



Designed for NGSS: Student Work Rubric

Analyze Evidence

Directions:

1. Review your assigned materials to describe the path of student thinking.
2. Represent your answers to the questions in the space provided.
3. Be prepared to share the path of student thinking visually on a public chart.

Answer (in words, graphics, or both)

Answer the following questions as you describe the path of student thinking in the materials. Consider what you would expect students to be thinking about through the learning experiences.

What are students figuring out/solving?

- A. What is driving student learning (e.g., question, scenario, problem, phenomenon, etc.)?
- B. What ideas and practices do students develop through these experiences?
- C. How do students access, engage, and use prior knowledge to further their thinking?
- D. How do students develop metacognitive abilities?

A more granular look can be found in each Driving Question Overview, which provides a short summary of each lesson. This example is from Grade 4 Module 4.

Overview: Full Course

Driving Question 1 How are waves involved in earthquakes?

FULL COURSE		
	LESSON	PAGE
ENGAGE	1 My House Collapsed! Students watch a video to engage them in thinking about natural disasters and then construct as tall a building as they can out of newspapers. The Module Investigative Problem is introduced, and students listen to a text to activate prior knowledge.	6 45 min
EXPLORE	2 Making Waves Students learn about waves to prepare them for understanding seismic waves. They observe a teacher demonstration and a video about waves, then draw and write explanations of what they observed. They share, discuss, and revise their visual models.	13 45 min
EXPLAIN	3 Learning the Ropes Students look at images of waves and discuss their similarities and differences before learning the abstract concepts of amplitude and wavelength by shaking ropes.	20 45 min
ELABORATE	4 Rocks and Ducks Students review what they have learned about waves, wavelength, and amplitude in previous lessons. They use an interactive to explore the connection between wave amplitude and amount of energy transfer, then discuss and explain their observations.	28 45 min
EVALUATE	5 How Big Was That Earthquake? Students observe a demonstration that illustrates the concept that earthquakes transfer energy to the ground as waves. They then read an informational text to learn about the size or magnitude of earthquakes and fill in a magnitude scale sheet.	34 45 min

Scientist and Engineer Investigation Experience

Digital Investigation Hands-On Investigation Video Investigation Reading for Evidence 3-D Assessment

Grade 4 Module 4 DQ1 Overview TE p.2

In addition, every module is complemented with a magazine-style leveled reader (available in four levels, plus Spanish) that provides another route into the Module Phenomena, as well as interviews with scientists and engineers from diverse backgrounds. Packed with stunning images, cartoons, and jokes, they are designed to appeal to students from a diverse range of learning abilities.

RUN FOR YOUR LIFE!

Here is how a lucky survivor described his nightmare.



Shake, Rattle, and Roll (Grade 4 Module 4 Leveled Reader p. 11)

CHAPTER 2 STEM CAREERS
MEET A SEISMOLOGIST

Many different kinds of scientists study the Earth's activity in and around the Ring of Fire. **Volcanologists** study volcanoes. **Seismologists** study earthquakes. They look at movements, or energy waves, in the Earth's crust. Let's find out more from seismologist Dr. Rebecca Bell.

Dr. Rebecca Bell

What does a seismologist do?

We are like detectives. We look for clues about the past in rocks. We study seismic waves. We do experiments and examine data to discover the source, size, and cause of seismic waves. They cause earthquakes.

Where do you do your work?

We spend a lot of time in the lab. We study rocks. We create and test computer models of earthquakes. I interpret images of what the Earth looks like below the surface. These images have been produced with sound waves. They show me where faults are located. These faults could cause earthquakes. I also use information from drilling into the ground to learn about how the ground might respond in an earthquake.

Shake, Rattle, and Roll (Grade 4 Module 4 Leveled Reader p. 16)

Chapter 1 reinforces and extends student learning of the Module Phenomena.
Chapter 2 connects the phenomena to STEM careers, and details a hands-on micro-lab.
Chapter 3 focuses on applying the ideas and phenomena explored to the students' lives.

Age-appropriate Trade Books are also provided for every module, further widening the scope and opportunities for all students to access authentic real-world phenomena.



Shake, Rattle, and Roll (Grade 4 Module 4 Levelled Reader)

SW2. Three-Dimensional Conceptual Framework.

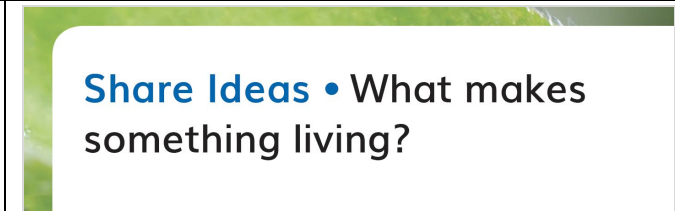
The student learning journey through each module is scaffolded through a series of DQs. These follow a conceptual flow, whereby students make sense of a subset of smaller phenomena/problems and then use their growing knowledge and skills to connect back to the more complex Module Phenomenon/Investigative Problem.

Their sense-making happens through a rich variety of learning experiences, including hands-on, digital, video, and informational text investigations, as well as language routines that support students to articulate their reasoning.

A short summary of each lesson is provided in the Driving Question Overview, with more detail provided on the Lesson Overview (**Grade 4 Module 4 DQ4L1 TE p. 128**). Here you can see how students grow and deepen their understanding and use of the three-dimensions across the lesson, activating prior knowledge, asking questions that connect to their learning, and sharing their ideas with peers.

Grade 4 Module 4 DQ4L1 TE p. 128

The SEPs the students use in each learning activity are labeled at point of use in the Student Edition (called the Twig Book), in grade-appropriate language.



Labeled SEPs in the Student Edition

SW3. Prior Knowledge.

The materials in Twig Science consistently leverage student prior knowledge and experiences to motivate their learning.

Across the Program

Teachers are supported to leverage prior knowledge from previous grades and previous modules at point of use in the instructional materials. The Performance Expectation Progressions table in the back cover of every TE highlights previous student experience relating to the phenomena and relevant dimensions. For example, for **Grade 4 Module 4**, we can see that this module builds on prior knowledge of engineering tasks completed in previous grades (Kindergarten Module 2, Grade 2 Module 2, and Grade 3 Module 4), plus natural hazards (Kindergarten Module 3, Grade 2 Module 3, Grade 3 Module 4) and use of maps (Grade 2 Module 1, Grade 4 Module 3).

EARTHQUAKE ENGINEERING

Performance Expectation Progressions
NGSS Topic Arrangements: Earth's Systems; Engineering Design

GRADE 4
MODULE 4

Earthquake Engineering introduces one NGSS Performance Expectation (PE) in Physical Sciences (4-PS4-1) and explores two in Earth Sciences (4-ESS2-2 and 4-ESS2-3). These PEs address waves, natural hazards, and the mapping of Earth's features and forces.

Three additional PEs engage students in engineering design: 3-5-ETS1-1, 3-5-ETS1-2, and 3-5-ETS1-3. While aspects of engineering design are addressed in other Grade 4 modules, Earthquake Engineering emphasizes designing structures to solve problems that arise from natural hazards.

PROGRESSION					
PRIOR KNOWLEDGE			CURRENT GRADE		FUTURE KNOWLEDGE
KINDERGARTEN	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 6
Module 2 K-PS2-2 K-2-ETS1-1 Marble Run Engineer Students define a force as a push or a pull. They discover that using a stronger push or pull causes an object to speed up or slow down more quickly, and that when objects touch or collide they can push each other, causing changes in direction and/or speed. Module 3 K-ESS2-2 K-2-ETS1-2 Be Prepared Students are introduced to the idea that natural processes can affect humans. They read about natural hazards posed by different forms of severe weather. They ask questions to understand and prepare for a severe weather scenario. They design umbrellas, explaining the connection between choice of materials and specific weather conditions.	Module 2 1-PS4-1 Animal Reporters Students develop an introductory understanding of sound waves. They investigate everyday objects to produce sounds. They discover that sounds cause objects to move and that all sounds are caused by vibrations. Module 3 K-2-ETS1-3 Master of Materials Students build and test the strength of model towers made of different materials. Module 4 K-2-ETS1-1 Save the Island Students explore the effects of erosion and sea level rise on "Linger Island." They define design criteria to address these problems. Students learn about engineering solutions and evaluate each against their design criteria.	Module 1 2-ESS2-2 My Journey West Students learn to interpret geological features on maps. They create maps and explore ways that maps can be used to convey different types of information. Module 2 2-PS1-2 K-2-ETS1-3 Master of Materials Students build and test the strength of model towers made of different materials. Module 3 K-2-ETS1-1 Save the Island Students explore the effects of erosion and sea level rise on "Linger Island." They define design criteria to address these problems. Students learn about engineering solutions and evaluate each against their design criteria.	Module 4 3-ESS3-1 3-5-ETS1-1 3-5-ETS1-2 Weather Warning HQ Students investigate natural hazards from severe weather. They explore the relationship between storms and lightning, and between lightning and hazards such as wildfires. They compare the relative effectiveness of different approaches to reducing hazards and to educating people about them. Module 5 4-PS4-1 Super Survivors Students investigate waves in water and sound waves. They model wave motion, explaining patterns of wave amplitude and wavelength. They discover how waves in water transfer energy. They compare the effect of waves on objects in the open ocean versus objects near shore.	Module 2 MS-ESS2-5 MS-ESS2-6 Destruction Everywhere Students explore the causes of weather and regional climates. They look for patterns on an interactive map and identify possible relationships between weather, climate, and geology.	

twigScience | NEXT GEN

Grade 4 Module 4 Performance Expectation Progressions table (TE Back Cover)

Within a Module

Modules kick off with a diagnostic pre-assessment called a Pre-Exploration. It's quick and easy to use, helps teachers identify students' prior knowledge, as well as any misconceptions they will need to address. Additional Pre-Explorations are included at strategic points in later DQs, so prior knowledge can be activated when most useful. Pre-Explorations are highlighted in the Driving Question Overviews (Grade 4 Module 4 DQ3 Overview TE pp. 94-95).

Grade 4 Module 4 DQ3 Overview TE pp. 94-95

A highly visual Prior-knowledge Read-Aloud is integrated at the start of every module to support activation of existing knowledge for students of all reading abilities. The Prior-knowledge Read-Aloud can be found in the material lists in the both the Driving Question Overview and Lesson Overview.

Earthquakes, Tsunamis, and Volcanoes
Prior-Knowledge Read-Aloud (Grade 4 Module 4)

Throughout each module students are consistently supported to revisit their early ideas, revise their claims, and relate their new understandings to answering the DQs and solving the Module Investigative Problem.

For example, in the first lesson in Grade 4 Module 4, students activate their prior knowledge by watching and discussing authentic footage of natural disasters ([Natural Disasters video](#)), and through a Prior-Knowledge Read-Aloud ([Earthquakes, Tsunamis, and Volcanoes Prior-Knowledge Read-Aloud](#)). They are prompted to think back to the concept of landscape changes they explored in Grade 4 Module 3 (CCC-5), and see how they compare to changes caused by natural disasters. They also complete two columns of a KLEW chart and note what they already Know about natural disasters and what Wonder about ([Grade 4 Module 4 DQ1L1 Reflect TE p. 11](#)).

Connections to prior knowledge are frequently found in the Connect section of the lesson.

Students refer to and revise their classroom Science Tools Poster, which explicitly details their growing use of the SEPs, and **motivates them** by helping them visualize their progression. Use of the Science Tools Poster is clearly identified in the TE. Students add “Evaluate information” to their Science Tools Poster ([Grade 4 Module 4 DQ2L2 Science Tools Poster TE p. 62](#)).

Reflect 6 min

Formative Assessment

Have students look at the KLEW Chart on page 4 in their Twig Books. Explain that they will fill out this table over the course of the module, reflecting their knowledge and learning about earthquakes, tsunamis, and volcanoes, and their impact on humans.

Ask students to reflect on how they might know facts about these topics. For example, they might have heard information on television, from their family and friends, or in their science lessons.

Have students fill in the “Know” column (what they know) and the “Wonder” column (what they wonder).

Use the Formative Assessment

Review students’ answers to assess their prior knowledge and determine discussion points for the Spark of the next lesson. In particular, note any entries that relate to the concept of waves.

Know	Learned	Evidence	Wonder
<ul style="list-style-type: none"> Earthquakes happen in a specific place and are caused by rocks moving. They make the ground split and cause landslides that can hurt and kill many people. Tsunamis are big waves caused by underwater earthquakes and are very destructive. They can kill thousands of people and cause a lot of damage. There are about 1500 active volcanoes on earth and they can be very dangerous, so erupt every year. 	<ul style="list-style-type: none"> Earthquakes are made up of waves of energy called seismic waves. The amount of energy in these waves, or magnitude, can be measured by recording their amplitude. The number of deaths caused by earthquakes has decreased over the years. This is because we are building safer and stronger buildings than we used to, as well as developing better emergency procedures and rescue techniques. 	<ul style="list-style-type: none"> The seismometer app showed us how energy is made of waves that can be measured. The “California Shakin’” article showed how the number of deaths has decreased over the last 180 years. In the San Francisco earthquake of 1906, 3,000 people died, compared to 1 person during in the 2014 South Napa earthquake. 	<ul style="list-style-type: none"> Can we guess when they will happen and how bad they will be? Do they happen in some places more than others? why? Can we protect people and places from the damage they cause?

Driving Question 1 | Lesson 1

Grade 4 Module 4 DQ1L1 Reflect TE p. 11

Chart SEP-8—Obtaining, Evaluating, and Communicating Information

Remind students that today they have successfully evaluated information, a practice of good scientists. Draw students’ attention to the Science Tools poster and add “Evaluate information.”

Science Tools

- Plan and carry out investigations
- Construct explanations
- Develop and use models
- Communicate information
- Design solutions
- Obtain information
- Argue from evidence
- Use math and computational thinking
- Ask questions
- Evaluate information

Grade 4 Module 4 DQ2L2 Science Tools Poster TE p. 62

SW4. Metacognitive Abilities.

In Twig Science, every module regularly provides students with explicit opportunities to consider how their learning experiences have changed their thinking.

Diagnostic pre-assessments (Pre-Explorations) found at the start of every module and at strategic points thereafter, support students to think about the three dimensions they are already familiar with and those they are not. The Progress Tracker helps raise awareness for both teachers and students of how their understanding is growing. How and where to use the trackers is clearly signposted in the TE (**Grade 4 Module 4 DQ1L5 Progress Tracker TE p. 41**).

Pre-Exploration
Have students complete the Earthquake Patterns Pre-Exploration on page 19 in their Twig Books in order to elicit misconceptions about earthquakes.
Have students refer to the list of statements about earthquakes, and check the box next to each statement that they believe to be true.
They should then write whether they think we can see patterns in when and where earthquakes occur, and give details.

Use the Pre-Exploration
Look for students who demonstrate the following misconceptions and record them on the **Earthquake Patterns Progress Tracker**. You will address these misconceptions in future lessons.

Earthquake Patterns Progress Tracker

Statement	True	False
Earthquakes occur every day.		
Earthquakes are most likely to happen in the ground to open up the ground.		
Earthquakes are equally likely to happen anywhere on Earth.		
Earthquakes are most likely to happen in the ground to open up the ground.		
Earthquakes are most likely to happen in the ground to open up the ground.		

Grade 4 Module 4 DQ1L5 Progress Tracker TE p. 41

In the Twig Book, a stunning visual spread at the start of each DQ is designed to excite students about their learning journey. The “I can...” statements, written in student-friendly language, raise visibility of the three dimensions they are using to figure out phenomenon and solve problems. For example, “I can... use an interactive to explore earthquakes and volcanoes, and interpret data to understand relationships between earthquakes and tectonic plates (**Grade 4 Module 4 DQ2 “I can...” TB p. 22**).

The five-part Twig Science lesson structure has been designed to support students to develop their metacognitive abilities on a daily basis, and monitor what and how they have learned across the three dimensions:

- **Spark:** An engaging “hook” activity, which motivates students for the investigations ahead.
- **Investigate:** Students think like scientists and design like engineers, through hands-on, digital, video, and informational text Investigations.
- **Report:** Students articulate what they’ve learned today, citing evidence and their use of the three dimensions.
- **Connect:** Students make connections to the DQs and Module Phenomenon/Investigative Problem, while building knowledge of CCCs and SEPs.
- **Reflect:** Students use different means to think about what they have learned so far and how they can use their new understandings to better figure out phenomena/problems. For example, in Grade 4 Module 4 DQ1L5, students add to the Learned and Evidence sections of the KLEW chart they started in DQ1L1.

I can...

- Use an interactive to explore earthquakes and volcanoes, and interpret data to understand the relationship between earthquakes and tectonic plates
- Read and analyze informational texts about earthquakes, and use gathered data to produce a news report.

4-ESS2-2

Grade 4 Module 4 DQ2 “I can... statements” TB p. 22

SW5. Equitable Learning Opportunities.

Learning experiences across all Twig Science modules are multimodal in approach, with numerous cross-curricular connections that are designed to engage students meaningfully in a variety of ways, and multiple access points and support for all students.

Multimodal and Multisensory

The learning experiences include tasks in all domains—writing, reading, listening (in the form of Read-Alouds, Trade Books and videos), speaking (turn-and-talks, class discussions, and presentations), plus drawing and all other manner of investigations (from hands-on to digital; text to video).

Language Support

Point-of-use language scaffolding for English Learners is found in the sidebars of TEs ([Grade 4 Module 4 DQ1L3 English Learners TE p. 25](#)), while research-based language routines are integrated into core instruction supporting all students to “talk science” using grade-appropriate scientific vocabulary. The digital version of the Twig Book includes a text-to-speech function.

English Learners

Provide support for students' discussions.

Substantial Support (Emerging Proficiency)

Pair students with native English speakers. Provide yes/no and simple response questions for them to answer:

- *Did you add energy to the rope? How?*
- *Did you shake it fast or slow?*

Moderate Support (Expanding Proficiency)

Pair students with native English speakers. Guide them to take turns speaking and listening. Provide the following sentence frames:

- A wave is caused by _____.
- When I shake the rope fast, _____.
- When I shake the rope more slowly, _____.

Light Support (Bridging Proficiency)

Prompt students to build on each other's ideas. Use the following sentence starters for support:

- I observed that _____.
- In addition _____.
- Another effect of _____.

[Grade 4 Module 4 DQ1L3 English Learners TE p. 25](#)

<p>The leveled readers have been designed to capture the imagination of young readers, with jokes and cartoons. They provide an alternative means for students to access the scientific content. Readers are available in four levels (Below, On, Above, and EL) plus Spanish, with complementary lessons to build language acquisition and develop informational text reading skills. On Level lessons are in the printed TE, and the other levels are available digitally. The leveled readers feature many positive role models in the field of science and engineering, which are designed to cultivate interest in STEM careers for all students. Chapter 2 of the leveled reader is always dedicated to an interview with an inspiring role model. The digital version of the leveled reader includes a text-to-speech function.</p> <p>Special Needs Suggestions for extra access points for students with many special needs are provided frequently at point-of-use in the sidebars of the TEs (Grade 4 Module 4 DQ1L3 Special Needs TE p. 25). These include physical, emotional, and cognitive disabilities.</p>	<p>Special Needs</p> <hr/> <p>Executive Functioning</p> <p>Seat students next to a peer who can offer assistance with note-taking, if needed. This is not to copy, but to direct attention and offer tips.</p> <p>Grade 4 Module 4 DQ1L3 Special Needs TE p. 25</p>
<p>Cultural Connections Culturally relevant content is core to the module. For example, in Grade 4 Module 4, students investigate engineering solutions in the US, as well as examples from around the world (including Nepal and Japan), with additional culturally-relevant contexts added at point of use (Grade 4 Module 4 DQ2L2 Cultural Connection TE p. 58).</p>	<p>Cultural Connection</p> <hr/> <p>Many Native Americans of the Pacific Northwest tell stories about two powerful supernatural creatures, the Thunderbird and the Whale. Their epic struggle causes earthquakes and tsunamis.</p> <p>Grade 4 Module 4 DQ2L2 Cultural Connection TE p. 58</p>
<p>Gate Students Higher-order Challenge activities, for GATE students who have already met the learning goals, are interspersed throughout the lesson investigations. They can be found in the Twig Books, with instruction in the sidebars of the TE (Grade 4 Module 4 DQ1L3 Challenge TE p. 25).</p> <p>Video The frequent use of high quality videos engages all students of the YouTube generation in varied phenomena and science concepts. Stunning footage and imaginative storytelling bring abstract concepts to life, and captivate even the most disengaged or disruptive student. Key words are overlaid on key images as on-screen text, supporting students to marry visuals with both the spoken and written word. Captions are provided in both English and Spanish.</p>	<p>Challenge</p> <hr/> <p>After the video, ask students what they would see if raindrops fell in exactly the same place once every second.</p> <ul style="list-style-type: none"> • A repeating pattern of equally-spaced ripples <p>Grade 4 Module 4 DQ1L3 Challenge TE p. 25</p>



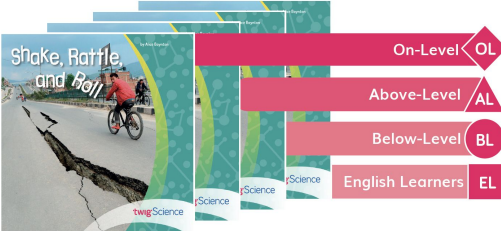
Designed for the NGSS: Foundations	High Quality 5	Medium Quality 3	Low Quality 1
<p>SW1. Phenomena/Problems. Materials provide phenomena/problems that:</p> <ul style="list-style-type: none"> engage students as directly as possible in authentic and relevant experiences; are matched to targeted learning goals; can be figured out/solved using scientifically accurate understandings and abilities; make connections beyond and to their daily lives, including to their homes, neighborhoods, communities, and/or cultures. 	Materials consistently offer quality phenomena/problems sufficient to motivate and drive student learning.	Materials sometimes offer quality phenomena/problems sufficient to motivate and drive student learning.	Materials rarely offer quality phenomena/problems sufficient to motivate and drive student learning.
<p>SW2. Three-dimensional Conceptual Framework. Materials include learning experiences that help students to build scientifically accurate understandings and abilities through opportunities for students to:</p> <ul style="list-style-type: none"> link prior knowledge to negotiated new understanding and abilities; use reasoning to connect grade-appropriate SEP, DCI, and CCC elements; ask and answer questions that link learning over time; negotiate new understandings and abilities by comparing their ideas, their peers' ideas, and ideas encountered in the learning experience(s); apply their understandings and abilities in a variety of ways. 	Materials consistently include learning experiences that help students build from prior experiences to negotiate new understandings and abilities, and apply their understandings in a variety of ways.	Materials sometimes include learning experiences that help students build from prior experiences to negotiate new understandings and abilities, and apply their understandings in a variety of ways.	Materials rarely include learning experiences that help students build from prior experiences to negotiate new understandings and abilities, and apply their understandings in a variety of ways.
<p>SW3. Prior Knowledge. Materials leverage students' prior knowledge and experiences to motivate student learning in ways that:</p> <ul style="list-style-type: none"> make visible students' prior knowledge and experiences related to the phenomena/problems and relevant SEPs, DCIs, and CCCs; revisit students' early ideas to see how they have changed (or not) as they figure out phenomena/solve problems; make explicit links to new ideas and practices being developed by students. 	Materials consistently leverage student prior knowledge and experiences to motivate their learning.	Materials sometimes leverage student prior knowledge and experiences to motivate their learning.	Materials rarely leverage student prior knowledge and experiences, and when included, they do not relate to the phenomena or problems.
<p>SW4. Metacognitive Abilities. Materials include learning experiences for students to:</p> <ul style="list-style-type: none"> set and monitor their learning in light of the targeted learning goals; consider, over time, what and how they have learned across the three dimensions; articulate how the three dimensions helped them figure out phenomena/solve problems. 	The materials provide students with regular, explicit opportunities to consider how their learning experiences changed their thinking.	The materials provide students with some opportunities to consider how their learning experiences changed their thinking.	The materials provide few opportunities for students to consider how their learning experiences changed their thinking.
<p>SW5. Equitable Learning Opportunities. Materials ensure that all students, including those from non-dominant groups and with diverse learning needs, have access to the targeted learning goals and experiences, including:</p> <ul style="list-style-type: none"> appropriate reading, writing, listening, and/or speaking alternatives for students who are English language learners, have special needs, read below the grade level, or have high interest and have already met the intended learning goals; culturally-relevant contexts and examples that support all students; opportunities to cultivate interest and confidence as scientists and engineers for all students. 	Most learning experiences in materials are designed such that students can engage meaningfully in a variety of ways, with multiple access points, and with supports for students.	Some learning experiences in materials are designed such that students can engage meaningfully in a variety of ways, with multiple access points, and with supports for students.	Few learning experiences in materials are designed such that students can engage meaningfully in a variety of ways, with multiple access points, and with supports for students.

Designed for NGSS: Student Work Rubric

Analyze Evidence

Directions:

1. Review the Designed for NGSS: Student Work Rubric.
2. Reflect on the evidence (or lack of evidence) that you and your team gathered.
3. Record strengths and limitations for each criterion based on your observations. Cite specific examples.

Strengths	
SW 1: Phenomena/ Problems	
<p>The Student Work is High Quality 5 in terms of SW1 Materials consistently offer quality phenomena/ problems sufficient to motivate and drive student learning.</p>	
<p>Evidence Look for the overarching Module Phenomenon and storyline in the Grade Scope and Sequence in the TE front cover. The Twig Book inside cover identifies the Module Phenomenon for students, while the Trailer videos explain the storyline. Reduxes of the Trailer videos are in the TE, while the videos themselves are found online with the module-level assets.</p> <p>The Family Outreach Letters are referenced in the TE—there’s always one in the first lesson of each module, while others are provided as needed throughout the module. They are accessed online in the Digital Resources.</p> <p>The Module Contents page in each TE (pp. i-ii) will help you identify the key phenomena/problem addressed in each DQ. A more granular view can be found in each Driving Question Overview, which provides a short summary of each lesson.</p>	 <p>Museum of Leafology Trailer video</p>  <p>Earthquake Engineering Trailer video</p>
<p>Print and digital copies of the module leveled readers are provided (and are available in four levels, plus Spanish).</p> <p>Chapter 1 reinforces and extends student learning of the Module Phenomena.</p> <p>Chapter 2 connects the phenomena to STEM careers, and details a hands-on micro-lab.</p> <p>Chapter 3 focuses on applying the ideas and phenomena explored to the students’ lives.</p> <p>Every module integrates at least one Trade Book. Trade Books are referenced in the lesson’s Resources list.</p>	 <p>Shake, Rattle, and Roll (Grade 4 Module 4 Leveled Reader)</p>

SW 2: Three-Dimensional Conceptual Framework

The Student Work is High Quality 5 in terms of SW2

Materials consistently include learning experiences that help students build from prior experiences to negotiate new understandings and abilities and apply their understandings in a variety of ways.

Evidence

Evidence of the student learning journey through each module can be found in the Module Contents of the TE, which details the DQs. These follow a conceptual flow whereby students make sense of a subset of smaller phenomena/problems, and then use their growing knowledge and skills to connect back to the more complex Module Phenomenon/ Investigative Problem.

Sense-making happens in the lessons through a rich variety of learning experiences, which you can find details of in the Driving Question Overview. More detail is provided on the Lesson Overview and, of course, in the lesson itself and in the Twig Book.

You will find that students are frequently supported to deepen their understanding and use of the three dimensions, activate prior knowledge, and share their ideas with peers. Class discussions, highlighted in blue in the TE (**Grade 4 Module 4 DQ2L3 Discussion Questions TE p. 69**), provide suggested prompt questions to help students connect their learning over time.

All the standards addressed in each lesson are clearly identified (**Grade 4 Module 4 DQ4 Lesson Overview TE p. 128**).

In the Twig Book, connections to the SEPs are highlighted in blue text before the student question/prompt.

Discuss Observations

Lead a class discussion about what students have observed and discovered. Ask students to take notes on page 32 in their Twig Books about important patterns that other students share. Consider connecting the discussion to some of the misconceptions from the Pre-Exploration, given in the table below.

- Did you see a pattern in your data?
- Did anyone observe a different pattern?
- Based on what all the teams have just described, can you summarize the data?
- How is the magnitude of each earthquake shown on the map?
- Did you notice any patterns in the magnitude of earthquakes around the world?
- Were there any areas of <the world/a specific region> that had <more/more powerful> earthquakes?
- Were you surprised by the locations of some of the earthquakes?

Grade 4 Module 4 DQ2L3 Discussion Questions TE p. 69

Grade 4 Module 4 DQ4 Lesson Overview TE p. 128

SW 3: Prior Knowledge

The Student Work is High Quality 5 in terms of SW3

Materials consistently leverage student prior knowledge and experiences to motivate their learning.

Evidence

Across the Program

Look for the Performance Expectation Progressions table in the back cover of every TE, which highlights previous student experience relating to the phenomena and relevant dimensions.

For example:

- Grade 1 Module 1 Performance Expectation Progressions table (TE Back Cover)
- Grade 4 Module 4 Performance Expectation Progressions table (TE Back Cover)

Within a Module

Pre-Explorations are diagnostic pre-assessments that help teachers and students identify students' prior knowledge, as well as any misconceptions that will need to be addressed. Additional Pre-Explorations are included at strategic points in later DQs, so prior knowledge can be activated when most useful. Pre-Explorations are highlighted in the Driving Question Overviews.

MUSEUM OF LEAFOLOGY
Performance Expectation Progressions
NGSS Topic Arrangement: Structure, Function, and Information Processing; Engineering Design

Museum of Leafology covers two NGSS Performance Expectations (PEs) in Life Sciences (LS.1.5.1 and LS.1.5.3) and three in Engineering Design (E.1.2.1, E.1.2.3, E.1.2.4) and K-2-ETS1-3.

Together, these PEs explore the structure and function of plants' external parts and the inheritance and variation of traits in plants. These are investigated further in Grade 3, Module 2, Animal Reproductive, with the focus shifting from plants to animals.

PRIOR KNOWLEDGE	PROGRESSION					FUTURE KNOWLEDGE
	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5	
Module 1 The Leafy Adventure Students are introduced to plants and their parts. They learn that plants need sunlight and water to grow. They explore how plants take in water and nutrients from the soil.	Module 2 The Leafy Adventure Students continue to explore plant parts and how they work. They learn about the structure and function of leaves and how they use photosynthesis to make food for the plant.	Module 4 The Leafy Adventure Students explore how plants take in water and nutrients from the soil. They learn about the structure and function of roots and stems.	Module 2 The Leafy Adventure Students explore how plants take in water and nutrients from the soil. They learn about the structure and function of roots and stems.	Module 5 The Leafy Adventure Students explore how plants take in water and nutrients from the soil. They learn about the structure and function of roots and stems.	Module 1 The Leafy Adventure Students explore how plants take in water and nutrients from the soil. They learn about the structure and function of roots and stems.	Module 1 The Leafy Adventure Students explore how plants take in water and nutrients from the soil. They learn about the structure and function of roots and stems.

Grade 1 Module 1 Performance Expectation Progressions table (TE Back Cover)

EARTHQUAKE ENGINEERING
Performance Expectation Progressions
NGSS Topic Arrangement: Earth's Systems; Engineering Design

Earthquake Engineering introduces one NGSS Performance Expectation (PE) in Physical Sciences (PS.4.3) and explores two in Earth Sciences (E.4.5.2-3 and E.4.5.3). These PEs address waves, natural hazards, and the mapping of Earth's features and forces.

Three additional PEs engage students in engineering design: E.4.5.1, E.4.5.2, and E.4.5.3. While aspects of engineering design are addressed in other Grade 4 modules, Earthquake Engineering emphasizes designing structures to solve problems that arise from natural hazards.

PRIOR KNOWLEDGE	PROGRESSION					FUTURE KNOWLEDGE
	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 6	
Module 2 The Earthy Adventure Students explore how Earth's features and forces shape the planet. They learn about the structure and function of the Earth's crust and how it moves.	Module 2 The Earthy Adventure Students explore how Earth's features and forces shape the planet. They learn about the structure and function of the Earth's crust and how it moves.	Module 3 The Earthy Adventure Students explore how Earth's features and forces shape the planet. They learn about the structure and function of the Earth's crust and how it moves.	Module 4 The Earthy Adventure Students explore how Earth's features and forces shape the planet. They learn about the structure and function of the Earth's crust and how it moves.	Module 5 The Earthy Adventure Students explore how Earth's features and forces shape the planet. They learn about the structure and function of the Earth's crust and how it moves.	Module 6 The Earthy Adventure Students explore how Earth's features and forces shape the planet. They learn about the structure and function of the Earth's crust and how it moves.	Module 6 The Earthy Adventure Students explore how Earth's features and forces shape the planet. They learn about the structure and function of the Earth's crust and how it moves.

Grade 4 Module 4 Performance Expectation Progressions table (TE Back Cover)

Prior-Knowledge Read-Alouds support activation of existing knowledge for students of all reading abilities. The Prior-Knowledge Read-Aloud can be found in the material lists in the both the Driving Question Overview (Grade 4 Module 4 DQ3 Overview TE pp. 94–95) and Lesson Overview (Grade 4 Module 4 DQ 4 Lesson 1 Overview TE p. 128).

Throughout each module students are consistently supported to revisit their early ideas, revise their claims, and relate their new understandings to answering the DQs and solving the Module Investigative Problem.

Grade 4 Module 4 DQ3 Overview TE pp. 94–95

Grade 4 Module 4 DQ 4 Lesson 1 Overview TE p. 128

Connections to prior knowledge are frequently found in the Connect section of the lesson (**Grade 4 Module 4 DQ1L1 Connect TE p. 10**).

Connect

10 min

Read Aloud

Display the **Earthquakes, Tsunamis, and Volcanoes** **Prior-Knowledge Read-Aloud**. Before reading the text aloud, guide the class to look at its features using the following steps:

- Step 1:** Read the title of the article. It explains its topic.
- Step 2:** Read the introduction and any headings. These relate to the main ideas of the text. Think about what the main ideas may be.
- Step 3:** Point out any photos and illustrations.
- Step 4:** Notice any features, e.g., special type, maps, and diagrams.
- Step 5:** Based on your preview, ask yourself what the text will be about.

Note: This approach models several strategies to help comprehension.

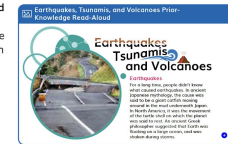
In this case, the features are straightforward and comprehension may only be impeded by the text's vocabulary. However, the routine is a useful habit to acquire and should be repeated until established as practice.

Read the **Earthquakes, Tsunamis, and Volcanoes** **Prior-Knowledge Read-Aloud**. You may ask volunteers to take turns reading paragraphs, rather than reading it yourself.

Introduce the Module Investigative Problem:

- How can we reduce the damage caused by earthquakes?

Explain that, throughout this module, students will learn about earthquakes, their impact on the natural world and human-made structures, and engineering.



Grade 4 Module 4 DQ1L1 Connect TE p. 10

The Science Tools Poster explicitly details students' growing use of the SEPs across the grade, and **motivates them** by helping them visualize their progression. Use of the Science Tools Poster is clearly identified in the TE (**Grade 4 Module 4 DQ2L2 Science Tools Poster TE p. 62**).

Students add "Analyze data" to their Science Tools Poster.

Chart SEP-8—Obtaining, Evaluating, and Communicating Information

Remind students that today they have successfully evaluated information, a practice of good scientists. Draw students' attention to the Science Tools poster and add "Evaluate information."

Science Tools

- Plan and carry out investigations
- Construct explanations
- Develop and use models
- Communicate information
- Design solutions
- Obtain information
 - Argue from evidence
 - Use math and computational thinking
- Ask questions
- **Evaluate information**

Grade 4 Module 4 DQ2L2 Science Tools Poster TE p. 62

SW 4: Metacognitive Abilities

The Student Work is High Quality (5) in terms of SW4

The materials provide students with regular, explicit opportunities to consider how their learning experiences changed their thinking.

Evidence

Look for the **Pre-Explorations** near the start of every module, and at strategic points thereafter, which support students to think about the three dimensions they are already familiar with and those they are not. The module Assessment Overview will identify the location of Pre-Explorations, and they're also highlighted in the **Driving Question Overviews**.

Progress Trackers that help monitor progression of student are found in the Digital Resources. How and where to use the trackers is clearly signposted in the TE (**Grade 4 Module 4 DQ1L5 Progress Tracker TE p. 41**).

"I can" statements appear in the Twig Book at the start of each DQ, and the five-part Twig Science lesson structure is clearly shown in the TE.

In the **Report**, students articulate what they've learned today, citing evidence and their use of the three dimensions. In the **Connect** section, they make further connections to the three dimensions the DQs and module phenomena, while in the **Reflect**, students use different means to think about what they have learned so far and how they can use their new understanding to better figure out phenomena/problem.

The image shows two digital resources. On the left is the 'Earthquake Patterns Pre-Exploration' page, which includes instructions for students to check boxes next to statements they believe to be true. The statements include: 'Earthquakes occur near oceanic and mountain ranges', 'All earthquakes are caused by shifting tectonic plates', 'Some areas on Earth experience more earthquakes than others', 'Small earthquakes happen every day', 'Earthquakes are most likely when they cause the ground to open up as people, animals, plants, and buildings can feel vibrations and damage', and 'Earthquakes are equally likely to happen anywhere on Earth'. Below these is a section titled 'Connect an Explanation' with a prompt: 'Do you think we can use our patterns to predict and share earthquakes in our lives?' and a space for students to write their answers. On the right is the 'Earthquake Patterns Progress Tracker' table, which has columns for 'I can' statements and rows for tracking progress.

Grade 4 Module 4 DQ1L5 Progress Tracker TE p. 41

SW 5: Equitable Learning Opportunities

The Student Work is High Quality 5 in terms of SW5

Most learning experiences in materials are designed such that students can engage meaningfully in a variety of ways, with multiple access points, and with supports for students.

Evidence

Multimodal and Multisensory Learning Activities

In each module, there is a range of learning experiences across the lessons. The icons in the Module Content in the TE will help you identify the different types investigations, while the lesson summaries in the Driving Questions Overview will add more context and list the resources provided for each lesson (e.g. Read-Alouds, Trade Books, kit items, interactives and videos).

Differentiated Instruction

Look for EL support, Special Needs support, Cultural Connections, and higher-order DOK Challenge activities in the sidebars of every lesson in the TE. A highlight of the differentiated instruction for each DQ is provided in the TE ([Grade 4 Module 4 DQ1L3 English Learners TE p. 25](#)).

Leveled Readers

Every module has complementary Leveled Readers in four levels (Below, On, Above, EL), plus Spanish, with lessons to build language acquisition and develop informational text reading skills. On Level lessons are in the back of the TE, other levels are available digitally. The digital version of the Twig Books and Leveled Readers includes a text-to-speech function.

Videos

Videos are integrated frequently throughout each module—just look for the reduses in the TE. Videos are found online in the Digital Resources section of each lesson. Closed captions are provided for each video in English and Spanish.

English Learners

Provide support for students' discussions.

Substantial Support (Emerging Proficiency)

Pair students with native English speakers. Provide yes/no and simple response questions for them to answer:

- *Did you add energy to the rope? How?*
- *Did you shake it fast or slow?*

Moderate Support (Expanding Proficiency)

Pair students with native English speakers. Guide them to take turns speaking and listening. Provide the following sentence frames:

- A wave is caused by _____.
- When I shake the rope fast, _____.
- When I shake the rope more slowly, _____.

Light Support (Bridging Proficiency)

Prompt students to build on each other's ideas. Use the following sentence starters for support:

- I observed that _____.
- In addition _____.
- Another effect of _____.

[Grade 4 Module 4 DQ1L3 English Learners TE p. 25](#)