“Twig was one of the best decisions we made...
Our teachers have been ecstatic about the quality of learning they have been able to facilitate [and] students have been equally impressed and highly engaged in science learning.”

Derek B., Director of Teaching and Learning, Newberg School District, Oregon
In Integrated volumes, modules from different disciplines (Life Science, Earth and Space Science, Physical Science) are grouped together to promote an interdisciplinary approach.

In Discipline-Specific volumes, modules of the same discipline are grouped together — i.e., all science lessons in Grade 6 are devoted to Earth and Space Science, all science lessons in Grade 7 are devoted to Life Science, etc.

Module content is the same in both routes.
Program Structure

Twig Science Middle School is made up of 28 modules, each underpinned by an Anchor Phenomenon. Making sense of these Anchor Phenomena drives student learning.

Each module comprises one to four lessons, and each lesson explores a Driving Question through a series of sessions. To investigate the lesson Driving Question, students plan, carry out, analyze, and critically reflect on a range of hands-on, digital, video, and text-based investigations and Engineering Design Challenges.
Instructional Design

Twig Science Middle School is based on an inquiry-driven instructional model and a 5E lesson design to engage and motivate your students through active learning.

Following the 5Es instructional model in every lesson of each module, students construct, demonstrate, and reflect on their understanding of the three dimensions of the module Performance Expectations. Each phase of the 5Es instructional model is the basis for one or more sessions of a lesson. Through the 5Es instructional model, students:

**Engage** with a phenomenon, connecting it to prior knowledge.

**Explore** Disciplinary Core Ideas (DCIs), gathering evidence through authentic Science and Engineering Practices (SEPs), while applying elements of familiar interdisciplinary Crosscutting Concepts (CCCs) as a lens for sense-making.

**Explain** their new ideas about the DCIs by developing and using models, constructing explanations, constructing scientific arguments, and other SEPs, using CCCs as a lens.

**Elaborate** on their new understandings by applying their three-dimensional learning in a new context.

**Evaluate** their mastery of the three dimensions of a Performance Expectation through a performance task, using a rubric.
PROGRAM COMPONENTS

Student Experience

Twig Journals
Throughout each lesson, students record data, observations, and predictions, develop models, engage in metacognitive reflection, and read and annotate informational text in their print or interactive digital Twig Journals. Teachers have access to versions of the Twig Journals with example answers for reference.

Hands-On
Each module includes a toolkit of materials for engaging modeling, investigation, and engineering design activities designed to provide students with memorable, meaningful experiences along their sense-making journeys.

Digital
Digital interactives give students rich investigative and modeling experiences with real-world phenomena.

Video
High-quality, engaging videos developed in alignment with the curriculum by documentary filmmakers bring phenomena to life using a rich repository of science footage and animation.

Integrated 3-D Challenges
Integrated 3-D Challenges are video-creation projects designed to help students make cross-discipline connections and apply their growing knowledge of science concepts using the embedded video editor.
Teacher Experience

Teacher Editions
Print and digital versions of Teacher Editions detail how Twig Science Middle School fully addresses the NGSS. They provide recommendations on how to prepare for and deliver each session, including discussion prompts with possible student responses, as well as differentiation, guidance for follow-up to assessment, and interdisciplinary connections.

Digital Platform
The easy-to-use digital platform is available as a stand-alone environment or with print. It includes teacher and student versions, presenter tools, digital interactives, assessments, reports, single sign-on, rostering, and accessibility tools, along with hundreds of award-winning videos.

3-D Assessment Suite
Developed with the Stanford Center for Assessment, Learning, and Equity (SCALE) to prepare students for state testing, the assessment suite includes informal, formative, and summative measures to assess students’ ability to meet Performance Expectations.

On-Demand Professional Learning
In-person, virtual, or on-demand training includes background refreshers, onboarding courses, and digital 3-D science guides.

Hands-On Kits
Inquiry-based activities are brought to life using resources supplied in Hands-On Kits and other everyday items.

What is a volcano?
A volcano is a point on the Earth's surface through which magma (molten rock beneath the Earth's surface) erupts as lava. Lava is extremely hot when it erupts, with temperatures typically ranging from 700–1,200°C, but eventually cools and solidifies into volcanic rock.

The features that can be seen above the surface of the Earth are only part of the system of a volcano. Magma from the Earth's mantle collects in chambers below the surface. Since the magma is less dense than the surrounding rocks, it tends to rise upward. The magma is under tremendous pressure, and eventually it escapes to the surface through vents and fractures. Magma exits the volcano, becoming lava.

A common misconception that students might have is that the mantle is completely liquid and that the tectonic plates are floating on a see of magma. This is not the case. The mantle is a solid that can behave plastically. It is not liquid but still able to move around very slowly. The movement and flows of the mantle are theorized to be the main driver of plate tectonics. Rock melts to form magma and appears on the surface as lava only under certain conditions.

Driving Question:
Are they hills and mountains, or volcanoes?
VOLCANO HUNTERS
Investigate what makes volcanoes tick before analyzing real-life data from active volcanoes, assessing threat levels, and devising a plan to protect people from the dangers of eruptions.

Vocabulary
- cementation
- compaction
- cooling
- crystallization
- deposition
- Earth’s core
- energy transfer
- erosion
- extrusive
- igneous
- intrusive
- lava
- magma chamber
- melting
- metamorphic
- model
- plate boundary
- pressure
- rock cycle
- sedimentary
- weathering

1 LESSON
Obtain and evaluate information to identify patterns in the locations of volcanoes around the world

In this lesson, I will:
1. Develop models of the rock cycle and use these models to understand the volcanic life cycle.
2. Construct a scientific explanation that describes how rock types can help determine whether a landform is volcanic or not.

REAL-WORLD INVESTIGATIONS

Video: Life of an Island Shield
The landscape features around Kathmandu, Bougainville Island, Auckland, and Yogyakarta all look different. How do geologic processes affect and change the landscape?

INVESTIGATIVE PHENOMENON
VOLCANO LIFE CYCLE
Obtain and Evaluate Information • Complete the activities at one of the stations and answer the questions. Then, rejoin your team and share what you’ve learned.

Stations 1 and 2: Beneath the Surface
Obtain and Evaluate Information • Read the Beneath the Surface Article handout and observe the Deep in the Earth visual. Summarize your findings about each of the Earth’s layers in the graphic organizer.

Embedding 3-D Instructional Shifts
- Students aren’t just given models — they develop their own to explain phenomena and solve problems.
- Science is explored as a dynamic, creative, and collaborative process rather than as a collection of facts.
- Students develop a passion for science through the thrill of experiencing their own aha! moments.
- Students record their findings in their Twig Journals as they investigate real-world phenomena through digital interactives, hands-on labs, video labs, and instructional texts.
- Students connect, build upon, and reflect on Anchor Phenomena and three-dimensional learning at module, Driving Question/lesson, and session levels.
STEM Career Explorations

Students gain exposure to dozens of aspirational STEM careers through videos, text, blogs, case studies, digital interactives, and virtual field trips.

In this lesson, I will:

investigate body systems
develop assistive technology
make slime
save the turtles
navigate the skies
form an ecosystem survival plan
analyze the behaviors of animals
construct an eco-city
design a water filtration system
slow the plastic tide
assess the threat from volcanoes
examine fossils
invent a customized helmet
create movie magic
build a beehive
Lesson 2 | Session 1 The Most Dangerous Volcano

Driving Question
Are all volcanoes equally dangerous to communities?

Overview
What Happened Here?
Students consider the effect of an eruption on nearby human populations.
What Makes Volcanoes Dangerous?
Students make observations of model eruptions using cola bottles.
Explosivity of Volcanic Eruptions
Students complete an exit ticket about the explosivity of volcanoes.

Prep
Create an Auckland Model: Shake one of the cola bottles a little. Open it so that it loses some of its fizz, and pour out 4–5 cm of cola.
Create a Merapi Model: Place the other cola bottle in a freezer for approximately 1 hour. Pour out 4–5 cm of cola and gradually add 1 tbsp of adhesive into the bottle, gently shaking as you go so the adhesive doesn’t clump. Replace the cap and shake the bottle until the adhesive has broken down and is evenly distributed. Let the bottle return to room temperature—this will take a few hours.

Note: This investigation was tested with non-diet cola. To replicate results, be sure to use this as opposed to other soft drinks.
Identify an outdoor location where the cola bottle eruptions can be modeled. Use a plastic table cover for easy cleanup.

Objectives
Students will:
• Observe models of different types of volcanoes and ask questions about explosivity.

Teacher Resources
• In kit: Measuring spoons
• In kit: 1 tbsp of all-purpose adhesive
• 2 × 16.9 fl. oz. bottles of cola (not diet)
For the eruption guided investigation:
• 2 eruption models (see Prep)
• In kit: Safety goggles
• In kit: Plastic table covers

Digital Resources
• Before and After visual
• Module Wonder Questions
• Observing Volcanoes video
• Eruptive Histories visual
• Phenomena Tracker Routine visual

www.twigscience.com
What Happened Here?
Activate Thinking About Eruptions

Remind students of the four locations they were investigating in Lesson 1. Optional: Prompt them to look at the images on pages 8–10 in their Twig Journals.

Display the Before and After visual. Explain that the images show a region near Merapi, the volcano near Yogyakarta, before and after an eruption in 2010.

- What differences are there between the before and after images?
- What effects do you think the eruption had on the people living nearby?

Let students know that 353 people died and over 350,000 people were evacuated from the area.

- Do you think all eruptions are this dangerous to nearby populations?

Think Talk—Co-Craft Questions

Display the Class Wonder Questions chart. Refer to the Module Wonder Questions, and share the group of questions that students will be investigating in this lesson. If needed, use the Co-Craft Questions language routine to reframe these as investigable questions.

Explain that students can share and add any new questions they have as they work through the module to their Wonder Questions charts on pages 4–5 in their Twig Journals.

English Learners

Support students as they discuss their observations of the Before and After visual. Pair ELs with a partner who has a higher level of English proficiency to help them share their observations before the discussion. Write volcano and eruption on the board, say each word, and have students repeat it. Show the visual and point to the damage the volcano caused. Model how to describe what’s happening to support students’ ability to describe what they’re seeing before and after the volcanic eruption. Invite students to repeat, modify, or add to your descriptions with words or gestures.
Pre-Exploration
(Diagnostic Pre-Assessment)

Identify preconceptions and misconceptions that students will address during the module.

Formative Assessment

Ongoing lesson/session assessment reveals student knowledge, reflection, and use of the three dimensions to meet learning objectives.

Developed in Partnership with Stanford University’s SCALE Team

The Twig Science assessment system evaluates student attainment of 3-D Performance Expectations and prepares students for state testing.

Pre-Exploration

1. A student gets a new toy for his younger sister's birthday. Four rings are placed on the floor. He wants to determine how some objects appear to defy gravity, based on his observations of the toy.

2. What should he investigate to best determine how objects appear to defy gravity?

a. What are the distances between the boxes and Earth?

b. Do the rings have like or opposite facing poles?

c. How did the mass of the rings change?

d. Is there an electric field?

Based on his argument investigation, which claim is correct?

- Transfer of more energy to the kinetic store
- Larger store of gravitational potential energy at a greater height
- Ball moves faster than ground
- Earth's gravitational force on Earth
- Larger store of gravitational potential energy at a greater height
- Ball stays the same—before the ball is dropped, the energy transferred to a higher store than the ball

The mass of Box 1 is 1.5 kg and the mass of Box 2 is 3 kg. The mass of the Earth is 5.97 × 10^24 kg. The distance between an object and the ground does not affect gravitational force. Distance and mass are both variables that affect gravitational force.

2. The table shows what gravitational force each box has on the Earth when at different distances from the ground.

<table>
<thead>
<tr>
<th>Distance from Ground (m)</th>
<th>Box 1's Gravitational Force (N)</th>
<th>Box 2's Gravitational Force (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12.4</td>
<td>24.8</td>
</tr>
<tr>
<td>2</td>
<td>13.2</td>
<td>26.4</td>
</tr>
<tr>
<td>3</td>
<td>14.0</td>
<td>28.0</td>
</tr>
<tr>
<td>4</td>
<td>14.8</td>
<td>30.4</td>
</tr>
<tr>
<td>5</td>
<td>15.6</td>
<td>32.8</td>
</tr>
</tbody>
</table>

Food poisoning affects the digestive system because it affects how the parts of the digestive system function. All of the parts of the digestive system are made of cells. When the digestive system is not working correctly, it can cause symptoms like nausea and vomiting. A sample from the patient is known to cause food poisoning.

Analyze the three patients' diagnoses. Think about how each patient's symptoms might affect the parts of the digestive system. Use the term involved to reflect the effect of the claim. Use the term evidence to reason why the claim is correct.

- Patient 1: I think this person has food poisoning.
  - Evidence: The patient has symptoms like nausea and vomiting.

- Patient 2: I think this person has food poisoning.
  - Evidence: The patient has a fever and stomach pain.

- Patient 3: I think this person has food poisoning.
  - Evidence: The patient has a headache and muscle aches.

Develop and use a hypothesis to meet learning objectives. Weave Studios | NEW YORK |

Our investigation showed that the strength of an electromagnet can be improved by increasing the number of coils wrapped around it. My hypothesis is that when an object was closer to an electromagnet, it was more likely to be attracted. Our investigation revealed that we could improve the strength of the electromagnet by increasing the number of coils. We used a hypothesis to predict the effects of our investigations.
Summative Performance Tasks
Measure student achievement of Performance Expectations through high-engagement tasks. Student and teacher rubrics are provided to establish expectations and provide support.

Summative Benchmark Assessments to Prepare for State Testing
Benchmark Assessments challenge students to apply three-dimensional understanding to new contexts in performance assessments developed by SCALE with multidimensional rubrics.

Assessment Platform
Comprehensive tools for planning, assigning, grading, and analyzing student assessments, with rubric-based scoring and reporting.
English Learners and Language Support
English Learner scaffolds for substantial, moderate, and light support toward language proficiency:

- Speaking, listening, reading, and writing language domains
- Linguistic frames, tiered vocabulary support, and Stanford Understanding Language/SCALE routines

Special Needs

Social-Emotional Functioning
Some students may have decided that they are “not good at science and technology.” They may have found reinforcement for these attitudes and ideas among their social group. Encourage these students to use KWL charts (you can find templates online) to investigate their thought processes and identify what is influencing their thinking. Add an “H” column to the chart for “How I Learned What I Know.” You can also use CER charts to investigate student beliefs and self-knowledge.

Special Needs Modifications
Light to moderate support for:

- Fine motor skills
- Physical disability
- Conceptual processing
- Executive functioning
- Social-emotional functioning
- Visual-spatial processing
- Expressive and receptive language
Students are inspired to explore science and engineering careers when they realize that STEM professionals are regular people just like them.

Twig Science Middle School features historical and contemporary examples of STEM professionals from all backgrounds, genders, races, and abilities.

Students experience a wide range of STEM career roles through phenomena-based investigations. Meet the STEM professionals who inspire and motivate students and help them explain phenomena and meet engineering design challenges.
You’ve never seen core like this before

Imagine Learning is with you every step of the way.
To learn more or to connect with your local account executive, go to www.imaginelearning.com/contact-us