes something move

Instructional days: 24

Domain: Physical, Life

Unit 8.3 Forces at a Distance

Anchoring Phenomenon:
Moving things from a distance

Instructional days: 30

Domain: Physical

Unit 8.4 Earth in Space

Anchoring Phenomenon:
Patterns in the sky

Instructional days: 31

Domain: Earth & Space, Physical

Unit 8.5 Genetics

Anchoring Phenomenon:
Big muscled animals

Instructional days: 28

Domain: Life, Earth & Space, Engineering

Unit 8.6 Natural Selection & Common Ancestry

Anchoring Phenomenon:
Ancient giant penguins

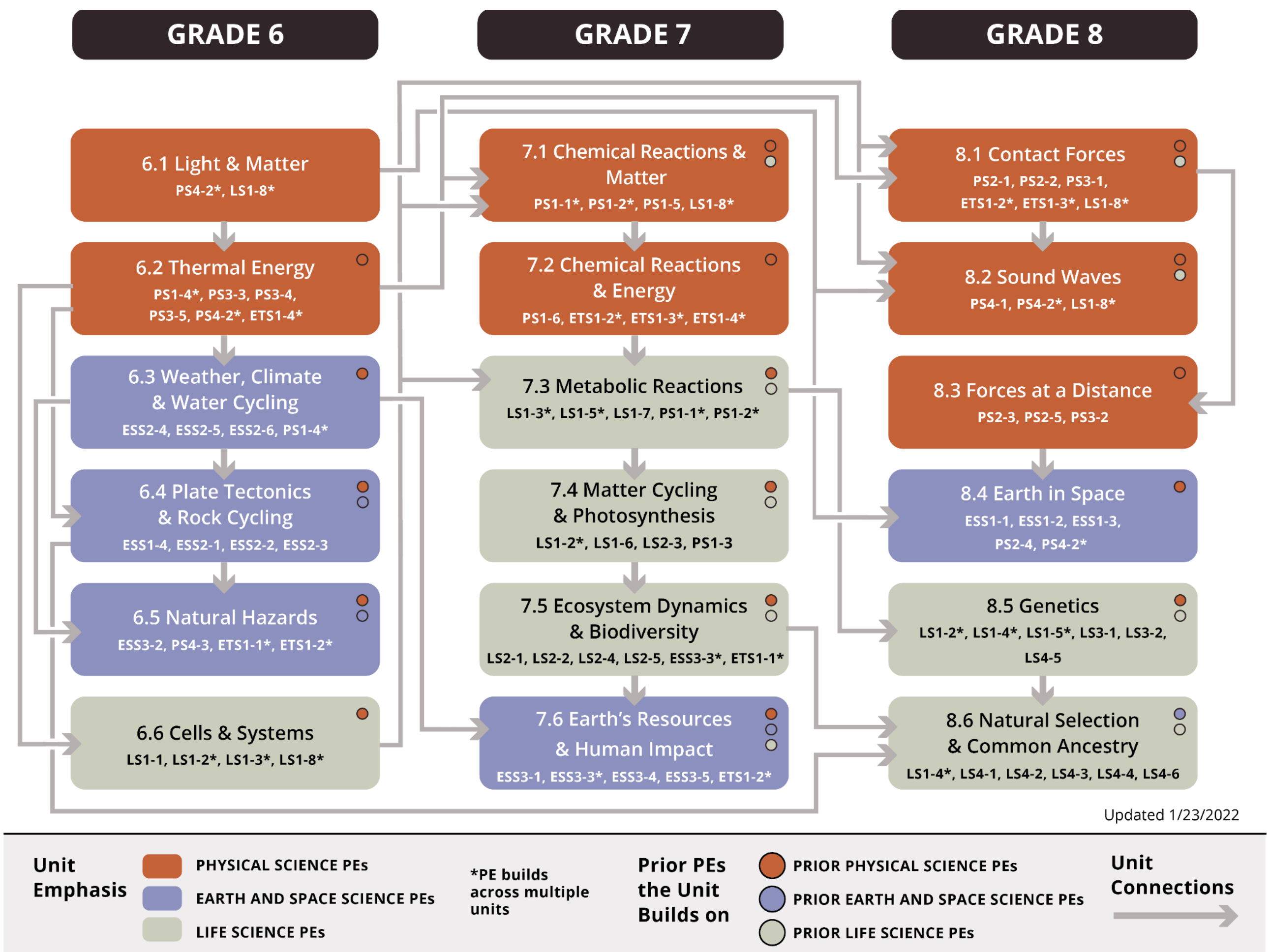
Instructional days: 32

Domain: Earth & Space, Engineering

Middle Grades Scope & Sequence

The OpenSciEd Middle School Program is organized around units that each target a bundle of performance expectations. The program is sequenced to enable units to build on what students have developed in prior units while supporting the development of the three dimensions of NGSS, disciplinary core ideas (DCIs), crosscutting concepts (CCCs), and science and engineering practices (SEPs) coherently across the program. This coherence allows for presenting the concepts in a way that makes sense to students. Materials were designed to motivate student learning and help students see science as more connected to their lives. The tables below show the DCI bundling and the progression summary for the SEPs and CCCs across the units. Access the complete Scope and Sequence document with additional detail from our website.

Disciplinary Core Idea (DCI) Bundling and Connections



Focal Science and Engineering Practices (SEPs) by Unit

Unit	Asking Questions & Defining Problems	Developing & Using Models	Planning & Carrying Out Investigations	Analyzing & Interpreting Data	Using Math & Computational Thinking	Construct. Explanations & Designing Solutions	Engaging in Argument from Evidence	Obtaining, Evaluating & Comm. Info.
6.1	Developed	Developed	Not a Focus	Not a Focus	Not a Focus	Developed	Not a Focus	Not a Focus
6.2	Key Use	Developed	Developed	Developed	Not a Focus	Developed	Key Use	Not a Focus
6.3	Key Use	Developed	Developed	Developed	Key Use	Developed	Not a Focus	Key Use
6.4	Key Use	Developed	Not a Focus	Developed	Developed	Developed	Key Use	Not a Focus
6.5	Key Use	Key Use	Not a Focus	Key Use	Developed	Key Use	Developed	Developed
6.6	Key Use	Developed	Key Use	Developed	Not a Focus	Key Use	Key Use	Key Use
7.1	Key Use	Key Use	Developed	Developed	Not a Focus	Developed	Developed	Not a Focus
7.2	Developed	Key Use	Key Use	Developed	Not a Focus	Key Use	Key Use	Key Use
7.3	Key Use	Key Use	Key Use	Developed	Not a Focus	Key Use	Key Use	Not a Focus
7.4	Key Use	Developed	Key Use	Not a Focus	Not a Focus	Key Use	Key Use	Key Use
7.5	Developed	Key Use	Key Use	Key Use	Developed	Key Use	Key Use	Key Use
7.6	Developed	Key Use	Not a Focus	Key Use	Developed	Key Use	Key Use	Key Use
8.1	Key Use	Key Use	Key Use	Developed	Not a Focus	Key Use	Key Use	Not a Focus
8.2	Not a Focus	Key Use	Not a Focus	Key Use	Developed	Not a Focus	Key Use	Not a Focus
8.3	Developed	Key Use	Developed	Key Use	Key Use	Key Use	Not a Focus	Not a Focus
8.4	Not a Focus	Developed	Key Use	Developed	Not a Focus	Not a Focus	Not a Focus	Key Use
8.5	Key Use	Key Use	Key Use	Not a Focus	Developed	Key Use	Not a Focus	Developed
8.6	Key Use	Key Use	Key Use	Developed	Not a Focus	Developed	Key Use	Key Use

● Developed ● Key Use ○ Not a Focus

Focal Crosscutting Concepts (CCCs) by Unit

Unit	Patterns	Cause and Effect	Scale, Proportion, and Quantity	Systems and Systems Models	Energy and Matter	Structure and Function	Stability and Change
6.1	Not a Focus	Key Use	Not a Focus	Developed	Not a Focus	Developed	Not a Focus
6.2	Developed	Key Use	Key Use	Developed	Developed	Developed	Not a Focus
6.3	Key Use	Developed	Not a Focus	Developed	Developed	Not a Focus	Developed
6.4	Key Use	Key Use	Developed	Not a Focus	Not a Focus	Not a Focus	Developed
6.5	Key Use	Key Use	Not a Focus	Key Use	Not a Focus	Key Use	Developed
6.6	Key Use	Key Use	Key Use	Key Use	Not a Focus	Key Use	Not a Focus
7.1	Key Use	Not a Focus	Developed	Not a Focus	Key Use	Not a Focus	Not a Focus
7.2	Key Use	Key Use	Key Use	Key Use	Developed	Not a Focus	Not a Focus
7.3	Key Use	Key Use	Not a Focus	Developed	Key Use	Key Use	Not a Focus
7.4	Key Use	Not a Focus	Not a Focus	Developed	Developed	Not a Focus	Not a Focus
7.5	Key Use	Key Use	Not a Focus	Key Use	Not a Focus	Not a Focus	Developed
7.6	Key Use	Key Use	Key Use	Key Use	Key Use	Not a Focus	Developed
8.1	Key Use	Key Use	Not a Focus	Key Use	Key Use	Developed	Developed
8.2	Key Use	Key Use	Developed	Not a Focus	Key Use	Not a Focus	Not a Focus
8.3	Key Use	Developed	Key Use	Key Use	Key Use	Not a Focus	Not a Focus
8.4	Developed	Key Use	Developed	Developed	Not a Focus	Not a Focus	Not a Focus
8.5	Key Use	Key Use	Key Use	Not a Focus	Not a Focus	Key Use	Not a Focus
8.6	Key Use	Key Use	Not a Focus	Not a Focus	Not a Focus	Key Use	Key Use

● Developed ◐ Key Use ○ Not a Focus

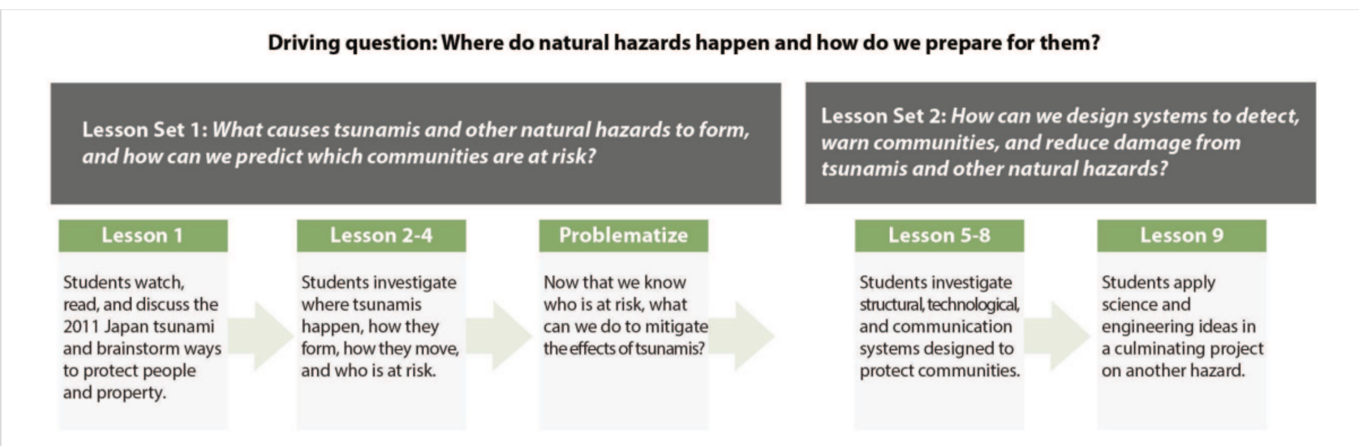
Comprehensive Suite of Materials

Each OpenSciEd unit is a comprehensive set of materials designed to be educative for teachers and engaging for students. Each unit has unit-level materials and lesson-level materials for teachers and students.

Program Structure

Units	There are six units per grade, ranging between 18-41 instructional days each. Units are designed for students to fully explore an anchoring phenomenon and follow a coherent, sequenced storyline to support three-dimensional learning. Units within a grade level should be completed in order.
Lesson Sets	Each lesson set advances the storyline by investigating one aspect of the anchoring phenomenon through an inquiry cycle. Students complete relevant OpenSciEd Routines (Anchoring Phenomenon, Investigation, Putting the Pieces Together, Problematizing, or Navigation) to end the Lesson Set with a more complete or sophisticated understanding of the phenomena.
Lessons	Range in length from one 45 minute class period to several and have parts or activities that work together to help students make sense of a phenomenon or problem. Each lesson's structure is determined by its OpenSciEd Routine and placement in the storyline.

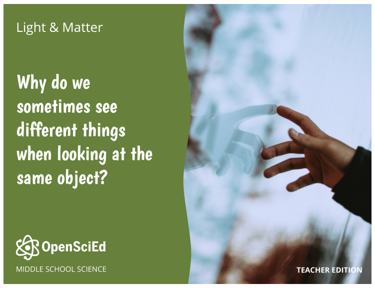
Example unit structure from Unit 6.5 Natural Hazards



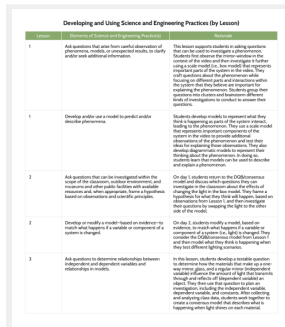
Unit Level Materials

Each unit includes

Unit Overview - Teacher



Elements of the NGSS



Student Edition

Unit Overview Information for the Teacher

- **Unit Overview Page –** An overview of the unit, the phenomena or problems addressed, and the NGSS Performance Expectations the unit builds toward

- **Unit Storyline –** A lesson-by-lesson summary of the unit with the lesson question, phenomena or design problem, what we do and figure out and how we navigate to the following lesson

- **Teacher Background Information -** Detailed information about the unit including the NGSS Dimensions developed, the structure of the unit and placement in the Scope and Sequence, how the unit supports equitable science learning, and other supportive topics
- **Home Communication -** A sample letter for parents/guardians about the unit to be sent home with students at the launch of the unit.
- **Guidance for Developing your Word Wall -** Guidance on vocabulary development within the unit, including word lists, procedures, and supports for emerging multilingual learners.

- **Assessment System Overview -**
  - **Overall Unit Assessment Table -** Each OpenSciEd unit includes an assessment system that offers many opportunities for different types of assessments throughout the lessons. This table outlines where each type of assessment can be found in the unit and the purpose of the assessment

    - **Lesson-by-Lesson Assessment Opportunities -** Summarizes opportunities in each lesson for assessing three-dimensional learning. Every lesson has a lesson-level performance expectation (LLPE), a three-dimensional learning expectation, combining elements of science and engineering practices, disciplinary core ideas, and crosscutting concepts.

Additional Unit Information for the Teacher
The following items are included in the unit folder when it is downloaded from OpenSciEd.org.

- **Elements of the NGSS Dimensions** - This document summarizes how the elements of the focal Science and Engineering Practices and Crosscutting Concepts are addressed in each lesson

- **Unit Materials List** - Each unit has a lab materials list for the unit as a whole, which is described in the unit-level section. The list describes the materials a teacher would need to teach six sections of 30 students grouped into small groups of 4 students. A PDF version of the unit material list is included in the downloadable folder for each unit. The unit list of materials is also available in a more interactive format on each unit's page at https://www.openscied.org/access-the-materials/

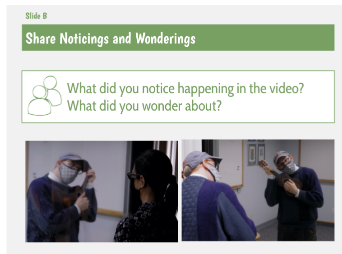
- General OpenSciEd Resources
    - Teacher Handbook - Provides overviews of features of the OpenSciEd units and resources that are likely to be new to many teachers. Each chapter focuses on a different feature.
    - Teacher Resources and Tools - Provides a collection of all OpenScieEd tools and resources that can be used and customized for other units. This document is organized into clusters of resources.
    - Professional Learning Materials - There are six different professional learning sessions that support the classroom materials, starting with the Curriculum Launch. All the professional learning resources are Open Educational Resources (OER) so they can be downloaded, adapted, and shared.

Lesson Level Materials

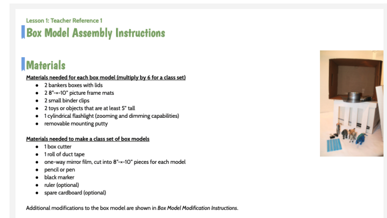
Each lesson includes

Lesson-Level Teacher Edition

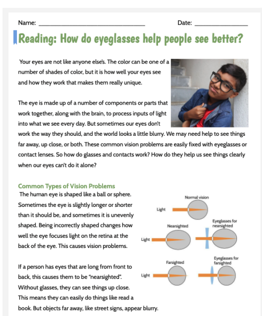
Slides



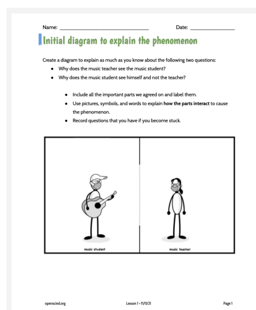
Teacher References



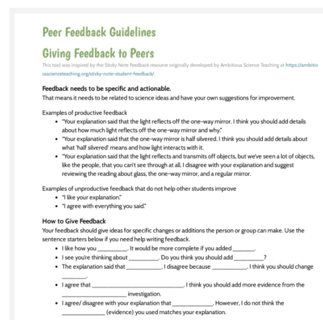
Readings



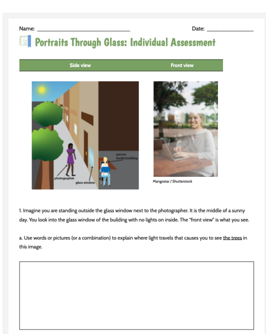
Handouts



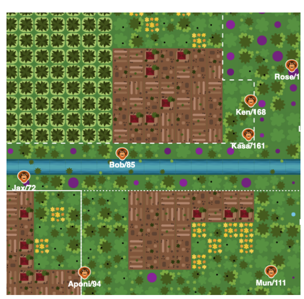
Student References



Assessments & Keys



Simulations, Data Interactives & Storymaps



Videos

Teacher Materials:

- **Teacher Edition -** Described in detail below
- **Slides -** Each lesson has an editable set of presentation slides and google docs that teachers can project and use as they move through each lesson.
- **References, Rubrics, and Keys -** Additional lesson resources, such as lab instructions, keys, and rubrics, as appropriate for the lesson.

Student Materials:

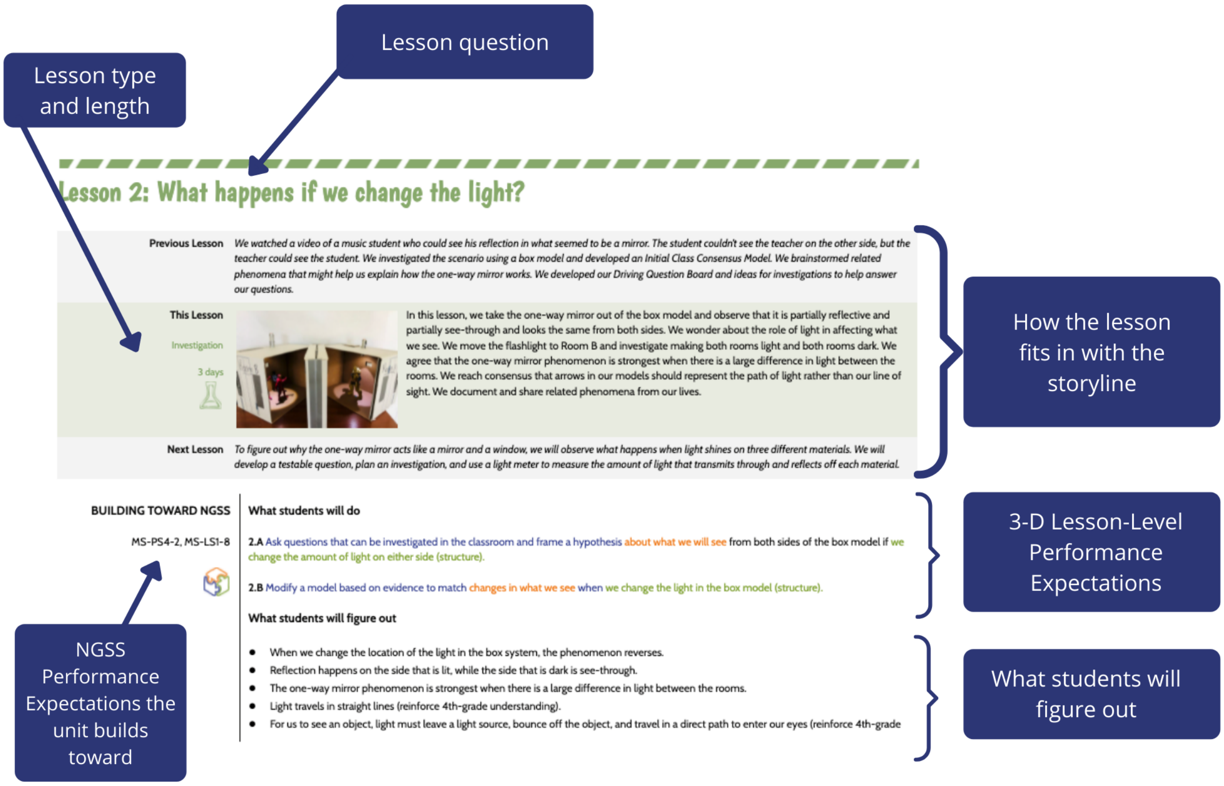
- **Handouts -** These include readings, references, and handouts
- **Assessments -** Each unit has a comprehensive assessment system with embedded formative and summative assessments
- **Interactive resources -** Students utilize simulations, videos, and interactive data visualizations as they are figuring out science ideas.

Teacher Edition - Lesson-Level

The Teacher Edition has five different components for each lesson.

1. Lesson Overview
2. Learning Plan Snapshot
3. Materials List & Preparation
4. Where we are Going and NOT Going
5. Learning Plan

1. Lesson Overview



Lesson 2: What happens if we change the light?

Previous Lesson *We watched a video of a music student who could see his reflection in what seemed to be a mirror. The student couldn't see the teacher on the other side, but the teacher could see the student. We investigated the scenario using a box model and developed an Initial Class Consensus Model. We brainstormed related phenomena that might help us explain how the one-way mirror works. We developed our Driving Question Board and ideas for investigations to help answer our questions.*

This Lesson
Investigation
3 days

In this lesson, we take the one-way mirror out of the box model and observe that it is partially reflective and partially see-through and looks the same from both sides. We wonder about the role of light in affecting what we see. We move the flashlight to Room B and investigate making both rooms light and both rooms dark. We agree that the one-way mirror phenomenon is strongest when there is a large difference in light between the rooms. We reach consensus that arrows in our models should represent the path of light rather than our line of sight. We document and share related phenomena from our lives.

Next Lesson *To figure out why the one-way mirror acts like a mirror and a window, we will observe what happens when light shines on three different materials. We will develop a testable question, plan an investigation, and use a light meter to measure the amount of light that transmits through and reflects off each material.*

BUILDING TOWARD NGSS
MS-PS4-2, MS-LS1-8

What students will do

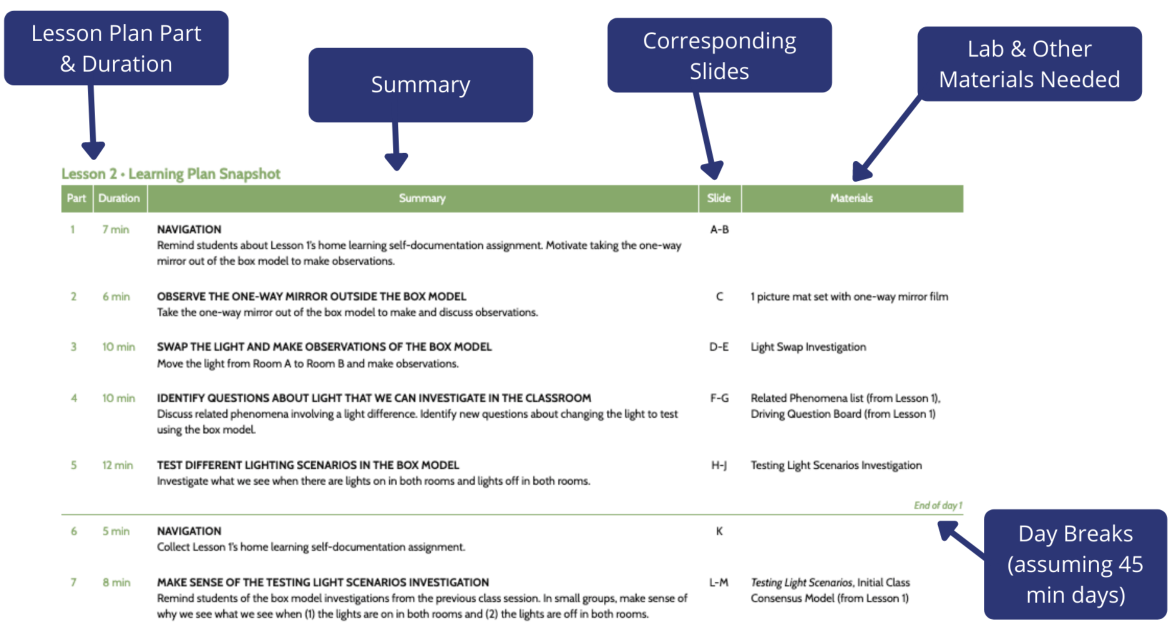
2.A Ask questions that can be investigated in the classroom and frame a hypothesis about what we will see from both sides of the box model if we change the amount of light on either side (structure).

2.B Modify a model based on evidence to match changes in what we see when we change the light in the box model (structure).

What students will figure out

- When we change the location of the light in the box system, the phenomenon reverses.
- Reflection happens on the side that is lit, while the side that is dark is see-through.
- The one-way mirror phenomenon is strongest when there is a large difference in light between the rooms.
- Light travels in straight lines (reinforce 4th-grade understanding).
- For us to see an object, light must leave a light source, bounce off the object, and travel in a direct path to enter our eyes (reinforce 4th-grade

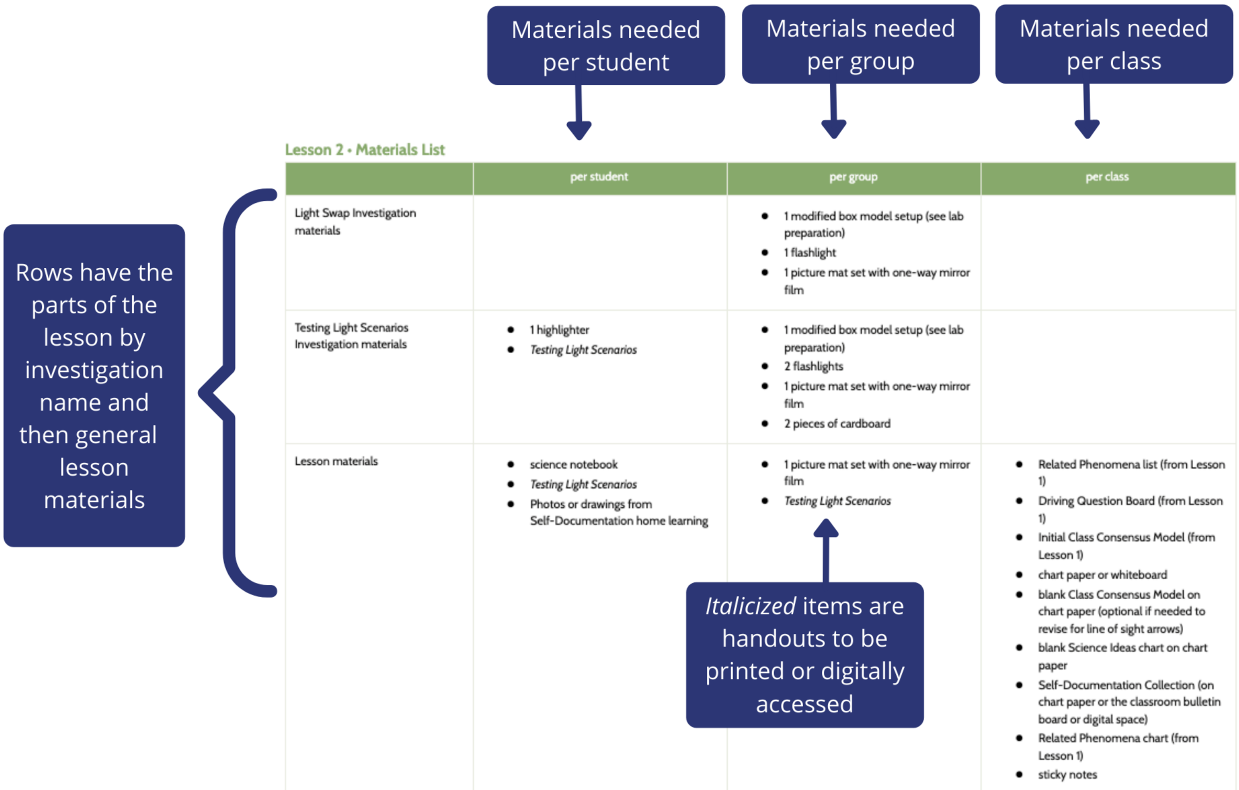
2. Learning Plan Snapshot



Lesson 2 • Learning Plan Snapshot

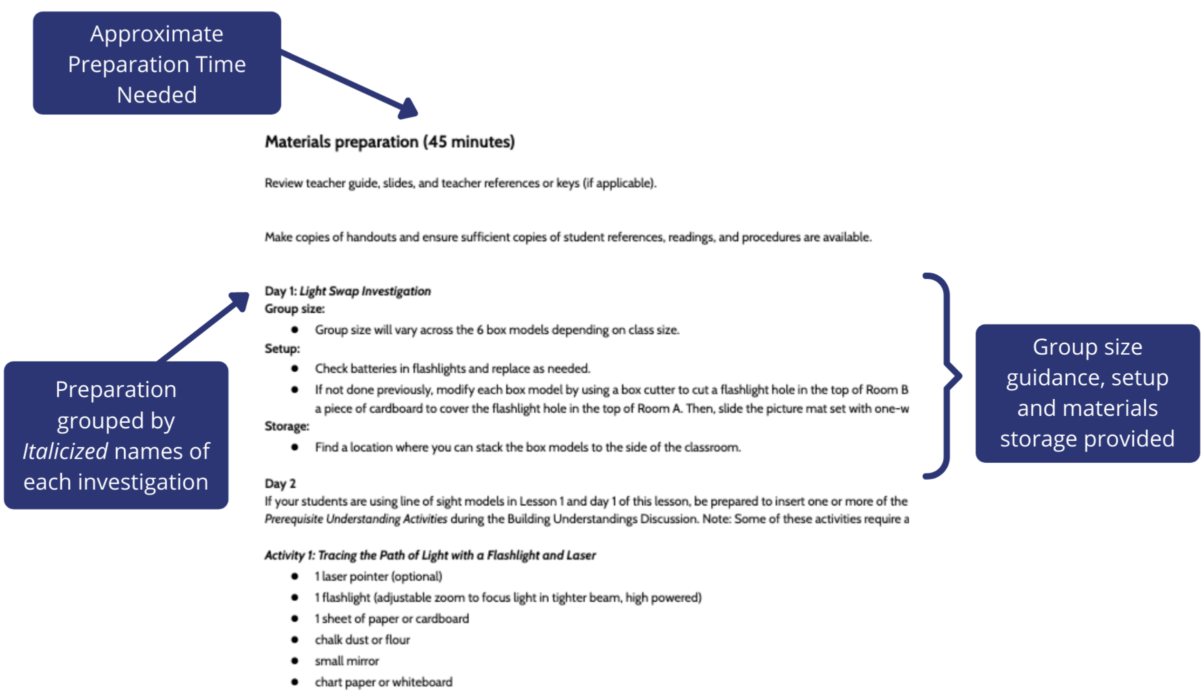
Part	Duration	Summary	Slide	Materials
1	7 min	**NAVIGATION** Remind students about Lesson 1's home learning self-documentation assignment. Motivate taking the one-way mirror out of the box model to make observations.	A-B	
2	6 min	**OBSERVE THE ONE-WAY MIRROR OUTSIDE THE BOX MODEL** Take the one-way mirror out of the box model to make and discuss observations.	C	1 picture mat set with one-way mirror film
3	10 min	**SWAP THE LIGHT AND MAKE OBSERVATIONS OF THE BOX MODEL** Move the light from Room A to Room B and make observations.	D-E	Light Swap Investigation
4	10 min	**IDENTIFY QUESTIONS ABOUT LIGHT THAT WE CAN INVESTIGATE IN THE CLASSROOM** Discuss related phenomena involving a light difference. Identify new questions about changing the light to test using the box model.	F-G	Related Phenomena list (from Lesson 1), Driving Question Board (from Lesson 1)
5	12 min	**TEST DIFFERENT LIGHTING SCENARIOS IN THE BOX MODEL** Investigate what we see when there are lights on in both rooms and lights off in both rooms.	H-J	Testing Light Scenarios Investigation
				End of day 1
6	5 min	**NAVIGATION** Collect Lesson 1's home learning self-documentation assignment.	K	
7	8 min	**MAKE SENSE OF THE TESTING LIGHT SCENARIOS INVESTIGATION** Remind students of the box model investigations from the previous class session. In small groups, make sense of why we see what we see when (1) the lights are on in both rooms and (2) the lights are off in both rooms.	L-M	*Testing Light Scenarios*, Initial Class Consensus Model (from Lesson 1)

3. Materials List & Preparation



Lesson 2 • Materials List

	per student	per group	per class
Light Swap Investigation materials		• 1 modified box model setup (see lab preparation) • 1 flashlight • 1 picture mat set with one-way mirror film	
Testing Light Scenarios Investigation materials	• 1 highlighter • *Testing Light Scenarios*	• 1 modified box model setup (see lab preparation) • 2 flashlights • 1 picture mat set with one-way mirror film • 2 pieces of cardboard	
Lesson materials	• science notebook • *Testing Light Scenarios* • Photos or drawings from Self-Documentation home learning	• 1 picture mat set with one-way mirror film • *Testing Light Scenarios*	• Related Phenomena list (from Lesson 1) • Driving Question Board (from Lesson 1) • Initial Class Consensus Model (from Lesson 1) • chart paper or whiteboard • blank Class Consensus Model on chart paper (optional if needed to revise for line of sight arrows) • blank Science Ideas chart on chart paper • Self-Documentation Collection (on chart paper or the classroom bulletin board or digital space) • Related Phenomena chart (from Lesson 1) • sticky notes



Materials preparation (45 minutes)

Review teacher guide, slides, and teacher references or keys (if applicable).

Make copies of handouts and ensure sufficient copies of student references, readings, and procedures are available.

Day 1: *Light Swap Investigation*
Group size:
- Group size will vary across the 6 box models depending on class size.

Setup:
- Check batteries in flashlights and replace as needed.
- If not done previously, modify each box model by using a box cutter to cut a flashlight hole in the top of Room B a piece of cardboard to cover the flashlight hole in the top of Room A. Then, slide the picture mat set with one-w

Storage:
- Find a location where you can stack the box models to the side of the classroom.

Day 2
If your students are using line of sight models in Lesson 1 and day 1 of this lesson, be prepared to insert one or more of the *Prerequisite Understanding Activities* during the Building Understandings Discussion. Note: Some of these activities require a

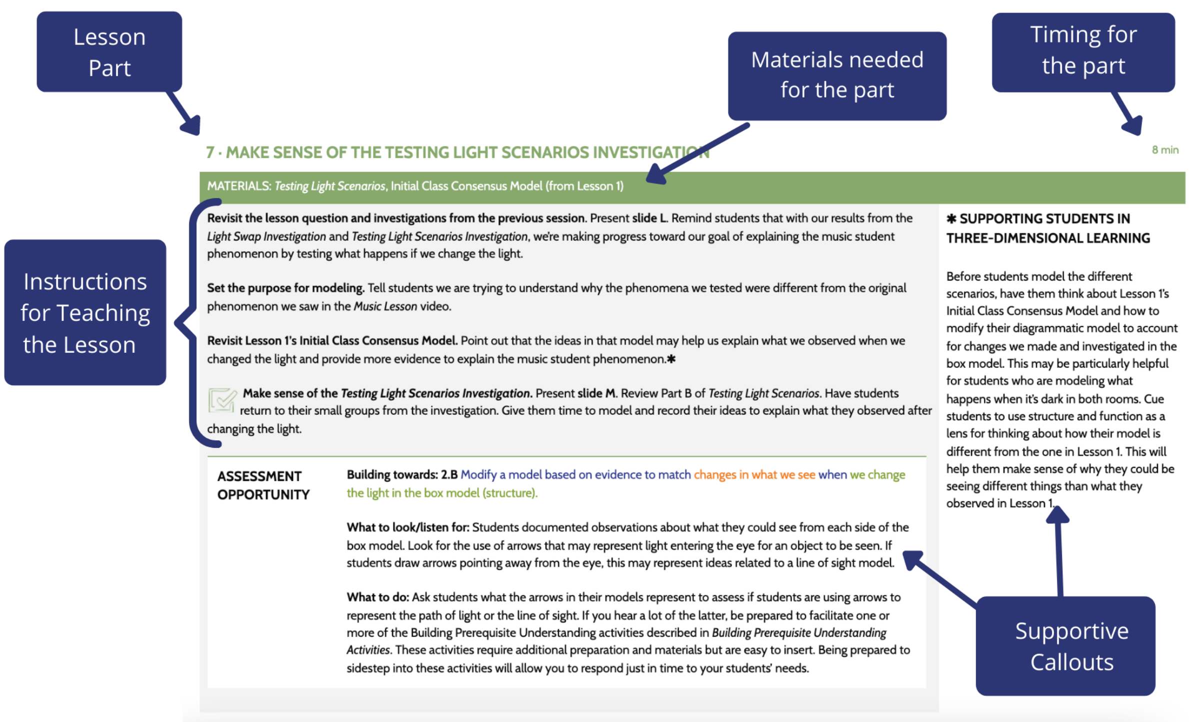
Activity 1: Tracing the Path of Light with a Flashlight and Laser
- 1 laser pointer (optional)
- 1 flashlight (adjustable zoom to focus light in tighter beam, high powered)
- 1 sheet of paper or cardboard
- chalk dust or flour
- small mirror
- chart paper or whiteboard

4. Where We Are Going and NOT Going

Each lesson has a section that describes the lesson's focus and where the lesson is deliberately not going. The boundaries exist because they were defined by the NGSS standards, meaning the content is either below or above grade level, or it could be that the content will be addressed in a future lesson or future unit. This section helps teachers understand what to focus on and listen for as part of the lesson.

5. Learning Plan

This section has detailed guidance for teaching the lesson. It is broken up by Lesson Part, which aligns with the parts in the Lesson Snapshot. Learning Plans are comprehensive, including example questions to ask at particular points in the lesson and example student responses. These guides are not intended to be used as a script but rather as suggestions for implementing the lessons, which teachers can start with in planning instruction for their specific settings and students.



Embedded within the Learning Plan are callout boxes with supports on the following topics:

- Assessment Opportunity Guidance
- Attending To Equity
- Supporting Emerging Multilingual Learners
- Supporting Universal Design for Learning
- Strategies for Facilitating Discussion
    - Initial Ideas Discussion
    - Building Understandings Discussion
    - Consensus Discussion
- Home Learning Opportunity
- Safety Precautions
- Supporting Students in
    - Engaging in the Focal Science & Engineering Practices
    - Developing and Using the Focal Crosscutting Concepts
    - Three-Dimensional Learning
    - Making Connections In English Language Arts
    - Making Connections In Mathematics
    - Writing In Science
    - Utilizing a Science Notebook
    - Collaboration

Below are a few callouts from Unit 6.1 Light and Matter.

ASSESSMENT OPPORTUNITY

Building towards: 2.A Ask questions that can be investigated in the classroom and frame a hypothesis about what we will see from both sides of the box model if we change the amount of light on either side of the box model (structure).

What to look/listen for: (1) Questions that focus on changing one aspect of the light in the box model at a time, (2) questions that are feasible in terms of time and materials, and (3) hypotheses framing what students expect to see.

What to do: Focus on helping students consider changes they could make to the structure of the box model specific to the light. Press them to explain *why* they think their questions are feasible to investigate in the classroom. Point them back to the box model to help them evaluate the ease with which some of their questions could be investigated given limitations of the materials on hand.

✱ ATTENDING TO EQUITY

The gallery walk will support students in collectively making sense of these phenomena. It also presents an opportunity to practice the norm of "Moving our science thinking forward" as we work together to figure things out. Encourage students to be open to changing their minds if they see a good idea from someone else. Highlight norms from this category:

- We use and build on other's ideas.
- We are open to changing our minds.
- We challenge ourselves to think in new ways.

✱ ATTENDING TO EQUITY

Supporting Emerging Multilingual Learners: Scaffolds such as the Communicating in Scientific Ways sentence starters can model and facilitate oral or written language production skills. Remind all students that they have this tool and can use the sentence starters to help them communicate. Such scaffolds may be of particular benefit for emerging multilingual students to help them develop language skills to write or communicate their ideas to peers. It is important that scaffolds be used purposefully and removed when no longer needed.

✱ SUPPORTING STUDENTS IN ENGAGING IN ASKING QUESTIONS AND DEFINING PROBLEMS

An important aspect of supporting students to ask testable questions is to help them consider what is feasible to investigate, particularly in terms of being able to gather evidence. While students likely have many questions they want to pursue, focus them on what is feasible in the classroom in terms of available resources and amount of time.

✱ SUPPORTING STUDENTS IN DEVELOPING AND USING STRUCTURE AND FUNCTION

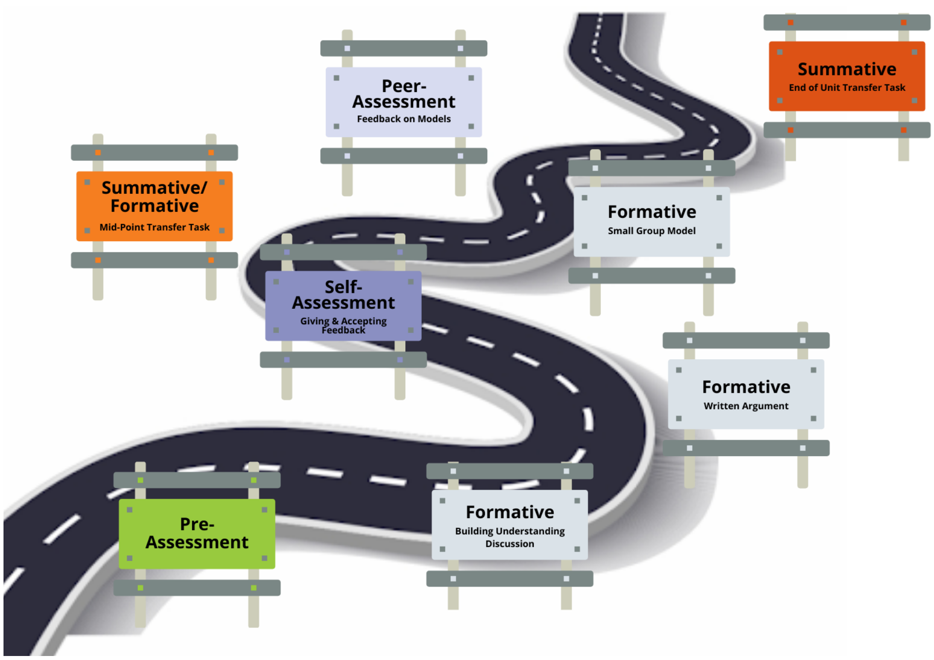
Emphasize that students are changing the ***structure*** of the box model by changing the location of the light. Point out that their questions are about how the one-way mirror will ***function*** differently given the change to the light.

Instructional Supports

Embedded in the OpenSciEd units are instructional supports that allow educators to provide a more holistic educational experience for students. They include support for assessing student learning and instructional differentiation for learners with a variety of needs.

Support for Assessing Student Learning

OpenSciEd has developed an assessment system grounded in the recommendations of the National Research Council (2014) report, Developing Assessments for the Next Generation Science Standards. An assessment system is a holistic way that supports teacher autonomy and multiple ways for students to demonstrate their ability to reason with the three dimensions. The OpenSciEd assessment system has [five different kinds of assessment] embedded in the unit: formative, summative, pre-assessment, self-assessment, and peer-assessment. Each unit's key assessment moments are listed in the Assessment Overview Table and the necessary materials and associated keys. You can find the Assessment Overview Table in the Unit Overview document for the digital version or at the end of the printed Teacher Editions.



Assessment Across an OpenSciEd Unit

Supports for Differentiation

OpenSciEd units are designed with Universal Design for Learning principles to provide equitable and accessible learning from the outset of the units. By making supports available for all students, equitable and accessible design can reduce the need for more nuanced differentiation in varying contexts. But, we acknowledge that teachers will still need to find ways to accommodate activities in the materials to better fit with student learning needs or the needs and resources of the classroom.

There are many ways differentiation occurs in classroom settings. OpenSciEd units are also designed with differentiation in mind, allowing teachers to adapt the materials as necessary without diminishing the learning experiences for students.

OpenSciEd units specifically include differentiation strategies in the following sections of the units: Teacher background knowledge, the lesson-level "Where we are going" and "Where we are not going" sections, and the assessment overview and guidance tables. These sections provide teachers with information about adapting the lessons' content, process, or product. Teachers can also find differentiation guidance within the Learning Plans in three particular types of callouts:

- **Equity** - Focus on moments in instruction in which a certain population may benefit from a particular strategy, for example, supporting language development for emergent multilingual learners, providing extended learning opportunities or readings for students with high interest, providing specific strategies for students with special learning needs.
- **Alternate Activity** - Provide guidance to teachers about going further or streamlining activities based on student progress and/or completing different learning activities. These can be particularly helpful for students with high interest or for students or classrooms that need to modify the unit based on the availability of time or access to resources.
- **Additional Guidance** - Provide more specific instructions to teachers about making a learning activity successful based on their students' needs. The callout boxes offer a variety of instructions to modify the timing, grouping, or resources for a particular activity.

Supporting Emerging Multilingual Learners (EMLs)

There are two primary ways that OpenSciEd supports Emerging Multilingual Learners (EMLs):

1. through the curricular design and pedagogical routines that are at the heart of its instructional model, and
2. through educative boxes embedded in the teacher materials.

The curricular design and routines of OpenSciEd grounds students' learning experiences in real-world phenomena. For instance, a 6th grade unit on thermal energy is anchored in students figuring out - how can containers keep stuff from warming up or cooling down? In this approach to science learning, students are not just memorizing science ideas or "facts" about energy transfer. Instead, they are working with peers to figure out their own understanding and design solutions for interesting problems in the world. When the phenomena being explored are relevant and accessible, EMLs can better contribute and build from their previous understandings about the phenomena.

OpenSciEd teacher materials also include callouts focused on EMLs, often appearing as supplemental text on the margins of lesson plans. These educative boxes support teachers in considering whether particular learning moments might be spaces where they can leverage their EMLs' assets and/or address potential challenges their students might encounter. These educative boxes help teachers provide additional in-time support and explain why these instructional moves are important for EMLs. They also range greatly, from suggesting particular ways to group students to unpacking the meaning of certain words in the context of science.

Supports for Remote Learning

Louisiana, one of OpenSciEd's partner states, has modified many of our units for a remote learning environment. In partnership with teachers, the Louisiana Department of Education arranged OpenSciEd content to stay true to the vision of the materials and provide clear guidance on how to use them in a fully remote environment. Since all OpenSciEd materials are Open Educational Resources, all educators can utilize their thinking and modify it for their learning environment.

These adapted materials do not omit lessons from the OpenSciEd units. The modified materials assume that teachers will have synchronous virtual meetings with students in addition to home learning. Examples of specific interactive platforms to support synchronous virtual meetings are provided, which can be adapted to the tools available in your district. This guide is intended as a supporting document and should be used in conjunction with the unit's Teacher Edition.

In addition to the Remote Learning Adaptations, we have developed a series of resources to support teachers with moving their instruction to a remote setting.
The resources linked below contain detailed information about adapting the OpenSciEd routines to a remote learning environment. They also provide a variety of approaches to remote learning, including options for students who do not have internet access.

Fostering Productive Norms
Anchor Phenomenon Routine
Navigation Routine
Supporting Discourse
Problematizing Routine

Resources for Adult-Level Learning

The OpenSciEd instructional model focuses on the teacher being a member of the classroom community, supporting students to figure out scientific ideas motivated by their questions about phenomena. Students iteratively build their understanding of phenomena as the unit unfolds. To match the incremental build of a full scientific explanation across a unit, the science content background necessary for teachers to teach individual lessons builds incrementally. Throughout each unit, we provide just-in-time science content background specific to the Disciplinary Core Ideas (DCIs) that are figured out in a lesson. Places to look for this guidance include the "Where we are going" and "Where we are not going" sections for each lesson. Additionally, the expected student responses, keys, and rubrics have illustrated important science ideas that should be developed in units. In addition, we recommend the following science content resources for teachers to consult:

- National Research Council. (2012). A framework for K-12 science education: Practices, crosscutting concepts, and core ideas. National Academies Press.
- Duncan, R. G., Krajcik, J. S., & Rivet, A. E. (Eds.). (2017). Disciplinary core ideas: Reshaping teaching and learning. NSTA Press.
- Lee, O., & Nordine, J. (Eds.). (2021). Crosscutting concepts: Strengthening science and engineering learning. NSTA Press.
- Schwarz, C. V., Passmore, C., & Reiser, B. J. (Eds.). (2017). Helping students make sense of the world using next generation science and engineering practices. NSTA Press.
- Paul Anderson at Bozeman Science has produced additional informational videos on the NGSS Dimensions: http://www.bozemanscience.com/next-generation-science-standards

The OpenSciEd Curriculum

How to Access the Materials

OpenSciEd materials are available free at OpenSciEd.org. They can be viewed or downloaded as PDF files or Google Docs to view or copy. The videos, interactive models, and other assets needed for each unit are also available on our website.

Because these are Open Educational Resources and licensed as CC BY 4.0, our materials are free to use, modify and distribute with attribution. As a result, the materials are available for download or purchase from various sources. We have developed partnerships with a small number of publishers who have gone through the process of becoming Certified Distributors. As part of this certification, we have reviewed their version of our materials to ensure quality at the curriculum and kit level. You can learn more about the Certified Distributors and how we work with these partners on our website.

Lab Investigation Kits

We believe that students should directly experience scientific phenomena as part of their science learning. Complete lists of materials for creating the phenomena in your classroom are available within the teacher materials and on our website here https://www.openscied.org/access-the-materials/. Teachers can assemble their own materials or can purchase certified kits from our partners, listed on the website.

Professional Learning

Free Online Resources - Our curriculum-based professional learning leverages OpenSciEd's award-winning materials to help teachers reach and engage every student in science learning. There are six different professional learning sessions that support the classroom materials, starting with the Curriculum Launch. All our professional learning resources are Open Educational Resources (OER) so you can easily download, adapt, and share

Professional Learning Services - Transformative professional learning is available directly from OpenSciEd or certified providers. Our team helps you determine what support is needed based on teacher and district needs. We adapt our professional learning to meet your teachers where they are at and move them forward. Our team will provide learning experiences that accommodate your preferred learning format: face-to-face, virtual (synchronous or asynchronous), or a hybrid of these formats. We can also provide support systems for continued learning and connect educators to a growing community of collaborative OpenSciEd educators.

Facebook Groups - Our teacher community actively supports each other through unit-specific Facebook groups moderated by classroom teachers with experience in implementing the units.