Amplify Science
CALIFORNIA

Grades K–5

NextGen TIME Rubric

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Rubric 1

Designed for the NGSS: Foundations
Analyze Evidence

Directions

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

Criteria	Strengths	Limitations
F1. Presence of Phenomena/Problems	In each Amplify Science unit, students are asked to inhabit the role of a scientist or engineer in order to figure out scientific phenomena through a 21st century, real-world problem context. Over the course of the unit, students collect and make sense of evidence from multiple sources and through a variety of modalities, ensuring that they have multiple vehicles through which to develop and articulate their understanding of each phenomenon. As the class progresses through their lessons, students move back and forth from first-hand investigation and inquiry to secondhand analysis and synthesis, formulating an increasingly complex explanation to help them solve the problem at hand. Finally, at the end of the unit, students are presented with a brand new problem context to consider, giving them an opportunity to take what they've learned over the course of the unit thus far and apply it to this new context, thereby demonstrating a deep understanding of the phenomenon. Evidence, grades K–5: ● **Needs of Plants and Animals** unit (kindergarten): Students assume the role of scientists helping a group of children to explain why there are no more monarch caterpillars in a community garden that was converted from a field which once had caterpillars. At the end	

	of the unit, students recommend a plan to redesign the garden in such a way that it accommodates the needs of both humans and monarch caterpillars. ● **Waves, Energy, and Information** unit (grade 4): Students take on the role of marine scientists investigating how bottlenose dolphin mothers and their calves use patterns of sound to communicate across distances. To learn about important characteristics of sound and how sound travels through materials, students engage with several models of sound waves, as well as informational text and first-hand investigations with sound, to learn how sound waves travel at the particle level and how a sound's volume and pitch correspond to the amplitude and wavelength of the sound wave. In the last chapter of the unit, students broaden their understanding of patterns in communication by investigating the patterns that humans use to communicate across distances. ● **Spinning Earth** unit (grade 1): Students assume the role of sky scientists, helping a young boy named Sai who lives in a place near them understand why the sky looks different to him than to his grandma when they talk on the phone. Students record, organize, and analyze observations of the sun and other sky objects as they look for patterns and make sense of the cycle of daytime and nighttime. Finally, students investigate why the lengths of daytime and nighttime change throughout the year, drawing conclusions about seasonal differences of daytime and nighttime. In addition to figuring out and explaining phenomena, students also design solutions for a variety of real world problems across K-5. Each year of Amplify Science K–5 has a unit that is focused on engineering design in which students apply science principles in order to design functional solutions, and iteratively test those solutions to determine how well they meet specific criteria. Students develop their understanding of science ideas from investigation and text, and apply them in designing a solution to an engineering problem. They then evaluate their solutions to see how well they meet a set of criteria for quality. Evidence, grades K–5: ● **Properties of Materials** unit (grade 2): Students take on the role of glue engineers and use engineering design practices to create a glue for use at their school. They conduct hands-on investigations to observe properties of a variety of possible glue ingredients and learn how certain materials respond to heating and cooling; they engage in digital card sorts to apply their understanding of how properties of ingredients affect properties of	

	mixtures; and they search for useful information about each ingredient in the unit's reference book. Over the course of the unit, students conduct tests that yield quantifiable results, graph their data, analyze and interpret results, and then use that evidence to iteratively design a series of glue mixtures, each one better than the one before. By the end of the unit, students are able to speak knowledgeably about their choices and argue for how a particular glue mixture best meets their design goals, with evidence from a variety of sources. ● **The Earth System** unit (grade 5): The cities of East Ferris and West Ferris are located on different sides of a mountain on the fictional Ferris Island. East Ferris is having a water shortage while West Ferris is not. As water resource engineers, students learn about the Earth system to help figure out what is causing the water shortage problem and design possible solutions, including freshwater collection systems and proposals for using chemical reactions to treat wastewater. To make the consistent presence of phenomena clear to teachers, every lesson in Amplify Science includes at least one "phenomenon statement" on the Lesson Brief page, which will always clearly and succinctly define what design problem and/or investigative, everyday, predicted or anchor phenomenon that particular lesson is in service of. Evidence, grades K–5: ● **Light and Sound** unit (grade 1): Lesson 1.1- ○ Design Problem: Design a puppet-show scene, using light. ○ Everyday Phenomenon: It is difficult to see in the dark. ● **Weather and Climate** unit (grade 3): Lesson 3.5- ○ Predicted Phenomenon: The future weather on three islands. ○ Investigative Phenomenon: Average monthly high temperatures and average monthly precipitation totals for Boston and San Francisco. ○ Everyday Phenomenon: Local average monthly high temperatures and local average monthly precipitation totals.	
F2. Presence of Three Dimensions	Amplify Science's real-world problems provide relevant, 21st-century contexts through which students will investigate different scientific phenomena and develop a deeper understanding of	

	Disciplinary Core Ideas (DCIs), acquire more experience with Science and Engineering Practices (SEPs), and observe the interconnectedness of various science disciplines through the Cross-Cutting Concepts (CCCs). The Amplify Science curriculum developers at UC Berkeley's Lawrence Hall of Science crafted each unit, chapter, and lesson with the following questions in mind: What do we want students to figure out (what DCI or part of a DCI)?; How do we want them to figure it out? (what scientific and engineering practice will they engage in to figure it out); and what crosscutting concept can scaffold students' understanding and connect it to other ideas about the natural world that they have learned? This resulted in a curriculum that incorporates a strategic, well balanced integration of the three dimensions. In order to help teachers recognize the three dimensional structure of every unit, chapter, and lesson, each unit contains a "3-D Statement" document that makes the integration clear. The "3-D Statement" document is made all the more effective by color-coding the three dimensions for easy recognition. This color-coded information is also made available to teachers at the individual lesson level, within the "Standards" section of the Lesson Brief. Evidence, grades K–5: 3-D statements from the **Light and Sound** unit (grade 1) include: ● **Unit Level:** Students investigate and construct explanations about how light and sound can be used to create solutions for a puppet-theater company (cause and effect). Students apply what they learn in order to design solutions to create shadow scenery and sound effects for a puppet-theater show. (patterns) ● **Chapter level:** Chapter 2, "How do we make a dark area in bright puppet show scene?"- Students investigate and construct explanations about the effect that some materials can have in blocking light from getting to a surface (cause and effect; patterns). ● **Lesson level:** Lesson 3.4 , "Planning and making our stencils"- Students make diagrams of their proposed solutions for stencils that will project a puppet-show scene that enables all, some, or no light to pass through (cause and effect). 3-D statements from the **Balancing Forces** unit (grade 3) include: ● **Unit Level:** Students are challenged to explain how a floating train works in order to reassure nervous citizens. To solve the mystery, students plan and conduct investigations, analyze patterns in data (patterns), and obtain information about magnetic force, gravity,	

	and balanced and unbalanced forces. Students write explanations and create physical models and diagram models to show why the train's vertical motion is stable at times and changes at times (stability and change). ● **Chapter level:** Chapter 4, "Why does the train float, even though gravity is acting on it?"- Students gather evidence to support the claim that two forces can act on an object at once. They discover how balanced forces can make an object's motion stable (stability and change) by planning and conducting investigations and obtaining information by reading. ● **Lesson level:** Lesson 3.4, "Modeling and Explaining the Falling Train"- Students use mathematical thinking as they create diagram models of forces that change the motion of several objects. They create physical models and write explanations about what causes the train to fall (cause and effect). This three dimensionality extends to engineering design focused units, as well. For example: 3-D statements from the **Waves, Energy, and Information** unit (grade 4) include: ● **Unit Level:** Using physical and computer models to observe and analyze patterns (patterns), students figure out how sound travels as a wave (energy and matter). They apply that knowledge to explain how dolphins in the fictional Blue Bay send and receive signals underwater when separated (energy and matter) and how humans encode, send and receive patterns of information for efficient communication across distances (patterns; scale proportion and quantity). ● **Chapter level:** Chapter 1, "How does a mother dolphin communicate with her calf across a distance?"- Students use models to investigate waves and how sound travels (patterns, energy and matter). They figure out that sound energy travels as a wave from a source to a listener (patterns, energy and matter). Students create initial Sound Diagrams, and the class constructs an initial scientific explanation about how a mother dolphin uses sound to communicate underwater with her calf across a distance (energy and matter; scale proportion and quantity) ● **Lesson level:** Lesson 4.3, "Communicating with Codes"- Students use the Code Communicator Tool to encode and image in binary code (patterns) and design a plan to communicate the image across a distance (patterns, energy and matter).	

F3. Presence of Logical Sequence	In creating Amplify Science, the curriculum development team at the Lawrence Hall of Science did not treat each PE separately as a box to be checked. Rather, developers bundled a variety of performance expectations together, then crafted instructional units that would allow students to explore these standards meaningfully and coherently through investigation of each unit's real world problem and overarching scientific phenomenon. In order to accomplish this, developers analyzed each PE, along with its constituent dimensions, in order to fully understand the intent of the standard. Developers then analyzed across PEs and their dimensions to consider how ideas could be put to work to explain phenomena in the natural world. Developers then bundled the PEs into meaningful groups for instructional units that support students in making a deep, causal explanation of what they judged to be the key phenomenon for the PE bundle. Finally, developers created unit Progress Builds based on that target explanation, and organized the units around those Progress Builds. Through the use of these "Progress Builds," or PBs, each successive lesson in a unit furthers student understanding of the phenomena they are investigating (and the targeted Performance Expectations) in a structured and considered way. Progress Builds are explicitly designed cognitive models for a given unit that express how students will develop their knowledge and competence in the domain. Amplify Science measures how well students can explain how and why things happen as they do, rather than merely measuring students' ability to describe science phenomena or recall isolated facts. This explanatory understanding of the world forms the basis for the levels of a PB. Each PB level characterizes an increasingly complex causal explanation of the unit's phenomenon. Each level also builds upon the knowledge and skills from lower levels toward a more complete, mechanistic understanding of that phenomenon. Evidence, grades K–5: **Vision and Light** unit (grade 4): ● Progress Build Level 1: Animals use senses to learn about their environment. ○ Description: Animals have sensory structures that allow them to learn about their environment by getting information from it. Learning about the environment helps animals survive.	

	- Progress Build Level 2: Light allows objects in an environment to become visible to the eyes. - Description: Animals have sensory structures that allow them to learn about their environment by getting information from it. Learning about the environment helps animals survive. **In order for an animal to get visual information about an object in its environment, light from a source needs to get to the object, reflect off it, and get to the animal's eye with information about the object.** - Progress Build Level 3: Light receptors in the eye respond to light and the brain forms an image. - Description: Animals have sensory structures that allow them to learn about their environment by getting information from it. Learning about the environment helps animals survive. In order for an animal to get visual information about an object in its environment, light from a source needs to get to the object, reflect off it, and get to the animal's eye with information about the object. **After light from the object enters the animal's eye, it hits the light receptors in the eye that respond to the light. The light receptors then send the information about the object from the light to the brain, which processes the information to form an image of the object. Then the brain compares this image to memories to decide which action to take.** - Progress Build level 4: Light receptors in the eye respond to light and the brain forms an image. - Description: Animals have sensory structures that allow them to learn about their environment by getting information from it. Learning about the environment helps animals survive. In order for an animal to get visual information about an object in its environment, light from a source needs to get to the object, reflect off it, and get to the animal's eye with information about the object. After light from the object enters the animal's eye, it hits the light receptors in the eye that respond to the light. The light receptors then send the information about the object from the light to the brain, which processes the information to form an image of the object. Then the brain compares this image to memories to decide which action to take. **The amount of light that the light receptors need in order for the brain to form a clear image is different for different kinds of animals. This is because different kinds of animals have light receptors that are sensitive to different amounts of**	

	light. If there is too much or too little light for the type of light receptors an animal has, its brain cannot form a clear image.	

Rubric 2

Designed for the NGSS: Student Work
Analyze Evidence

Directions

1. Review the Designed for the 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.

Criteria	Strengths	Limitations
SW1: Phenomena/ Problems	In each Amplify Science unit, students are asked to inhabit the role of a scientist or engineer in order to figure out scientific phenomena through a 21st century, real-world problem context. Over the course of the unit, students collect and make sense of evidence from multiple sources and through a variety of modalities, ensuring that they have multiple vehicles through which to develop and articulate their understanding of	

	each phenomenon. As the class progresses through their lessons, students move back and forth from first-hand investigation and inquiry to secondhand analysis and synthesis, formulating an increasingly complex explanation to help them solve the problem at hand. Finally, at the end of the unit, students are presented with a brand new problem context to consider, giving them an opportunity to take what they've learned over the course of the unit thus far and apply it to this new context, thereby demonstrating a deep understanding of the phenomenon. Evidence, grades K–5: ● **Needs of Plants and Animals** unit (kindergarten): Students assume the role of scientists helping a group of children to explain why there are no more monarch caterpillars in a community garden that was converted from a field which once had caterpillars. At the end of the unit, students recommend a plan to redesign the garden in such a way that it accommodates the needs of both humans and monarch caterpillars. ● **Waves, Energy, and Information** unit (grade 4): Students take on the role of marine scientists investigating how bottlenose dolphin mothers and their calves use patterns of sound to communicate across distances. To learn about important characteristics of sound and how sound travels through materials, students engage with several models of sound waves, as well as informational text and first-hand investigations with sound, to learn how sound waves travel at the particle level and how a sound's volume and pitch correspond to the amplitude and wavelength of the sound wave. In the last chapter of the unit, students broaden their understanding of patterns in communication by investigating the patterns that humans use to communicate across distances. ● **Spinning Earth** unit (grade 1): Students assume the role of sky scientists, helping a young boy named Sai who lives in a place near them understand why the sky looks different to him than to his grandma when they talk on the phone. Students record, organize, and analyze observations of the sun and other sky objects as they look for patterns and make sense of the cycle of daytime and nighttime. Finally, students investigate why the lengths of daytime and nighttime change throughout the year, drawing conclusions about seasonal differences of daytime and nighttime.	

	In addition to figuring out and explaining phenomena, students also design solutions for a variety of real world problems across K-5. Each year of Amplify Science K–5 has a unit that is focused on engineering design in which students apply science principles in order to design functional solutions, and iteratively test those solutions to determine how well they meet specific criteria. Students develop their understanding of science ideas from investigation and text, and apply them in designing a solution to an engineering problem. They then evaluate their solutions to see how well they meet a set of criteria for quality. Evidence, grades K-5: ● **Properties of Materials** unit (grade 2): Students take on the role of glue engineers and use engineering design practices to create a glue for use at their school. They conduct hands-on investigations to observe properties of a variety of possible glue ingredients and learn how certain materials respond to heating and cooling; they engage in digital card sorts to apply their understanding of how properties of ingredients affect properties of mixtures; and they search for useful information about each ingredient in the unit's reference book. Over the course of the unit, students conduct tests that yield quantifiable results, graph their data, analyze and interpret results, and then use that evidence to iteratively design a series of glue mixtures, each one better than the one before. By the end of the unit, students are able to speak knowledgeably about their choices and argue for how a particular glue mixture best meets their design goals, with evidence from a variety of sources. ● **Environments and Survival** unit (grade 3): Students assume the role of biomimicry engineers studying a population of grove snails to understand how the snails' traits influence their survival in a changing environment. At the end of the unit, students use their newfound understanding of how the traits of organisms affect their survival in order to help the engineering firm design a robot that aims to mitigate the effect of an environmental change. ● **The Earth System** unit (grade 5): The cities of East Ferris and West Ferris are located on different sides of a mountain on the fictional Ferris Island. East Ferris is having a water shortage while West Ferris is not. As water resource engineers, students learn about the Earth system to help figure out what is causing the	

	water shortage problem and design possible solutions, including freshwater collection systems and proposals for using chemical reactions to treat wastewater.	
SW2: Three-Dimensional Conceptual Framework	Students consistently use all three dimensions to figure out these questions, and negotiate increasingly sophisticated understandings of unit concepts as they do. In fact, the Amplify Science curriculum developers at UC Berkeley's Lawrence Hall of Science crafted each unit, chapter, and lesson with the following questions in mind: What do we want students to figure out (what DCI or part of a DCI)?; How do we want them to figure it out? (what scientific and engineering practice will they engage in to figure it out); and what crosscutting concept can scaffold students' understanding and connect it to other ideas about the natural world that they have learned? This resulted in a curriculum that incorporates a strategic, well balanced integration of the three dimensions. In order to help teachers recognize the three dimensional structure of every unit, chapter, and lesson, each unit contains a "3-D Statement" document that makes the integration clear. The "3-D Statement" document is made all the more effective by color-coding the three dimensions for easy recognition. This color-coded information is also made available to teachers at the individual lesson level, within the "Standards" section of the Lesson Brief. Evidence, grades K–5: 3-D statements from the **Light and Sound** unit (grade 1) include: ● **Unit Level:** Students investigate and construct explanations about how light and sound can be used to create solutions for a puppet-theater company (cause and effect). Students apply what they learn in order to design solutions to create shadow scenery and sound effects for a puppet-theater show. (patterns) ● **Chapter level:** Chapter 2, "How do we make a dark area in bright puppet show scene?"- Students investigate and construct explanations about the effect that some materials can have in blocking light from getting to a surface (cause and effect; patterns). ● **Lesson level:** Lesson 3.4 , "Planning and making our stencils"- Students make diagrams of their proposed solutions for stencils that will project a puppet-show scene that enables all, some, or no light to pass through (cause and effect).	

	3-D statements from the **Waves, Energy, and Information** unit (grade 4) include: ● **Unit Level:** Using physical and computer models to observe and analyze patterns (patterns), students figure out how sound travels as a wave (energy and matter). They apply that knowledge to explain how dolphins in the fictional Blue Bay send and receive signals underwater when separated (energy and matter) and how humans encode, send and receive patterns of information for efficient communication across distances (patterns; scale proportion and quantity). ● **Chapter level:** Chapter 1, "How does a mother dolphin communicate with her calf across a distance?"- Students use models to investigate waves and how sound travels (patterns, energy and matter). They figure out that sound energy travels as a wave from a source to a listener (patterns, energy and matter). Students create initial Sound Diagrams, and the class constructs an initial scientific explanation about how a mother dolphin uses sound to communicate underwater with her calf across a distance (energy and matter; scale proportion and quantity) ● **Lesson level:** Lesson 4.3, "Communicating with Codes"- Students use the Code Communicator Tool to encode and image in binary code (patterns) and design a plan to communicate the image across a distance (patterns, energy and matter). As they work to figure out the focal phenomena of each unit, students have frequent opportunities to develop and explore their own questions. At all grade levels, for example, students are encouraged to ask, record, and discuss questions they have while reading the program's science texts.Doing so enables students to discuss their own connections and pursue answers to their questions collaboratively, thereby promoting a culture of inquiry that will facilitate deeper science learning. The sense-making strategy of asking questions is developed throughout the Amplify Science program, including in activities that give students practice with creating and critiquing investigation questions and determining whether a question is investigable. Evidence, grades K–5: ● **Light and Sound** unit (grade 1): In Activity 1 of Lesson 2.2, a Shared Reading of the unit book *What Makes This Shadow?* gives students practice with asking and	

	answering questions. In fact, the book is designed to model asking questions and gives students a rich context in which to ask their own questions about shadows. In this particular activity, teachers guide students in using the strategies of asking questions and interpreting visual representations to make meaning of this text. ● **Inheritance and Traits** unit (grade 3): In Lesson 1.5 students are asked, " Based on your observations of the Elk Mountain Pack, what questions do you have about the wolves in Graystone National Park?" Pairs then work together to generate and record science questions. While they do so, the teacher circulates and encourages students to evaluate their questions so in order to figure out whether or not they are science questions. Students continue to practice asking their own science questions throughout the rest of the unit.	
SW3: Prior Knowledge	Our approach to leveraging students' prior knowledge and experiences includes the following: 1. Basing the unit design, in particular the entry level of the Progress Build (learning progression), on extensive research into the most common student preconceptions (using both the literature and the Lawrence Hall of Science's own cognitive labs and classroom pilots). 2. Summarizing the most important aspects of that research for the teacher's awareness 3. Providing students with opportunities to express and activate their prior knowledge and experiences. For instance, when students are introduced to the context of each unit and the role they will be taking on it, they are invited to share their initial ideas and connections with it. a. Example: In Lesson 1.1 of the unit **Weather and Climate** (grade 3), the teacher introduces the context of the unit (working as meteorologists to figure out where to build an orangutan reserve) saying, "We're going to explore the topic of weather so we can figure out which island has the best weather for an orangutan reserve. What do you picture in your mind when you hear the word *weather*?" Then, a short video is showing different types of weather is played for students. As they watch the	

	video, students write words on sticky notes that describe different types of weather, with the teacher giving the instructions, “For example, you may observe sunny weather in the video. You could write "sunny” or “the sun” on one of your sticky notes.” This prompts students to access their prior knowledge and experiences with weather and gives them a connection to the unit context. 4. Bringing in carefully chosen everyday examples and real-world phenomena that are likely to be familiar to students and help them make connections to less familiar concepts and phenomena 5. Providing the teacher with support in key cases where students’ prior knowledge can be a support, or in some cases, a hindrance, with suggestions for how to use that information.	
SW4: Metacognitive Abilities	Students in Amplify Science have frequent opportunities to reflect on and make sense of what they are learning. At the end of every chapter of every unit, students engage in a metacognitive self-assessment. This quick yet important activity asks students to monitor their own learning by reflecting on what they do or do not yet understand about the core concepts from the unit. Reviewing students’ responses can give teachers a sense of what students think they know. Importantly, engaging in self-assessment may increase students’ motivation, intentionality, and focus throughout the unit. Example: Each Amplify Science unit provides students with a problem to solve. In the **Properties of Materials** unit (grade 2), the challenge is to create a glue for use at their school that meets a set of design goals. Towards the end of each chapter, students are invited to reflect on their learning so far, and the progress they are making in figuring out how to make a good glue to use at school, with the following prompts: ● I understand how to describe the properties of a material like glue. (Yes/Not yet) ● I understand how mixtures made of different ingredients can make glue that has different properties. (Yes/Not yet) ● I understand that heating or cooling can change the properties of ingredients that are mixed to make glue. (Yes/Not yet)	

	- I understand that scientists and engineers look for causes and effects, like how ingredients can cause the properties of mixtures to change. (Yes/Not yet) - What are you still wondering about your glue mixture, its ingredients, or their properties? In addition to self-assessments, students in Amplify Science are guided to reflect on their learning by consistently building on their experiences to develop increasingly sophisticated ideas. For instance, students regularly return to earlier iterations of models, claims, scientific explanations, classroom charts, and/or annotations to update them amidst their newer, deeper understanding. Evidence, grades K–5: **Weather and Climate** unit (grade 3): With the addition of a new criterion, this chapter builds on students' criteria for evaluating evidence from the last two chapters. Through a discussion of the new criterion and an activity in which pairs sort evidence based on how useful it is for predicting weather in future years, students come to understand that though a month of weather data can be strong evidence for making a claim about the weather in the days just before or after that month or in the same month in future years, one cannot support a claim about long-term weather with just one month of data. Giving students a chance to realize that evidence which they previously categorized as strong (a month of temperature or rainfall data) is now weak for claims about the long-term yearly weather, is an important opportunity for them to revise their thinking about the islands under investigation. **Earth's Features** unit (grade 4): In Lesson 1.1, students share what they already know and what questions they have about rocks and fossils, first with a partner then with the whole class, in order to activate prior knowledge and to motivate learning. Teachers emphasize to students that it is okay to not be totally sure of their thinking; that thinking about a topic before students start investigating can help make it easier for them to learn new information. Students responses in the discussion are recorded on an Anticipatory Chart, which will be revisited throughout the unit to add new ideas, revise inaccurate ones, and record additional questions. This gives students a chance to reflect on what they have	

	learned about rocks and fossils as the unit progresses.	
SW5: Equitable Learning Opportunities	Amplify Science units provide many varied learning opportunities as well as timely supports to ensure that diverse learners can be successful with the language and content demands of science, ultimately becoming more independent learners and thinkers. First, Amplify Science is rooted in the research-based, multimodal approach of *Do, Talk, Read, Write, Visualize*. This approach provides diverse learners multiple entry points to rich science content. Students engage with SEPs, figure out DCIs, and notice and reflect upon CCCs in thoughtful, structured activities for each lesson. ● **DO:** "Do" means collecting firsthand evidence. This can include conducting hands-on investigations, making observations of a video clip, or collecting data using a digital simulation, all of which can then be used as evidence in formulating a convincing scientific argument. ● **TALK:** Student-to-student discourse is a key indicator of a productive learning environment, and talking is a key modality for instruction in an Amplify Science class. This is more than just partner activities or group work (though there's plenty of that, too). For example, reading activities are followed by a student-to-student discussion where students share their insights and questions with each other and with the whole class. Through talking and developing a collaborative environment, students feel comfortable asking questions of each other, challenging assumptions, and learning from each other. ● **READ:** Student books, written by the Lawrence Hall of Science, serve multiple purposes: they help students make connections between science concepts and real-world contexts; provide students with secondhand data to analyze; and model science practices, showing real scientists in action. Students also learn to read actively, with explicit instruction on how to record their questions, seek evidence from text, and monitor their understanding as they read. ● **WRITE:** Students in Amplify Science have frequent opportunities to write in order to help them reflect and make sense of what they are learning. Across the program students learn how to express their scientific thinking by leveraging evidence and using relevant vocabulary as they apply their thinking to writing. Frequent reflective writing help students to gain a deepening understanding of	

the genres of scientific arguments and explanations, both of which embody the foundation of scientific understanding and expression.

- **VISUALIZE:** Through a combination of sims, media, hands-on activities, readings, and digital and physical models, students are empowered to visualize scientific phenomena in ways never possible before.

<u>**Example:**</u>

In Chapter 2 of the grade 5 unit **Modeling Matter**, students are trying to figure out why some salad dressings have sediments, and others do not. In order to figure this out, students investigate the idea of solubility. They **DO** a hands on activity in which they test to see which of a number of flavor ingredients dissolve in water and which do not. They **READ** the book *Solving Dissolving*, a fictional text about a brother and sister who make lemonade and wonder what happens when the sugar seems to disappear. After the hands-on experience, students **TALK** with a partner about dissolving using a shared listening routine. First they talk about what they think a sugar-and-water mixture would look like if they looked at it with nanovision goggles; and then they wonder why some liquids leave sediments when you mix them into liquids. Later they talk about the different models of dissolving they have seen. Students **WRITE** several times, first about the observations and inferences they made when reading the book. Later they evaluate two written explanations of dissolving. Throughout the sequences, students have several opportunities to **VISUALIZE** dissolving: first when they use the Modeling Matter sim to investigate dissolving at the nanoscale; next when they see models that the brother in the book draws for his sister as he tries to explain what he thinks has happened to the sugar; and finally when students use the diagramming tool to create their own model of dissolving.

The **Do, Talk, Read, Write, Visualiz** approach has been extensively assessed by outside evaluators from the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) at the University of California, Los Angeles (UCLA), 2005; by Mark Girod at Western Oregon University, 2005; and by David Hanauer at Indiana University of Pennsylvania, 2005. These gold standard studies showed that students who received instruction based on this multimodal learning approach instruction saw the following benefits:

	- English Language Learners (ELLs) significantly outperformed other ELLs in reading comprehension, science vocabulary, and science content knowledge. - Students significantly outperformed other students receiving their usual science instruction in Science Vocabulary, and Science Content Knowledge. In addition to employing the Do, Talk, Read, Write approach, which serves to provide repeated opportunities for students to access content, every lesson of Amplify Science includes a **Differentiation** section in the Lesson Brief. The Differentiation Brief describes what is built into the lesson to support diverse learning needs; highlights potential challenges teachers should be aware of; and provides specific strategies for differentiating instruction. The Differentiation Brief contains the following sections: **Embedded Supports for Diverse Learners:** Every unit is designed with diverse learners in mind, with the goal of providing rigorous yet accessible science instruction. Each lesson is intentionally planned to provide multiple entry points for students, and to enable all students to be successful with all of the activities. This section of the Differentiation Brief highlights the scaffolds already embedded within the lesson so that teachers can take advantage of the power of these carefully designed activities. **Potential Challenges in This Lesson:** This section of the Differentiation Brief highlights aspects of the lesson that may present particular cognitive, linguistic, or social challenges for students. **Specific differentiation strategies for English Learners (ELs)**: This section of the Differentiation Brief points out activities that could pose linguistic challenges for ELs or reduce their access to science content, and suggests supports and modifications accordingly. Suggestions include linguistic supports to bolster students' understanding of science content, supports for engaging with science texts, ideas for helping students participate in discussions, multiple ways students can express their ideas in writing, and more. **Specific differentiation strategies for students who need more support:** Every lesson includes ways for teachers to support those students who are struggling or who have special needs. These additional scaffolds are to be used entirely at the discretion of the teacher, and provide targeted suggestions tailored for the activities in that particular lesson.	

	Specific differentiation strategies for students who need more challenge: Every lesson has ways for a teacher to expand upon the lesson, or go beyond the scope of what is expected in that lesson. This section of the Differentiation Brief provides suggestions that allow students to engage with content more deeply, explore the material with a new purpose, pursue more independent research on a topic, and more. Amplify Science also supports diverse learners by embedding scaffolding throughout the curriculum with the use of the Gradual Release of Responsibility model. With the Gradual Release of Responsibility there is an emphasis on teacher modeling and direction at the beginning of the unit, but much of the scaffolds that existed earlier in the unit are thoughtfully and meaningfully removed as the unit progresses. This enables students to become more independent and confident in their own abilities over time. Evidence, grades K–5: **Plant and Animal Relationships** unit (grade 2): In Lesson 1.6, the teacher introduces students to the conceptual meaning of the word *measure.* After a brief class discussion about why scientists measure and the various tools they use to do so, students use rulers to complete their first measurements as a class. Throughout the unit, students gain more and more practice with investigations and analyzing results with measurements. In Lesson 3.3, student pairs dissect models of bird droppings to practice their measurement skills more independently (counting droppings and counting seeds inside droppings) and to consolidate their understanding of how seeds could end up in new places in a habitat. In Lesson 4.2, student pairs work together to set a purpose for investigating in the Fluffy Seed Investigation, and decide how they will measure in the investigation. **Balancing Forces** unit (grade 3): Students read the book *Forces All Around* in Lesson 1.3. In this lesson, the reading experience is heavily scaffolded, with clear teacher modeling and very specific instructions for the students. By the end of the unit, in Lesson 4.4, students read their last book “Explaining a Bridge” and provide their own purpose for reading the book with minimal teacher-provided scaffolding.	

	• **Earth's Features** unit (grade 4): In Lesson 1.6, students are introduced to the features of a scientific argument in a discourse routine called Evidence Circles. Students receive evidence and have small group discussions about how the evidence supports the claim that Desert Rocks National Park used to be underwater. Afterwards, with input from the students, the teacher models writing a scientific argument about what Desert Rocks National Park was like in the past. The Evidence Circles discourse routine continues to be used throughout the unit, with less and less instruction from the teacher. Ultimately, in Lessons 4.5, students engage in Evidence Circles to discuss new evidence about Desert Rocks Canyon and Keller's Canyon and work together to make a claim about why more rock layers were exposed in Desert Rocks Canyon. This prepares them for writing a scientific argument on their own, which serves as Part 2 of the End-of-Unit Assessment. Finally, in addition to encouraging and validating diversity within the classroom, Amplify Science makes science more relatable to a variety of students by making sure its content reflects the diversity seen in the real world. For example: • **Inheritance and Traits** unit (grade 3): Students read a nonfiction book that follows a Latina arachnologist, Lauren Esposito, as she discovers a new species of scorpion. • **Ecosystem Restoration** unit (grade 5): Students read the book *Walk in the Woods*, which follows a soil scientist named Asmeret Asefaw Berhe, who is an African-American woman. We are proud to say students encounter many more examples of diverse peoples throughout the curriculum**.**	

Rubric 3

Designed for the NGSS: Student Progress
Analyze Evidence

Directions

1. Review the Designed for the NGSS: Student Progress 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.

Criteria	**Strengths**	**Limitations**
SP1: Three-Dimensional Performance	The Amplify Science assessment system is grounded in the principle that students benefit from regular and varied opportunities to demonstrate understanding through performance. In practice, this means that for the overwhelming majority of assessment opportunities in each unit, student conceptual understanding is revealed through engagement in the science and engineering practices. This commitment to multidimensional, NGSS-aligned performance is clear in the embedded assessment opportunities that occur in nearly every lesson: Students investigate phenomena, construct scientific explanations, develop and use models, and engage in argumentation as a core part of the problem-based deep dives in each unit. Careful consideration is given to ensure that each unit includes multiple opportunities to provide evidence of understanding of the focal concepts and practices in a given unit, as well as instructional suggestions for taking action based on that evidence.	

	Evidence, grades K–5: ● **Inheritance and Traits** unit (grade 3)**:** In Lesson 3.5, students employ the practice of creating models to demonstrate their understanding of the core ideas of how the environment can influence traits, including inherited traits, in the context of the crosscutting concept of cause and effect. The activity contains use of a digital modeling tool that allows students to collect and analyze data, which they then use to engage in classroom discussions. ● **Pushes and Pulls** unit (Kindergarten): In Lesson 1.4, students are introduced to the Box Model they will use throughout the unit as they work to design a solution for how to create a pinball machine that can make the pinball move in all the ways they want it to. After a hands-on activity in which students install launchers in their Box Models, students make sense of forces in the model by creating a diagram of their Box Model. They also create a record of their initial design that they can refer to for later changes. These written diagrams (SEP), in conjunction with their oral responses to Clipboard Assessment questions, provide evidence of students' understanding that movement is caused (CCC) by a force (DCI) from another object. ● **Patterns of Earth and Sky** unit (grade 5): In Lesson 4.3, students follow plans they made in the previous lesson as they conduct their investigations and look for patterns in the data. After 15 minutes, they reflect with their partners about the challenges they faced while investigating and then share and receive support in a whole-class setting. Student pairs revise their investigation plans and conduct the investigation again. Students reflect on the role of revision in investigation and think about how professional scientists often have to change their investigation plans along the way. This investigation serves as an assessment that is designed to reveal students' facility with the performances of Planning and Conducting Investigations and Analyzing and Interpreting Data, and with their understanding of unit-specific science concepts, and the crosscutting concept of Patterns.	
SP2: Variety of Measures	Amplify Science's multiple measure approach to assessment is designed to minimize bias by providing a wide variety of opportunities for students to demonstrate understanding--not just text, but also talk, diagramming and modeling, and hands-on (especially for early elementary) modalities.	

	Evidence, grades K–5: ● **Needs of Plants and Animals** unit (Kindergarten): Lesson 1.6 contains a kinesthetic On-the-Fly Assessment in which students first search for milkweed in pictures, then physically move to different habitat stations in the classroom when the teacher prompts, "Now pretend you are a monarch caterpillar. Which habitat would you live in, the field of weeds or the forest with pine trees and water lilies?" Their selection of a habitat for the caterpillars is an opportunity to assess students' understanding that animals can only live in a place with the food they need. The "Chapter 1: Clipboard Assessment Tool" is available as a reference for key questions and a place to record notes on students' responses. ● **Waves, Energy, and Information** unit (grade 4): In Lesson 4.4, students apply their understanding of sound waves and patterns in digital communication to complete an end-of-unit writing task. In this three-dimensional performance task, students construct explanations for how patterns in the motion of air particles allow sound to travel as a wave from the computer to Maria. Students also analyze and interpret data as they use the waveform of the sound from the computer to explain why the music suddenly surprised her. To assess students' written explanations—as a performance of the practice of constructing explanations and of their understanding of the concepts being explained—three rubrics are provided. Rubric 1 is designed to formatively assess the practice of constructing explanations. Rubric 2 may be used summatively to assess students' understanding of the science ideas encountered in the unit. Rubric 3 may be used summatively to assess students' application of the crosscutting concept of Patterns as applied to a specific phenomenon. ● **Spinning Earth** unit (grade 1): In Lesson 5.3, the culminating lesson of the unit, the teacher sits with students, one at a time, and prompts them to explain a sequence of images from the book *What Spins?* that show the sky at five different times of day. The teacher also asks students to look at a set of data organizers from the unit, to describe a pattern that they see in one of the organizers, and to describe how one of the organizers helped them to see a pattern. These one-on-one conversations are an opportunity to assess students' progress toward the core learning goals of the unit—their understanding of discipline-specific concepts, their application of the crosscutting concept of Patterns, and their developing facility with organizing data to	

	see patterns, which is a key practice of science and engineering.	
SP3: Student Progress Over Time	The assessment system for each Amplify Science unit is designed to provide teachers with actionable diagnostic information about student progress toward the learning goals for the unit. Assessment of unit learning goals is grounded in the unit's Progress Build, which describes how student understanding is likely to develop and deepen through engagement with the unit's learning experiences. The assessment system includes formal and informal opportunities for students to demonstrate understanding and for teachers to gather information throughout the unit — all while giving teachers flexibility in deciding what to score and what to simply review. Built largely around instructionally embedded performances, these opportunities encompass a range of modalities that, as a system, attend to research on effective assessment strategies and the NRC *Framework for K–12 Science Education*. The variety of assessment options for Amplify Science include: ● **Pre-Unit Assessment** (formative): Written responses ● **On-the-Fly Assessments** formative): 3–4 per chapter; each On-the-Fly Assessment includes guidance on what to look for in student activity or work products, and offers suggestions on how to adjust instruction accordingly. ● **End-of-Chapter Scientific Explanations** (formative)**:** Three-dimensional performance tasks to support students' understanding of ideas encountered in each chapter. ● **Self-assessments** (formative): One per chapter; brief opportunities for students to reflect on their own learning, ask questions, and reveal ongoing thoughts about unit content. ● **Critical Juncture Assessment** (formative)**:** Occurring at the end of each chapter, similar in format to the Pre-Unit and End-of-Unit assessments. ● **End-of-Unit Assessment** (summative): Written responses ● **Investigation assessment (summative):** In each grade, there is one opportunity to summatively assess an embedded performance in which students plan and conduct investigations. This three-dimensional assessment provides an opportunity for teachers to assess students' facility with the practices of Planning and Conducting Investigations and Analyzing and Interpreting Data as well as students'	

	understanding of disciplinary core ideas and crosscutting concepts. ● **Portfolio assessment (summative):** Through the portfolio assessment students have an opportunity to reflect on their goals and growth throughout the school year as they compile and reflect on work products from each unit. Guidance is provided for teachers and students on selecting work and reflecting on and evaluating growth across the year. ● **Benchmark Assessments***: Delivered three to four times per year in Grades 3–5, benchmark assessments report on students' facility with each of the grade-level appropriate DCIs, SEPs, CCCs, and performance expectations of the NGSS. Evidence, grades K–5: ● **Environments and Survival** unit (grade 3), select examples: This unit, like all others in grades 3–5, begins with a pre-unit writing task that offers insight into students' initial understanding of the unit's core content and offers a baseline from which to measure growth over the course of the unit. Each unit also features an end-of-unit writing task, which, for this unit, is a culminating written explanation of why the snails with yellow shells were more likely to survive in their environment 10 years ago. Students also apply these ideas in a design challenge in the final chapter, which provides an opportunity to assess students' developing facility with the practice of designing solutions and their application of the crosscutting concept of Structure and Function. Along the way, a range of assessment opportunities are embedded in instruction. These include Critical Juncture Assessments designed to assess students' understanding at key moments in each chapter (for example, in Lessons 1.4, 2.6 and 3.3), and frequent On-the-Fly Assessments (such as the ones employed in Lessons 2.7 and 4.3) that were designed to guide teachers as they monitor students' learning progress on a lesson-by-lesson basis. Each Critical Juncture and On-the-Fly Assessment features specific guidance on how to make instructional use of the information gathered through the assessment opportunity. Together, the assessments are a coherent system through which teachers gain actionable, timely, and relevant insight into their students' learning. **The Amplify NGSS Benchmark Assessments were authored by Amplify and were not developed as part of the Amplify Science program or created by the Lawrence Hall of Science.*	

SP4: Equitable Access	In addition to the multiple measure approach, described above, all assessments are carefully reviewed to improve accessibility and to eliminate bias. The review process is supported by psychometricians, assessment experts, science educators, literacy experts, and educators with deep experience in the grade level in which particular assessments occur. As a part of this process to create unbiased assessments, language in assessment items is carefully chosen to be grade-level appropriate and to avoid common pitfalls of assessment design, like false cognates and complex grammatical structure or tense. As an important element of construct validity, contexts used for assessment items and performance tasks are carefully chosen to avoid advantaging or disadvantaging students from different backgrounds—we want student performance to be a function of the understanding and practices being learned and assessed, not the set of experiences they are familiar with.	

Rubric 4

Designed for the NGSS: Foundations
Teacher Support Evidence Chart

Teacher Materials	Strong	Adequate	Weak
F1. Presence of Phenomena/Problems. Identify and provide background information about the phenomena/problems in the unit and how they match the targeted learning goals.	X		

F2. Presence of Three Dimensions. Identify and provide background information about each of the three dimensions in the unit. Also take note of any support for nature of science and engineering, technology, and applications of science.			
The SEPS	X		
The DCIs (including engineering)	X		
The CCCs	X		
also note NoS and ETS	X		
F3. Presence of Logical Sequence. Identify and provide background information on the sequence of learning in the unit.	X		

Strengths related to these Teacher Supports	**Limitations related to these Teacher Supports**
In addition to a range of formalized professional development opportunities that are offered, Amplify Science provides ample instructional support and background information embedded within the curriculum itself. In fact, the Teacher's Guide includes a wealth of resources through which Amplify Science teachers can develop and extend their knowledge on the items noted above and more. For example: ● **Unit-level resources**, just some of which include: ○ **Unit Overview**: A few paragraphs outlining the unit, including what the unit is about, why it was written this particular way, and how students experience the unit. ○ **Lesson Summaries**: 1–2 pages on each lesson in the unit, aimed at facilitating planning and explaining the logic behind lesson sequencing. ○ **Unit Map**: A short one-page summary of the unit, showing how student investigations grow increasingly sophisticated over the course of the unit.	

○ **Progress Build**: A thorough explanation of the unit's learning progression. ○ **Standards and Goals**: An in-depth explanation of the targeted NGSS performance expectations, DCIs, emphasized science and engineering practices, and focal crosscutting concepts in the unit, as well as a list of supported CCSS ELA and CCSS Math standards. ○ **Science Background**: A teacher-facing document that gives valuable science content information and calls out common student misconceptions and preconceptions. ● **Embedded lesson-level teacher supports** in the lessons, such as: ○ Clear step-by-step instructions for each activity ○ Differentiation strategies for each lesson (see next section for more details) ○ Teacher Support notes for activities within the lessons, including background knowledge on the scientific information being taught, pedagogical rationale, and suggestions on technology usage For NOS and ETS connections, the Teacher Support notes are especially helpful. When lessons present particularly useful opportunities to address the nature of science, the Teacher's Guide will contain a Teacher Support tab, to which teachers can refer for insight into how that specific activity facilitates and highlights those connections. Evidence, grades K–5: ● **Earth's Feature**s unit (grade 4): In Activity 2 of Lesson 3.3, students read the book *Arguing to Solve a Mystery*. In the book, students see pictures of men and women engaging in scientific debate, experimentation, and field work. Students read about the process of gathering data to find evidence that supports a claim, and how that method of investigation leads to a growing body of knowledge about how the world works. Students also discuss the ideas and arguments presented in the book about what natural event may have caused the extinction of the dinosaurs. Collectively, this text illustrates the ideas that science explanations describe the way natural events happen, science is both a body of knowledge and processes that add new knowledge, and men and women from all cultures and backgrounds choose careers as scientists and engineers.	

Designed for the NGSS: Student Work
Teacher Support Evidence Chart

Teacher Materials	Strong	Adequate	Weak
SW1. Phenomena/Problems. Provide support and strategies for how to help students figure out/solve authentic and relevant phenomena/problems using the three dimensions.	X		
SW2. Three-Dimensional Conceptual Framework. Provide support and strategies for how teachers • help students develop a conceptual framework of scientifically accurate understandings and abilities related to:			
The SEPS	X		
The DCIs (including engineering)	X		
The CCCs	X		
also note NoS and ETS	X		
• create a learning environment that values students' ideas, motivates learning, and helps students negotiate new meaning as they interact with others' ideas, new information, and new experiences.	X		
SW3. Prior Knowledge. Provide support and strategies to leverage students' prior knowledge and experiences to motivate learning.	X		
SW4. Metacognitive Abilities. Provide support and strategies	X		

for how to help students develop metacognitive abilities.			
SW5. Equitable Learning Opportunities. Provide resources and strategies for how to ensure that all students, including those from nondominant groups and with diverse learning needs, have access to the targeted learning goals and experiences.	X		

<table>
<tr><th>Strengths related to these Teacher Supports</th><th>Limitations related to these Teacher Supports</th></tr>
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To support teachers in providing the best possible instruction, every lesson includes a Differentiation section in the Lesson Brief. The Differentiation Brief describes what is built into the lesson to support diverse learning needs; highlights potential challenges teachers should be aware of; and provides specific strategies for differentiating instruction. The Differentiation Brief contains the following sections:

Embedded Supports for Diverse Learners: Every unit is designed with diverse learners in mind, with the goal of providing rigorous yet accessible science instruction. Each lesson is intentionally planned to provide multiple entry points for students, and to enable all students to be successful with all of the activities. This section of the Differentiation Brief highlights the scaffolds already embedded within the lesson so that teachers can take advantage of the power of these carefully designed activities.
Potential Challenges in This Lesson: This section of the Differentiation Brief highlights aspects of the lesson that may present particular cognitive, linguistic, or social challenges for students.
Specific differentiation strategies for English Learners (ELs): This section of the Differentiation Brief points out activities that could pose linguistic challenges for ELLs or reduce their access to science content, and suggests supports and modifications accordingly. Suggestions include linguistic supports to bolster students’ understanding of science content, supports for engaging with science texts, ideas for helping students participate in discussions, multiple ways students can express their ideas in writing, and more.
Specific differentiation strategies for students who need more support: Every lesson includes ways for teachers to support those students who are struggling or who have special needs. These additional scaffolds are to be used entirely at the discretion of the teacher, and provide

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targeted suggestions tailored for the activities in that particular lesson. ● **Specific differentiation strategies for students who need more challenge**: Every lesson has ways for a teacher to expand upon the lesson, or go beyond the scope of what is expected in that lesson. This section of the Differentiation Brief provides suggestions that allow students to engage with content more deeply, explore the material with a new purpose, pursue more independent research on a topic, and more. To help K-5 students develop metacognitive abilities, the instructional materials provide regular opportunities for teachers to have students take included self-assessments. These quick yet important activity asks students to reflect on what they do or do not yet understand about the core concepts from the unit. Reviewing students' responses can give teachers a sense of what students think they know. Students' responses can also provide insight into what students are curious about, and this insight can help teachers provide motivation for the investigations that follow. For guidance on helping students develop scientifically accurate understandings and abilities, and strategies for leveraging students' prior experiences, teachers have access to the following for individual activities in each Amplify Science lesson: ● **Instructional Guide**: Teacher-facing instructions for delivering that specific activity. Within the Instructional Guide, teachers will see step-by-step instructions, optional model language to use, and quick access to any images intended for projection to students. This aids teachers in guiding students to increasingly sophisticated understandings of grade level concepts, as well as leveraging students' prior experiences. For instance, when students are introduced to the problem context for the unit, and the role they will be inhabiting to figure that problem out, the Instructional Guide provides questions teachers can pose to elicit a student discussion of related experiences they may have had, and their initial ideas related to the context.The Instructional Guide is not intended to be a "script;" teachers are encouraged to adapt the lessons as needed to make the lessons fit their teaching style. The Instructional Guide ensures that every teacher, no matter their training in NGSS or experience in the classroom, has all the tools and instructions they need to deliver effective, research-based, three-dimensional instruction to their students. ● The Instructional Guide also provides **Teacher Support**: Helpful insights into the activity, such as pedagogical rationale, classroom management suggestions, recommendations on managing technology, extensions to the activity, literacy supports, and more. Teacher Supports also include Instructional Suggestions that teachers should plan on incorporating into the lesson as	

they see fit. Example: ● **Ecosystem Restoration** unit (grade 5): In Lesson 1.1, the teacher asks students, "what do you know about ecosystems?," accepting all responses. Afterwards, the teacher projects images of different ecosystems, and the Instructional Guide instructs her to, "Let students know that as you project photographs of different ecosystems, they should share their ideas about the types of living things they might find there and what those living things might need to grow. As you project each ecosystem, ask the same question: What living things do you think you would find in this ecosystem?" This discussion gives students the opportunity to activate prior knowledge before taking on the role of ecologists trying to figure out why jaguars, sloths, and cecropia trees in a reforested section of a Costa Rican rain forest are not growing and thriving, and what can be done to return the ecosystem to its original healthy state The instructional materials also help teachers incorporate strategies that support students in developing literacy and math competencies. The Teacher's Guide of every unit of Amplify Science contains a "Standards and Goals" document that outlines not only the Next Generation Science Standards that are addressed in that unit, but the Common Core Language Arts and Mathematics Standards, as well. Furthermore, the Instructional Guide of each lesson also indicates which of these standards that particular lesson's activities address. For math connections, teachers have multiple opportunities for math extensions throughout the program. These are noted in the Teacher Support notes of appropriate activities. ● Evidence, grades K–5: ○ **Plant and Animal Relationships** unit (grade 2): In Lesson 1.3, students are introduced to their Investigation Notebooks and use them to record information from the text, *My Nature Notebook.* As a math extension, the Teacher Support Tab of the Instructional Guide suggests, *"to give students practice making bar graphs and analyzing data, have them use the data table on page 15 of My Nature Notebook. Working in pairs, invite students to each make one bar graph. One student should make a bar graph to represent the growth of the young oak tree while the other makes a bar graph that represents the growth of grass. Partners can then describe their graphs to each other. Ask them how the*	

height of the young oak tree and grass have changed over time [...]. The purpose of this activity is to give students practice analyzing and interpreting data using bar graphs." ○ **Pushes and Pulls** unit (Kindergarten): In Lesson 1.4, students install launchers into their Box Models to get pinballs to start moving. As a math extension, the Teacher Support tab of the Instructional Guide includes the suggestion that teachers, *"Engage students in a discussion about the different shapes. Start by asking students to identify the shapes and describe what they see. They will likely identify that the box is shaped like a rectangle, and they will describe its sides. Deepen the conversation by asking students to analyze the shapes. Ask questions such as 'Why do you think the Box Model is shaped like a rectangle?' 'What would happen if we made a pinball machine that is a different shape?' or 'What would be different if we turned the machine sideways?' Repeat this line of questioning with other shapes that students identify with the Box Models [...]. The purpose of thinking in this way is to provide students with experience using informal language as they analyze and compare different sizes and orientations of two- and three-dimensional shapes."* ○ **Sunlight and Weather** unit (Kindergarten): In Lesson 2.2, students record the temperature data they collected outside on the Class Playground Temperature chart. As a math extension, the Teacher Support tab of the Instructional Guide suggests, *"Once the class has added data to the Class Playground Temperature Chart, consider inviting students to compose evidence-based results statements using the data. These statements allow students to practice reading graphs to make better sense of the information the graph conveys. For instance, students could say, "We had 6 mornings that were cold." More sophisticated statements might say, "There were 3 more very warm playground surfaces then there were cold playground surfaces." If time allows consider recording students' statements underneath the graph as a way to support the connection between oral and written language."* Amplify Science also provides instructional support for literacy, and provides instructions on how to read scientific texts, write scientific explanations and arguments from evidence, and engage in scientific discourse. ● Reading: In Amplify Science, students don't simply "read the text and answer the questions that follow." Rather, students are always approaching their readings with a purpose in mind, from	

looking for pieces of evidence to support their scientific argument, to asking and recording questions as they read through the text. ○ Evidence, grades K–5: ■ **Animal and Plant Defenses** unit (grade 1): In Lesson 2.1, students are led in a Shared Reading of the book *Tortoise Parts,* with the express purpose of gathering information about how tortoises do what they need to do to survive. Using the strategy of visualizations to make sense of the structures in the text, students become acquainted with the idea that animals use specific body parts to meet their survival needs. ■ **Modeling Matter** unit (grade 5): In Lesson 2.3, students read the book *Solving Dissolving*, a fictional text about a brother and sister who make lemonade. The teacher first models making inferences with the first few pages of the text. As students read the book with partners, they make inferences about the text, using the images as well as the text to help them understand what they are reading. After reading the book, students record two observations made in the text as well as inferences that they made while reading. Students discuss the models used in the text and how they contribute to an overall understanding of the text. ■ **Changing Landforms** unit (grade 2): In Lesson 2.3, students are introduced to a new Investigation Question (*How could water change a landform even though landforms are made of hard rock?*), and participate in a Partner Reading of the informational text *What's Stronger? How Water Causes Erosion,* with the specific purpose of gathering evidence related to the question. The lesson concludes with a class discussion about different examples of landforms and how water can change them, using the book as reference. ● Writing: In addition to vocabulary development, students will engage in a variety of writing activities, from quick warm ups that start the class, to end of chapter scientific explanations, and finally, end of unit scientific arguments. ○ Evidence, grades K–5: ■ **Inheritance and Traits** unit (grade 3): The pre-unit assessment in Lesson 1.1 is a writing assignment intended to reveal students' initial understanding of the unit's content. Later, in Lesson 1.7, after groups review gathered data, the class	

works together to write their first scientific explanation to answer the Chapter 1 Question: *Why are wolves different even though they are all the same species?* This allows the teacher to model the scientific practice of constructing explanations. Throughout the unit, students will continue to engage in writing scientific explanations, and will do so with increasing independence. Ultimately, in Lesson 3.6, students construct a final written explanation about why the wolf they have been studying is medium in size.

- **Energy Conversions** unit (grade 4): In Lesson 1.6, students are introduced to the vocabulary word *evidence,* then get practice with the concept by writing a response to the prompt, "*Look at the picture of the Ergstown subway on page 17. Name at least two forms of energy that you see evidence of. What is your evidence?"* At the end of the lesson, students work in pairs to gather additional evidence for a claim and write their first argument of the unit. Each subsequent chapter also concludes with a written scientific argument.
- **Spinning Earth** unit (grade 1): In Lesson 1.5, students draw and write (using Word Rings) about what two friends see in the sky, and use that information to determine if they live in the same place. The teacher then introduces Interpretation Language Frames and leads students in a Shared Writing about why the sky looks different to Sai than it does to his grandma when they talk on the phone. Teachers record the sentences that students orally compose and then invite students to read these sentences aloud together to consolidate their understanding of the explanations. In the final Shared Writing of the unit, which occurs in Lesson 5.2, the teacher guides students to synthesize their ideas and compose an answer to the Chapter 5 Question: *Why was it nighttime for Sai when he called his grandma during the winter?*

- Vocabulary: Developing a robust scientific vocabulary is an important aspect of our approach to literacy development. For each unit, a carefully selected set of conceptually important words has been identified, and students get repeated exposure to these words through multiple modalities: reading, writing, listening, and student-to-student talk.
  - Evidence, grades K–5:
    - **Needs of Plants and Animals** unit (Kindergarten): In Lesson 1.1, teachers use a specific vocabulary routine with students to introduce the word *scientist*. In the

exercise, students get the opportunity to hear, see, and say the word, and then connect the word to a student-friendly definition. This routine provides a consistent way to introduce and practice new words as students encounter focal vocabulary throughout the unit. ■ **Balancing Forces** unit (grade 3): In Lesson 1.2, students are introduced to the words *force* and *evidence.* First, students engage in a hands-on activity in which they use blocks and everyday materials to explore different ways that one object can push or pull on another object. To build on this experience, the teacher leads a discussion to help students make sense of the class data, defining *force* and guiding students to figure out what *evidence* of a *force* might be from their investigation. ■ **Weather and Climate** unit (grade 3): In Lesson 1.2**,** students are introduced to the word *data.* First, students engage in a hands-on activity in which they explore how to measure rainfall in a way that allows them to compare different amounts of rain. The discussion that teachers lead afterwards codifies the word *data* for students, enabling them to make the connection that the information they recorded in their notebooks is, in fact, *data.* The word continues to be used throughout the unit, such as in Lesson 3.3, when students engage in student-to-student discussion about what they observed in weather data that spans 50 years and 3 locations. ● Discourse: Students in Amplify Science have numerous opportunities for structured student-to-student discourse, with low-stakes and high-stakes opportunities to share ideas, use newly acquired vocabulary, and craft oral scientific arguments. ○ Evidence, grades K–5: ■ **Vision and Light** unit (grade 4): Students participate in a Think-Pair-Share routine to reflect on questions about light receptors and vision. This routine allows students to quickly develop ideas about what they are learning and to discuss those ideas. Think-Pair-Share in Amplify Science iis especially beneficial for English learners and other students who may feel reluctant to speak in front of the whole class without preparation. ■ **Light and Sound** unit (grade 1): In Lesson 1.3, students participate in a Shared Listening routine in which they think about and discuss the question: *What is*	

another light source that you know of that we did not see on our Light-Source Hunt? The teacher explains that each partner will have a turn being the speaker and the listener, but that each student can only fulfill one role at a time, and provides language frames to get them started. The Shared Listening routine is used throughout the unit, and is designed to provide students with multiple opportunities to think on their own and then discuss their ideas with a partner as a way to clarify, refine, add to, or change their understanding. ■ **Earth's Features** unit (grade 4): In Lesson 1.1, students share what they already know and what questions they have about rocks and fossils, first with a partner then with the whole class, in order to activate prior knowledge and to motivate learning. Teachers emphasize to students that it is okay to not be totally sure of their thinking; that thinking about a topic before students start investigating can help make it easier for them to learn new information. Students responses in the discussion are recorded on an Anticipatory Chart, which will be revisited throughout the unit to give students a chance to reflect on what they have learned about rocks and fossils.	

Designed for the NGSS: Student Progress

Teacher Support Evidence Chart

Teacher Materials	Strong	Adequate	Weak
SP1. Three-Dimensional Performances. Provide support with a range of sample student responses and/or rubrics for interpreting evidence of student learning across the three dimensions, specific to the element of each dimension, and	X		

related to the phenomenon/problem that provides context for the student performance.			
SP2. Variety of Measure. Provide guidance and scoring tools for using a variety of measures matched to the targeted learning goals to help students monitor their progress toward learning goals and reflect on what they have learned, how they learn it, and how to use metacognition productively.	X		
SP3. Student Progress Over Time. Provide guidance for using formative and summative assessments to monitor student progress over time. Examples include support for capturing student growth, interpreting results, adjusting instruction and planning for future instruction, providing feedback to students, and prompting students to consider what and how they've learned.	X		
SP4. Equitable Access. Provide support and strategies for ensuring that assessments are accessible to students from diverse backgrounds and with diverse learning needs.	X		

Strengths related to these Teacher Supports	**Limitations related to these Teacher Supports**
The assessment system for each Amplify Science unit is designed to provide teachers with actionable diagnostic information about student progress toward the learning goals for the unit. Assessment of unit learning goals is grounded in the unit's Progress Build, which describes how student understanding is likely to develop and deepen through engagement with the unit's learning experiences. The assessment system includes formal and informal opportunities for students to demonstrate understanding and for teachers to gather information throughout the unit — all while giving teachers flexibility in deciding what to score and what to simply review. Built largely around instructionally embedded performances, these	

opportunities encompass a range of modalities that, as a system, attend to research on effective assessment strategies and the NRC *Framework for K–12 Science Education*. The variety of assessment options in Amplify Science include: ● **Pre-Unit Assessment** (formative): Written responses ● **On-the-Fly Assessments** (formative): 3–4 per chapter; each On-the-Fly Assessment includes guidance on what to look for in student activity or work products, and offers suggestions on how to adjust instruction accordingly. ● **End-of-Chapter Scientific Explanations** (formative)**:** Three-dimensional performance tasks to support students' understanding of ideas encountered in each chapter. ● **Self-assessments** (formative): One per chapter; brief opportunities for students to reflect on their own learning, ask questions, and reveal ongoing thoughts about unit content. ● **Critical Juncture Assessment** (formative)**:** Occurring at the end of each chapter, similar in format to the Pre-Unit and End-of-Unit assessments. ● **End-of-Unit Assessment** (summative): Written responses ● **Investigation assessment (summative):** In each grade, there is one opportunity to summatively assess an embedded performance in which students plan and conduct investigations. This three-dimensional assessment provides an opportunity for teachers to assess students' facility with the practices of Planning and Conducting Investigations and Analyzing and Interpreting Data as well as students' understanding of disciplinary core ideas and crosscutting concepts. ● **Portfolio assessment (summative):** Through the portfolio assessment students have an opportunity to reflect on their goals and growth throughout the school year as they compile and reflect on work products from each unit. Guidance is provided for teachers and students on selecting work and reflecting on and evaluating growth across the year. ● **Benchmark Assessments***: Delivered three to four times per year in Grades 3–5, benchmark assessments report on students' facility with each of the grade-level appropriate DCIs, SEPs, CCCs, and performance expectations of the NGSS. **The Amplify NGSS Benchmark Assessments were authored by Amplify and were not developed as part of the Amplify Science program or created by the Lawrence Hall of Science.* Amplify Science's multiple measure approach to assessment is designed to minimize bias by providing a wide variety of opportunities for students to demonstrate understanding--not just text, but also talk, diagramming and modeling, and hands-on (especially for early elementary) modalities.	

Evidence, grades K–5: ● **Needs of Plants and Animals** unit (Kindergarten): Lesson 1.6 contains a kinesthetic On-the-Fly Assessment in which students first search for milkweed in pictures, then physically move to different habitat stations in the classroom when the teacher prompts, “Now pretend you are a monarch caterpillar. Which habitat would you live in, the field of weeds or the forest with pine trees and water lilies?” Their selection of a habitat for the caterpillars is an opportunity to assess students’ understanding that animals can only live in a place with the food they need. The “Chapter 1: Clipboard Assessment Tool” is available as a reference for key questions and a place to record notes on students’ responses. ● **Waves, Energy, and Information** unit (grade 4): In Lesson 4.4, students apply their understanding of sound waves and patterns in digital communication to complete an end-of-unit writing task. In this three-dimensional performance task, students construct explanations for how patterns in the motion of air particles allow sound to travel as a wave from the computer to Maria. Students also analyze and interpret data as they use the waveform of the sound from the computer to explain why the music suddenly surprised her. To assess students’ written explanations—as a performance of the practice of constructing explanations and of their understanding of the concepts being explained—three rubrics are provided. Rubric 1 is designed to formatively assess the practice of constructing explanations. Rubric 2 may be used summatively to assess students’ understanding of the science ideas encountered in the unit. Rubric 3 may be used summatively to assess students’ application of the crosscutting concept of Patterns as applied to a specific phenomenon. ● **Spinning Earth** unit (grade 1): In Lesson 5.3, the culminating lesson of the unit, the teacher sits with students, one at a time, and prompts them to explain a sequence of images from the book *What Spins?* that show the sky at five different times of day. The teacher also asks students to look at a set of data organizers from the unit, to describe a pattern that they see in one of the organizers, and to describe how one of the organizers helped them to see a pattern. These one-on-one conversations are an opportunity to assess students’ progress toward the core learning goals of the unit—their understanding of discipline-specific concepts, their application of the crosscutting concept of Patterns, and their developing facility with organizing data to see patterns, which is a key practice of science and engineering. In addition to the multiple measure approach, all assessments are carefully reviewed to improve	

accessibility and to eliminate bias. The review process is supported by psychometricians, assessment experts, science educators, literacy experts, and educators with deep experience in the grade level in which particular assessments occur. As a part of this process to create unbiased assessments, language in assessment items is carefully chosen to be grade-level appropriate and to avoid common pitfalls of assessment design, like false cognates and complex grammatical structure or tense. As an important element of construct validity, contexts used for assessment items and performance tasks are carefully chosen to avoid advantaging or disadvantaging students from different backgrounds—we want student performance to be a function of the understanding and practices being learned and assessed, not the set of experiences they are familiar with. Guidance on interpreting student performance along the three dimensions is included through Amplify Science units. Categories of evaluation guidance found throughout the program include: ● Assessment guides/rubrics: Guidance is provided to gauge the level of student performance on the assessment task, with suggestions for student feedback and questioning strategies to advance learning, revise performance, or elicit and clarify student thinking. Assessment guides/rubrics are available as a digital resource in the Lesson Brief for the lesson in which the task occurs. ● Possible student responses: Possible student responses are provided to model how evidence of understanding, or partial understanding, may be demonstrated by the student for the specific task. Possible student responses are provided in the Possible Responses tab in the activity where there is an applicable notebook page. Possible student responses also appear in the Assessment Guide for the End-of-Unit Assessment (in Digital Resources). ● Look for/Now what? notes: Each On-the-Fly Assessment includes a two-part description of what evidence of understanding would look like for the task (Look for) and how instruction may be adjusted in response (Now what?). These are accessible by pressing the orange hummingbird icon in the activity in which they appear. ● Assess understanding/Tailor instruction notes: Each Critical Juncture Assessment includes a two-part description of how the expected level of student understanding may be demonstrated in the task (Assess understanding) and how instruction may be adjusted in response (Tailor	

instruction) at the class, group, and student level. These are accessible by pressing the orange hummingbird icon for the activity in which they appear. Evidence, grades K–5: ● **Ecosystem Restoration** unit (grade 5): For the End-of-Unit Assessment in Lesson 3.7, students write final scientific arguments in response to the same prompt as they did in the Pre-Unit Assessment. Students' arguments provide an opportunity to assess their level of understanding of the core concepts from the unit, as specified in the Progress Build, and provide evidence of growth over time when compared with their pre-unit writing. Students' arguments also reveal students' developing facility with the practice of engaging in argument from evidence. In the "Guide to Assessing Students' End-of-Unit Arguments" (located in Digital Resources for Lesson 3.7), two rubrics are provided for assessing students' writing along several dimensions. These dimensions include attention to students' understanding about how energy and matter flows in an ecosystem, students' knowledge of how parts of an ecosystem interact, and students' abilities to construct scientific arguments from evidence. ● **Energy Conversions** unit (grade 4): In Lesson 1.6, students gather additional evidence to support a claim and write their first argument of the unit. The Possible Responses tab of the Instructional Guide provides teachers with example responses. In addition, the "On-the-Fly Assessment" reference information guides teachers with the following information: "As students are recording evidence, notice if they are including evidence that is relevant to the claim and that also comes from one of the sources designated on the notebook page. Since this is students' first experience in this unit with providing evidence to support a claim, it is acceptable at this stage if not all students have mastered this. If you find that many of your students are including irrelevant evidence or writing down their own opinions rather than evidence from a specific unit source, you may decide to add in further discussion after students complete pages 18–19, 'Writing an Argument About the Blackout,' in the notebook. You may also choose to present a student work example that includes evidence supporting the claim and talk through why the evidence is relevant and where it came from." ● **Changing Landforms** unit (grade 2): In Lesson 1.1, students are presented with a rock arch in the ocean and are told that the hole in the arch has gotten bigger over time. Students are asked to explain why the hole got bigger. This pre-unit writing assessment is an opportunity for students to articulate their initial ideas about why and how landforms can change over time. This will allow the teacher to draw connections to students' experiences and to watch for alternate	

conceptions that might get in the way of students' understanding. In "Guide to Interpreting Students' Pre-Unit Explanations" (in Digital Resources for Lesson 1.1), guidance is provided to help the teacher draw insights into students' initial thinking about the content. The Guide includes examples of students' experiences that the teacher can connect to activities in the unit, ideas students may have about rock, and alternate conceptions to watch out for.	

Rubric 5

Designed for the NGSS: Program
Analyze Evidence

Directions

1. Review Designed for the NGSS: Program Rubric.
2. Review the teacher materials and/or student materials to assess the strength of each element.
3. Record strengths and limitations for each component based on your evidence. Cite specific examples.

PROGRESSIONS OF LEARNING. Within a program, learning experiences are more likely to help students develop a greater sophistication of understanding of the elements of SEPs, CCCs, and DCIs when teacher materials	Strong	Adequate	Weak
• make it clear how each of the three dimensions builds logically and progressively over the course of the	X		

program and make clear how students			
• engage in the science and engineering practices with increasing grade-level-appropriate complexity over the course of the program.	X		
• utilize the crosscutting concepts with increasing grade-level-appropriate complexity over the course of the program.	X		
• engage in grade-level/band-appropriate disciplinary core ideas.	X		
• provide a rationale for a logical sequence and treatment of ETS and NoS.	X		

Strengths	**Limitations**
Amplify Science was designed with an emphasis on coherence. The Amplify Science Program Guide provides ample program-level information, including how each of the three dimensions are addressed across grade levels. In addition, every unit comes with a Standards and Goals resource in the Teacher's Guide that clearly outlines how that particular unit fits into the Amplify Science program as a whole. This makes it easy for teachers to see how their students will have been prepared for the unit, and how they will continue to build on the understanding and experience developed in the unit after they complete it. The units in Amplify Science are designed and sequenced to build students' expertise with each of the three dimensions. First, throughout the curriculum, crosscutting concepts are infused into students' learning experiences and provide students with the tools they need to approach new content and integrate ideas across the sciences. For example, in the grade 3 unit **Balancing Forces**, students explore the CCC of Stability and Change through a variety of modalities with grade level appropriate complexity. In their role as scientists, students investigate systems of interacting forces. Sometimes, the forces acting on objects cause those objects to move. This happens when the	

forces acting on an object are unbalanced—this lack of balance causes the position of the object to change. Other times, the forces acting on objects are balanced—their position is stable. Students return to the ideas of stability and change again and again across the unit. Amplify Science also addresses all science and engineering practices with increasing complexity as students move through each grade level. One example of this can be found in how the practice of Designing Solutions to Problems is addressed from K-5. As students move up the elementary grades, they focus on important aspects of engineering practice in an intentional sequence. ● **Pushes and Pulls** unit (Kindergarten): The specific aspect of designing solutions that students focus on is constructing a solution to a problem. In each chapter of the unit, students revisit the problem of how to make a pinball machine, iteratively learning, constructing, and reconstructing a solution to a problem. ● **Properties of Materials** unit (grade 2): Students' experience with the practice of design becomes more sophisticated as they move through grade 1 and 2. In grade 2, for instance, the focal practices is conducting tests to determine how well a solution meets the design goals. Students have multiple opportunities throughout the unit to evaluate their own solutions for whether or not they meet the design goals for good glue. Students also read about a boy, Jess, who conducts tests on possible hair gels to see how well these solutions meet the design goals he set. ● **Energy Conversions** unit (grade 4): When students get to grade 4, they focus more on another important aspect of design: evaluating solutions based on criteria. Students have multiple opportunities to evaluate proposed solutions for solving the problem of blackouts in Ergstown by considering whether or not the solutions meet criteria set forth by the city's leader, Mayor Joules. They also read *Sunlight and Showers*, a book about engineering students who use criteria to design water heaters in Guatemala. As an example of the DCI coherence Amplify Science facilitates across grade levels, below we show how, across the K–5 grade span, units are designed to support increasingly complex reasoning about the ideas that matter cycles and energy flows through ecosystems: ● In Kindergarten, students develop an understanding that animals and plants have needs that they must meet in the place they live. In the **Needs of Plants and Animals** unit, students learn that even without directly contacting plants and animals, humans can impact a place in ways that make it easier or more difficult for living things to meet their needs. ● In Grade 2, students build on these ideas and deepen their understanding of interdependence. In the **Plant and Animal Relationships** unit, students consider that, just as animals need plants in order to eat to survive, plants need animals to get to a place with water and sunlight so they can survive.	

● In Grade 5, students add to their understanding as they investigate more complex ecosystems in the **Ecosystem Restoration** unit. Students figure out that the food relationships they have learned about are necessary because food supplies the matter and energy that all organisms need to grow and thrive. Plants can make their own food from water and air by using energy from the sun, and students trace the path of matter and energy through an ecosystem. Students add to their understanding of interdependence as they learn that while animals depend on plants, plants also need the nutrients that decomposers release into the soil to help them make food. Opportunities for students to develop understandings about the Nature of Science are embedded within all Amplify Science units. Students engage in oral and/or written reflections on their science learning, as well as on the nature and history of science, as they work to figure out the unit's focal phenomena. Students are also continuously supported in addressing applications of science via the real world contexts employed in each unit, as well as via the books, articles, and media that present applications of science. Evidence, grades K–5: ● **Weather and Climate** unit (grade 3): This unit gives students an opportunity to experience the understanding that Scientific Knowledge Is Based on Empirical Evidence. Specifically, comparing measurements with a thermometer to qualitative measurements of temperature (such as in Activity 4 of Lesson 3.6) illustrates the idea that scientists use tools and technologies to make accurate measurements and observations. ● **Energy Conversions** unit (grade 4): Students take on the role of systems engineers. Evidence, grades K–5: ● **Properties of Materials** unit (grade 2): Students read the book J*elly Bean Engineer*, which shows how food engineers use design practices to create new kinds of food. In the book, readers meet Ambrose Lee, a food engineer who invents new jelly bean flavors. Students see Ambrose and his colleagues using their senses, designing mixtures to have certain properties, and working as a team. They learn about how ingredients create the texture of jelly beans and get a glimpse at the hard work and serendipity that are part of the design process. This book provides a real-world parallel to the work students are doing as they design mixtures in the classroom. ● **Weather and Climate** unit (grade 3): This unit gives students an opportunity to experience the understanding that Scientific Knowledge Is Based on Empirical Evidence. Specifically, comparing measurements with a thermometer to qualitative measurements of temperature (such as in Activity 4 of	

Lesson 3.6) illustrates the idea that scientists use tools and technologies to make accurate measurements and observations. ● **Energy Conversions** unit (grade 4): Students take on the role of systems engineers. Additionally, when lessons present particularly useful opportunities to address the nature of science, the Teacher's Guide will contain a Teacher Support tab, to which teachers can refer for insight into how that specific activity facilitates those connections. Evidence, grades K–5: ● **Earth's Feature**s unit (grade 4): In Activity 2 of Lesson 3.3, students read the book *Arguing to Solve a Mystery*. In the book, students see pictures of men and women engaging in scientific debate, experimentation, and field work. Students read about the process of gathering data to find evidence that supports a claim, and how that method of investigation leads to a growing body of knowledge about how the world works. Students also discuss the ideas and arguments presented in the book about what natural event may have caused the extinction of the dinosaurs. Collectively, this text illustrates the ideas that science explanations describe the way natural events happen, science is both a body of knowledge and processes that add new knowledge, and men and women from all cultures and backgrounds choose careers as scientists and engineers.	

UNIT-TO-UNIT COHERENCE. Units across a program demonstrate coherence when student materials	Strong	Adequate	Weak
● are designed with an appropriate sequence and development of DCIs, CCCs, and SEPs to support students in demonstrating learning across a program as they figure out phenomena/problems.	X		
● make explicit connections from one unit to the next across the three dimensions to connect prior learning, current learning, and future learning as students figure	X		

out phenomena/problems.			
• support students in making connections across units and disciplines by helping students negotiate more sophisticated understandings and abilities.	X		

Strengths	**Limitations**
Every unit of Amplify Science includes a “Standards and Goals” resource that clearly outlines how that particular unit fits into the Amplify Science program as a whole. This makes it easy for teachers to see how their students will have been prepared for the unit, and how they will continue to build on the understanding and experience developed in the unit after they complete it. Additionally, the Program Guide includes a supplementary list of opportunities for students to demonstrate their proficiency with grade level performance expectations. **Example of unit-to-unit coherence**: In grade 3, students begin the year by investigating balanced and unbalanced forces in the **Balancing Forces** unit. Students engage in the focal SEP of Developing and Using Models, using and creating various digital, physical, and diagram models to construct and explain ideas about forces. The focal CCC of Stability and Change supports students in thinking about the changes that occur when forces on an object become unbalanced. Students also look for patterns as they investigate with magnets in order to identify the relationship between the forces on an object and the object’s movement. In the **Inheritance and Traits** unit, students extend their thinking about the CCC of Patterns as they analyze data to identify patterns that provide evidence of inheritance and variation in the traits of organisms. Students consider what information can be gleaned from the available data as they delve deeply into the SEPs of Asking Questions and Planning and Carrying Out Investigations, focusing in particular on asking investigable questions. Students’ understanding of traits serves them well as they move on to the **Environments and Survival** unit, in which they consider adaptive and non-adaptive traits. The focal CCC of Structure and Function helps students make sense of how different traits make it easier or harder for organisms to survive in different environments. Students also consider the relationship between structure and function as they engage in the focal SEP of Designing Solutions, drawing inspiration from the adaptive traits they studied. Finally, students end the year with the **Weather and Climate** unit, when the higher probability of nice weather allows for measuring weather conditions outdoors. Students apply and deepen their understanding of the CCC of Patterns as they	

collect, analyze, and interpret weather data, identifying patterns that reveal differences in the climate of different regions and enable them to predict future weather. Contrasting day to day variations in weather with longer term stability also helps students develop a more nuanced understanding of stability and change. Students use weather data and their knowledge of weather patterns as they engage in Arguing from Evidence, the unit's focal SEP. They also have a chance to apply what they learned about designing solutions to design structures that can withstand a simulated natural hazard. The DCIs emphasized in each unit work together to support deep explanations of the unit's anchor phenomenon. For example, in the **Inheritance and Traits** unit, investigating why a wolf in one of two Greystone National Park wolf packs has the traits it does leads students to construct ideas about the Growth and Development of Organisms (DCI LS1.B), Social Interactions and Group Behavior (DCI LS2.D), Inheritance of Traits (DCI LS3.A), and Variation of Traits (DCI LS3.B). One aspect of the unit-to-unit coherence that is incorporated into Amplify Science units is the facilitation of students making connections across disciplines. The program organizes student learning around the exploration and explanation of real-world phenomena. Many real-world phenomena, by their very nature, cross the domain boundaries of life, physical, or earth and space science. Thus, when appropriate, strong links are made across the science domains in Amplify Science units. Evidence, grades K–5: ● **Vision and Light** unit (grade 4): Students take on the role of conservation biologists to figure out why a population of Tokay geckos has decreased since the installation of new highway lights in the rainforest. Students use their understanding of vision, light, and information processing to figure out why an increase in light in the geckos' habitat is affecting the population. Doing so requires students to engage with the life science concepts of information processing and structure and function, as well as the physical science idea that light reflecting from objects and entering the eye allows objects to be seen. In addition, because the geckos are affected by new highway lights, repercussions of human impact on the environment, a concept from Earth science, is also addressed. The unit thus serves as an excellent example of how real scientists must make linkages across domains in order to solve problems and explain phenomena. ● **Waves, Energy, and Information** unit (grade 4): Students take on the role of marine scientists and work to figure out how mother dolphins communicate with their calves. They write a series of scientific explanations with diagrams to demonstrate their growing understanding of how sound waves travel. Then	

they apply what they've learned about waves, energy, and patterns in communication to figure out how humans too can create patterns that can communicate information over distances. As they solve these problems, students construct a foundational understanding of how waves transfer information from one place to another. In doing so, students learn physical science concepts in tandem with ideas from life science (information processing) and Earth science (solutions to reduce the impact of Earth processes on humans). • **Patterns of the Earth and Sky** unit (grade 5): Students play the role of astronomers helping a team of archaeologists figure out what the missing piece of a recently discovered artifact might have depicted. As they learn about the sun and other stars and the movement of Earth, students can explain what is shown on the artifact and what might be on the missing piece. In doing so, students learn important concepts from Earth and space science (the universe and its stars; the Earth and solar system) in conjunction with ideas from physical science (gravitational force). Students also make sense of phenomena and problems across domains by effectively employing crosscutting concepts throughout the curriculum. For example, the crosscutting concept emphasized in the grade 3 **Inheritance and Traits** unit is Patterns. In their role as wildlife biologists, students delve deeply into making observations of traits in a wide variety of organisms, observing both similarity and variation. As students begin to understand that patterns in particular traits can be evidence that organisms are more closely related or less closely related, students use more and different kinds of data to look for patterns to answer questions about traits. Later in the year, students act as meteorologists in the **Weather and Climate** unit. In this unit, students organize weather data and figure out that they can use the patterns they discover to make predictions about when and where weather events, such as natural hazards and seasonal temperature change, will occur.	

PROGRAM ASSESSMENT SYSTEM. Over the course of the program, teacher materials will demonstrate a system of assessments that	Strong	Adequate	Weak
• coordinates the variety of ways student learning is monitored to provide information to students and teachers regarding student progress for all three	X		

dimensions of the standards and toward proficiency at the identified grade-level/band performance expectations.			
• includes support for teachers and other leaders to make program-level decisions based on unit, interim, and/or year-long summative assessment data.	X		
• is driven by an assessment framework and provides a structured conceptual map of student learning along with details of how achievement of the outcomes can be measured.	X		

<table>
<tr><th>Strengths</th><th>Limitations</th></tr>
<tr><td>The assessment system for each Amplify Science unit is designed to provide teachers with actionable diagnostic information about student progress toward the learning goals for the unit. Assessment of unit learning goals is grounded in the unit’s Progress Build, which describes how student understanding is likely to develop and deepen through engagement with the unit’s learning experiences. The assessment system includes formal and informal opportunities for students to demonstrate understanding and for teachers to gather information throughout the unit — all while giving teachers flexibility in deciding what to score and what to simply review. Built largely around instructionally embedded performances, these opportunities encompass a range of modalities that, as a system, attend to research on effective assessment strategies and the NRC Framework for K–12 Science Education.

The variety of assessment options for Amplify Science include:
Pre-Unit Assessment (formative): Written responses
On-the-Fly Assessments (formative): 3–4 per chapter; each On-the-Fly Assessment includes guidance on what to look for in student activity or work products, and offers suggestions on how to adjust instruction accordingly.
End-of-Chapter Scientific Explanations (formative): Three-dimensional performance tasks to support students’ understanding of ideas encountered in each chapter.
Self-assessments (formative): One per chapter; brief opportunities for students to reflect on their own learning, ask questions, and reveal ongoing thoughts about unit content.</td><td></td></tr>
</table>

● **Critical Juncture Assessment (CJ)** (formative)**:** Occurring at the end of each chapter, similar in format to the Pre-Unit and End-of-Unit assessments. ● **End-of-Unit Assessment** (summative): Written responses ● **Benchmark Assessments***: Delivered three to four times per year in Grades 3–5, benchmark assessments report on students' facility with each of the grade-level appropriate DCIs, SEPs, CCCs, and performance expectations of the NGSS. **The Amplify NGSS Benchmark Assessments were authored by Amplify and were not developed as part of the Amplify Science program or created by the Lawrence Hall of Science.* Evidence, grades K–5: ● **Pushes and Pulls** unit (kindergarten): Lesson 1.1 contains a discussion-based Pre-unit Assessment. In it, students view a video of a homemade pinball machine in which the pinball moves around the pinball machine in different directions with different amounts of force. Students share their ideas—first in pairs and then as a class—about what made the pinball move in different ways. This discussion is an opportunity for students to articulate their initial ideas. In the accompanying "Assessment Guide," guidance is provided to help the teacher gain insight into students' initial thinking about the content. It also includes examples of students' experiences that the teacher can connect to activities in the unit, ideas students may have about forces or cause and effect on which they can build, and preconceptions to address or watch out for. ● **Vision and Light** unit (grade 4): In Lesson 2.1, students use the digital simulation to investigate the role that light plays in an animal's ability to get information from its environment, demonstrating their understanding of controlling variables as a science practice, as well as the crosscutting concept of cause and effect, as they do. In Lesson 3.2, they get another opportunity to demonstrate their understanding of both by engaging in a class discussion about the book *Crow Scientist*, which profiles prominent wildlife biologist John Marzluff and focuses on his investigation of the American crow's ability to recognize individual human faces. Both activities include On-the-Fly Assessment information that provides teachers guidance on what they should look for in student performance. Guidance on interpreting student performance along the three dimensions is included through Amplify Science units. Categories of evaluation guidance found throughout the program include: ● Assessment guides/rubrics: Guidance is provided to gauge the level of student performance on the assessment task, with suggestions for student feedback and questioning strategies to advance learning,	

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Amplify.