Science

CORE CURRICULUM

twig SCIENCE

Middle School

Phenomena-Based, Digital-Forward, 3-D Learning

imagine learning

“Twig was one of the best decisions we made...

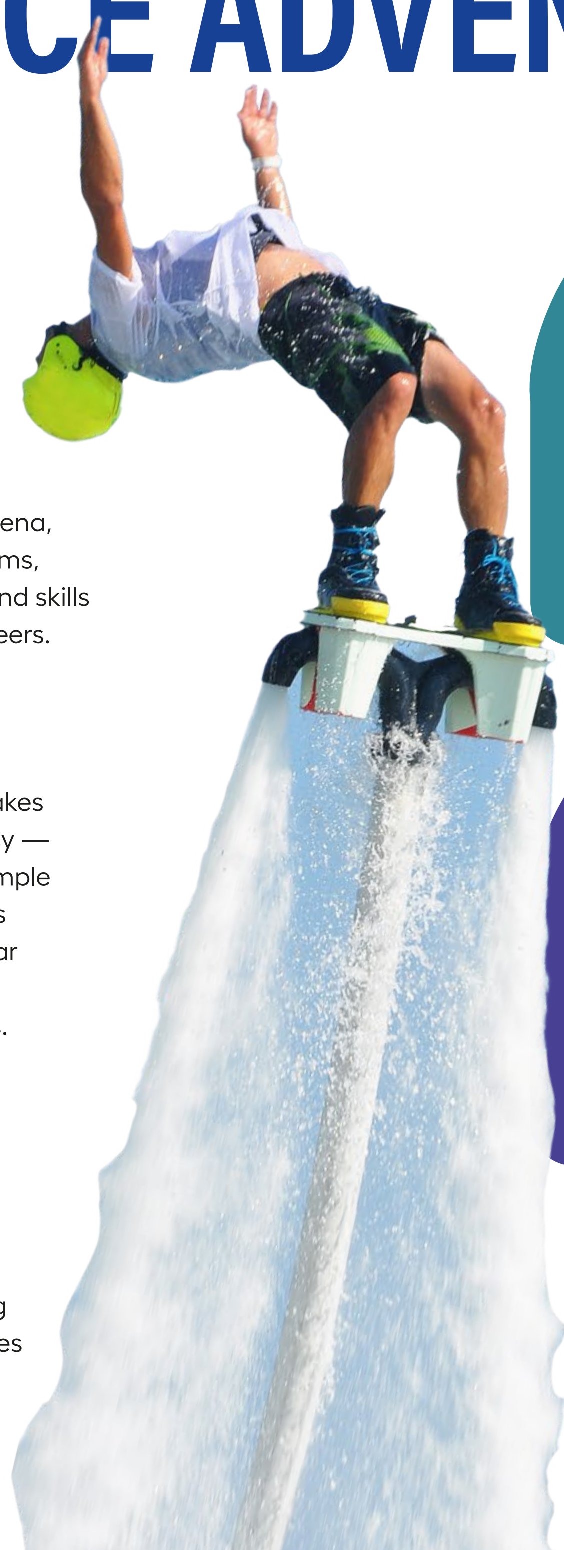
Our teachers have been ecstatic about the quality of learning they have been able to facilitate [and] students have been equally impressed and highly engaged in science learning.”

. . .

Derek B., Director of Teaching and Learning, Newberg School District, Oregon

twig SCIENCE Middle School

STUDENT-FOCUSED SCIENCE ADVENTURES



Science that Speaks to Students

Engaging with multimodal, phenomena-based projects brings science meaningfully into students' lives. By collaborating in investigations, using analytical skills, making sense of phenomena, and solving engineering problems, students develop knowledge and skills they'll need for college and careers.

Stop Finding Time, Start Saving Time

Twig Science Middle School makes hitting 3-D NGSS standards easy — and with comprehensive yet simple assessment tools and countless opportunities for cross-curricular applications, it provides rich, rewarding learning experiences.

Thinking like Scientists, Designing like Engineers

Learning is centered around captivating anchor phenomena and engineering design challenges, empowering students to unravel the mysteries of the world and solve real-life, relevant problems.

Integrated Volumes

In Integrated volumes, modules from different disciplines (Life Science, Earth and Space Science, Physical Science) are grouped together to promote an interdisciplinary approach.

Discipline-Specific Volumes

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.

DESIGNED TO ENGAGE

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.

MODULE

- Anchor and Investigative Phenomena
- Diagnostic Pre-Explorations
- 3-D Challenges

DRIVING QUESTION LESSON

- Phenomena Tracker
- 3-D Performance Expectations Progressions
- Academic and Domain-Specific Vocabulary

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.

ENGAGE
- Investigative Phenomena & Engineering Design Challenges
- 3-D Student Learning Objectives
- Activate Prior Knowledge
- Differentiated Instruction
- Discussion

EXPLORE / EXPLAIN
- Hands-On Labs
- Video Labs
- Digital Interactives
- Reading for Evidence
- Language Routines
- Discussion

ELABORATE
- Investigative Phenomena
- Connections
- Critical Thinking and Reading
- Differentiated Instruction
- Discussion

EVALUATE
- Summative Assessments
- 3-D Formative Assessments
- Differentiated Instruction
- Discussion

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

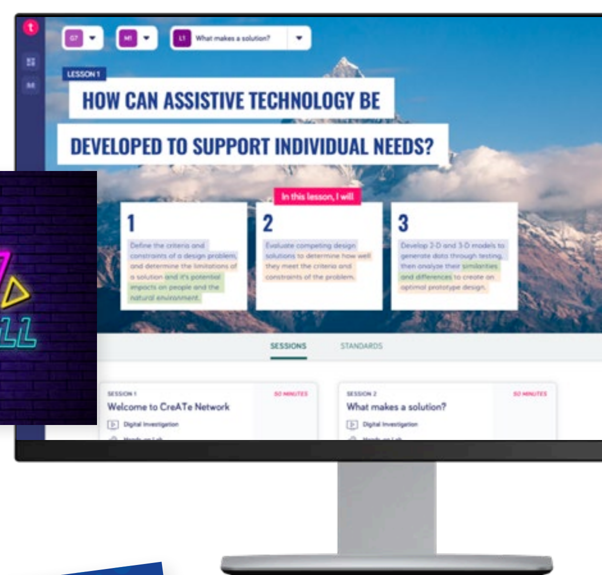
Digital interactives give students rich investigative and modeling experiences with real-world phenomena.

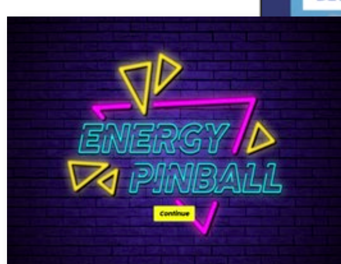
Video

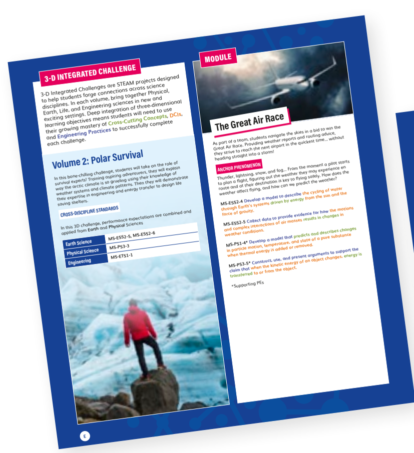
High-quality, engaging videos developed in alignment with the curriculum by documentary filmmakers bring phenomena to life using a rich repository of science footage and animation.

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.



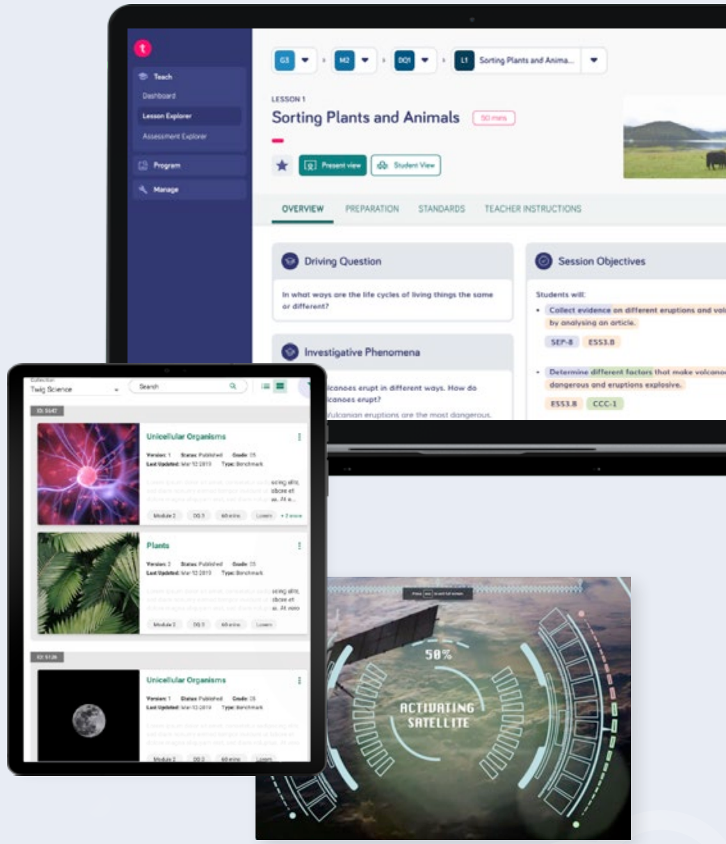




Teacher Experience

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.

REAL-WORLD INVESTIGATIONS

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

PLAN YOUR LESSON

In **print** or **digital**, whether you're teaching a module focused on an **Anchor Phenomenon** or **Engineering Design Challenge**, Twig Science Middle School puts all the information and tools that you need at your fingertips to plan your instruction.

Lesson 2 | Session 1 The Most Dangerous Volcano

SESSION 1

Engage | Explore / Explain | Elaborate | Evaluate

Driving Question

Are all volcanoes equally dangerous to communities?

Driving Questions encourage students to engage in practices to explain phenomena.

Wonder Question

What happens during an eruption?

Investigative Phenomenon

Volcanoes erupt in lots of different ways.

Students make sense of phenomena and solve problems.

Overview

What Happened Here? 5 min

Students consider the effect of an eruption on nearby human populations.

What Makes Volcanoes Dangerous? 40 min

Students make observations of model eruptions using cola bottles.

Explosivity of Volcanic Eruptions 5 min

Students complete an exit ticket about the explosivity of volcanoes.

Lesson structure, pacing, and planning.

Objectives

Students will:

- Observe models of different types of volcanoes and ask questions about explosivity.

Color-coded NGSS learning objectives.

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

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.

Digital Resources

- Before and After visual
- Module Wonder Questions
- Observing Volcanoes video
- Eruptive Histories visual
- Phenomena Tracker Routine visual

Clear guides to digital and teacher resources aid prep.

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Lesson 2 | Session 1 The Most Dangerous Volcano

Engage | Explore / Explain | Elaborate | Evaluate

Built-in discussion prompts and exemplar responses.

What Happened Here?

5 min

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.

Before and After visual

- ***What differences are there between the before and after images?***
- ***What effects do you think the eruption had on the people living nearby?***
  I think people died because of the eruption.
  Homes were destroyed and covered with ash, so people can't live in them.
  Crops probably died, so people wouldn't have enough food.

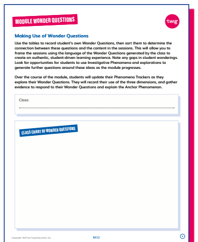
Let students know that 353 people died and over 350,000 people were evacuated from the area.

- ***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.



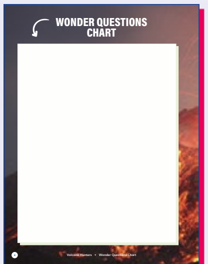
Module Wonder Questions

Language routines are used to support sense-making and language development.

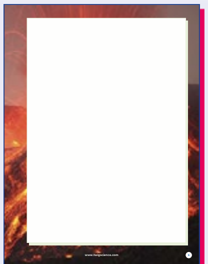
Scaffolds for honors/advanced, special needs, intervention, and English learners.

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.



Twig Journal, p.4


Twig Journal, p.5

High Quality NGSS Design
Awarded to
Volcano Hunters
Module
Awarded by WestEd

3-D PERFORMANCE ASSESSMENTS

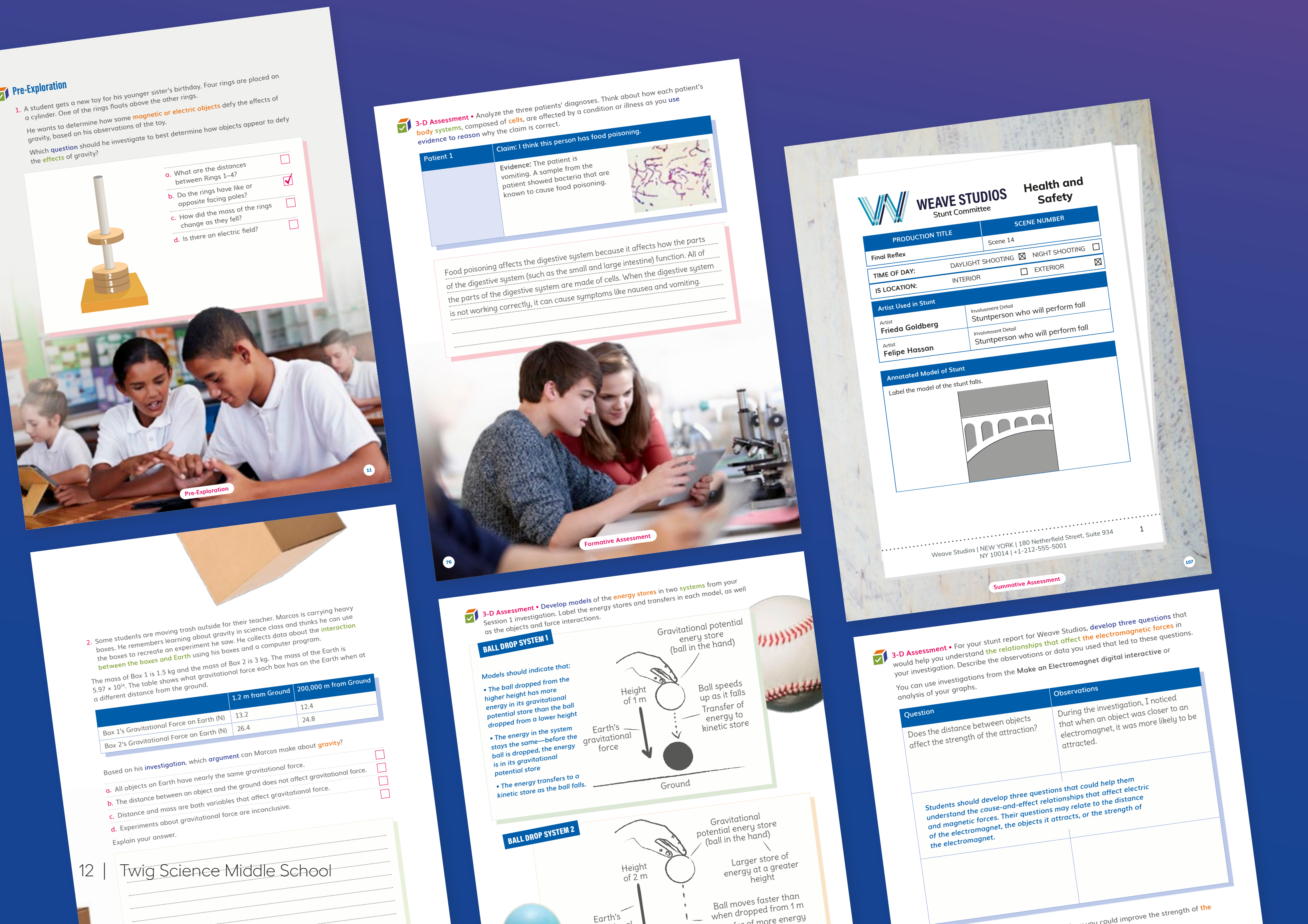
The Twig Science assessment system, developed in partnership with Stanford University's SCALE Team (now SCALE Science at WestEd), evaluates student attainment of 3-D Performance Expectations and prepares students for state testing.

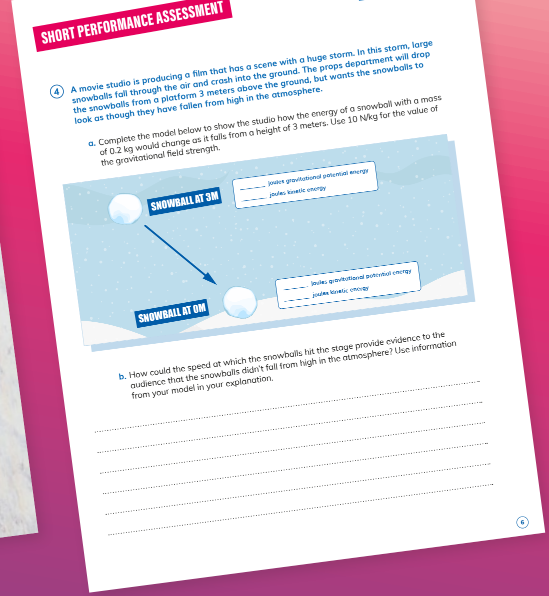
Pre-Exploration (Diagnostic Pre-Assessement)

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.



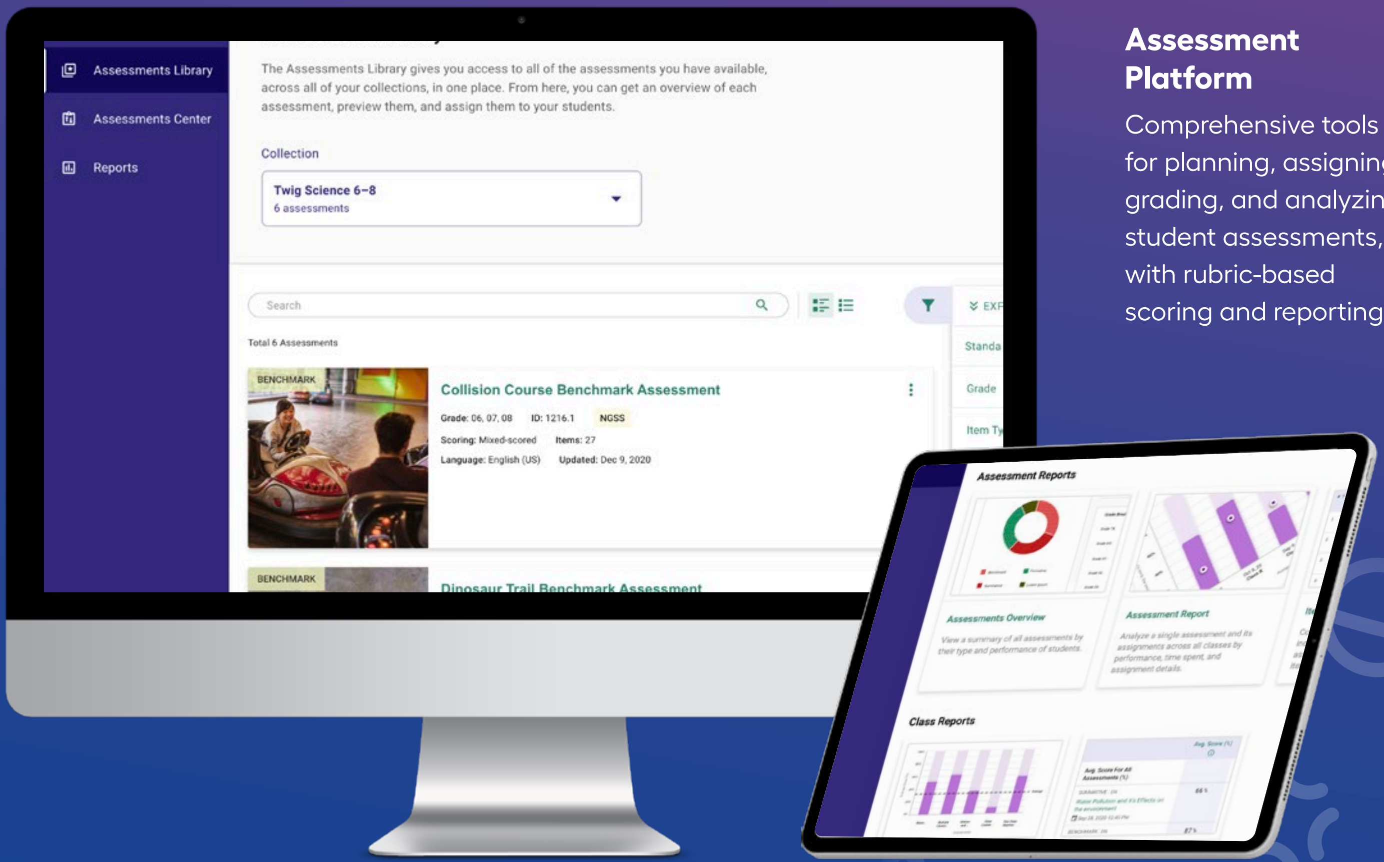


Summative Performance Tasks

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

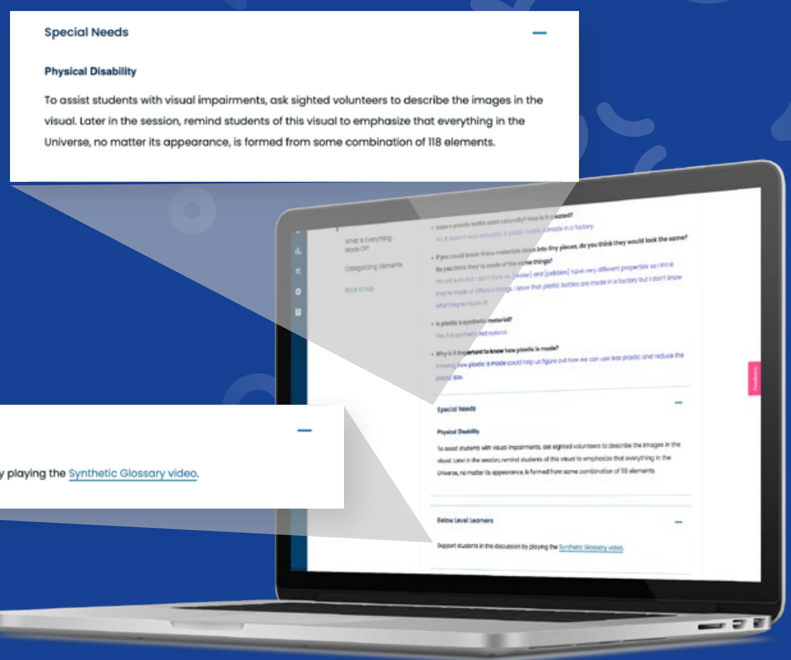
Comprehensive tools for planning, assigning, grading, and analyzing student assessments, with rubric-based scoring and reporting.

SUPPORTING EVERY LEARNER

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



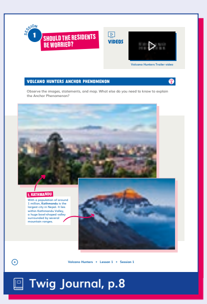
Below Level Learners

Support students in the discussion by playing the Synthetic Glossary video.

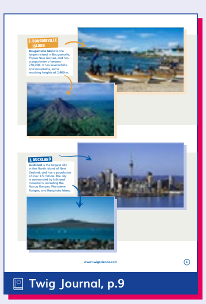
Special Needs

Social–Emotional Functioning

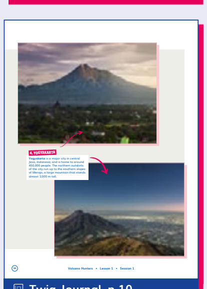
Some students may have decided that they are "not good at science and technology." They may have found reinforcement for these attitudes and ideas among their social group. Encourage these students to use KWL charts (you can find templates online) to investigate their thought processes and identify what 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.



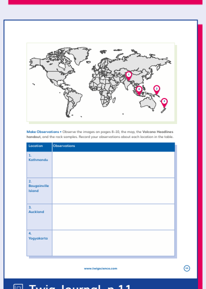
Twig Journal, p.8



Twig Journal, p.9



Twig Journal, p.10



Twig Journal, p.11

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

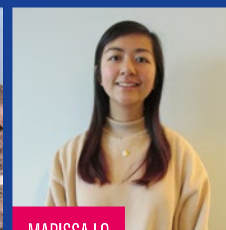
ACCESS AND EQUITY

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.

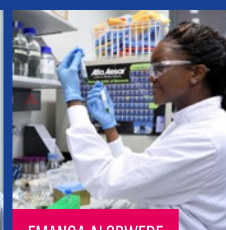
Students experience a wide range of STEM career roles through phenomena-based investigations. Meet the STEM professionals who inspire and motivate students and help them explain phenomena and meet engineering design challenges.


DR. XU XING

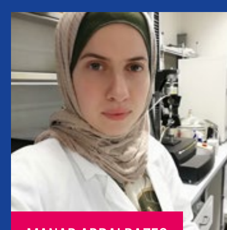

MARISSA LO


DR. SAMUEL RAMSEY

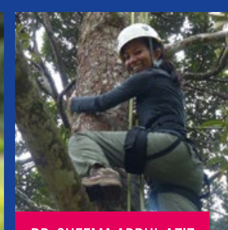

DR. MAZDAK GHAJARI

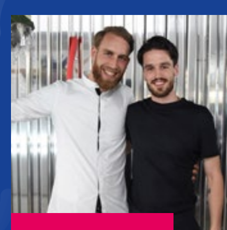

EMANGA ALOBWEDE


ALEX LEWIS


MANAR ABDALRAZEQ


PROFESSOR ROBERT EWERS


DR. SHEEMA ABDUL AZIZ


FABIAN ENGEL & SIMON OSCHWALD


DR. ELENA CUESTA


BRADON COY