Maryland
STATE DEPARTMENT OF EDUCATION

Science High-Quality Instructional Materials Rubric Companion Guide

Office of Teaching and Learning

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Purpose and Organization

The companion guide breaks down each criterion from the K-12 Science High-Quality Instructional Materials (HQIM) Rubric into smaller components for deeper analysis and offers specific examples that highlight a strong representation of that criterion might look like in practice. The examples provided in this document are not exhaustive.

This companion guide was developed in partnership with Student Achievement Partners (SAP) and BSCS Science Learning (BSCS) and is grounded in SAP's Essential x Equitable (e²) Instructional Practice Framework and using content with permission from BSCS. To learn more about the research and scholarship that underpins this work, please refer to MSDE's Science HQIM Selection Framework.

For each criterion in the Maryland Science HQIM Rubric, the companion guide provides:

- **Key Definitions:** for common language and interpretation of terms and jargon.
- **How to Gather Evidence:** Guidance about where and how to look for evidence of each criterion**.**
- **Examples of Evidence:** Offer concrete ways criteria may appear in instructional materials. These examples are not exhaustive, but to provide reviewers with additional guidance about what evidence of criteria can look like within instructional materials.
- **Red Flags:** Signal evidence that is not aligned or cautions of harmful implications.

A Glossary of key terms can be found at the end of the document. It contains definitions of terms found frequently throughout.

Within both Examples of Evidence and Red Flags, additional guidance is provided through:

- **Grade-Level Considerations:** Where applicable, specific grade-level considerations are flagged (e.g., Grades K-2) within criteria to highlight evidence pertaining to a specific grade level or grade band. When evidence or red flags are not grade-band specific, consider them broadly applicable across grades, even if their application may look different. If grade-level considerations are nested underneath a bullet, they apply specifically to that example.
- **Student Considerations:** Where applicable, considerations for two specific student groups that are central to the design of these resources, multilingual learners and students with diverse learning needs are noted. These student considerations point to related ideas from key frameworks to support all students: CAST's Universal Design for Learning Guidelines to center students with diverse learning needs and the English Learner Success Forum's Science Guidelines to support multilingual learners.

ORGANIZATION

Each review tool in this suite follows the same overarching organization, connected to Maryland's Science HQIM Identification Framework. Review materials for HQIM in Maryland are organized into four categories. Categories are divided into domains, which are further broken down into individual criteria.

For further information on the instructional materials review process, visit the Maryland HQIM website.

CONSIDERATIONS FOR REVIEW

To prepare for the review of each program, scan the front matter of the teacher materials and ancillary materials (e.g., assessments, investigations, teacher handbook) to identify the information that is provided in each resource. Review the table of contents provided in the student materials and in the teacher materials to familiarize yourself with the structure or organization of the program (e.g., chapters, lessons, learning sets, modules). Some criteria will require a scan across the program. Other criteria will require a deep analysis of a learning experience, set of learning experiences, or unit. It may be helpful to choose a consistent “topic” to study in each program under consideration. One approach is to examine the tables of content in each program and choose a set of ideas that are consistent across all programs.

- **Front Matter and Ancillary Review**. The front matter of a science program typically provides information about its instructional design, scope and sequence, routines and strategies, and assessment system. Information about standards alignment may be found in the front matter or may be described at the unit level. Reviewers will need to determine how the program attends to the nature of science and Common Core State Standards. Frequently, developers will provide an overview of standards alignment. The actual alignment needs to be verified through analysis of the materials.
- **Program Level Analysis**. Gathering evidence for some criteria will require deep analysis across units of instruction, particularly related to progressions, in part to ensure that scaffolding for the science and engineering practices (SEPs) fades over time and students develop increasing complexity in their performances.
- **Unit Level Analysis**. In this document, the reference to “unit” means a larger set of learning experiences that would typically require multiple weeks of instruction–the higher the grade level, the longer the unit. Criteria that focus on coherence will require a deep analysis of at least one unit of instruction to determine how well the developers stayed true to the instructional design and use of routines and strategies, how well the materials support student learning of the stated three-dimensional expectations for learning, and the strength of the storyline.
- **Analysis of Lessons or Learning Experiences**. Lessons or learning experiences represent parts of a unit of instruction. Gathering evidence for some criteria may require analysis of lessons or learning experiences. This includes criteria related to phenomenon- or problem-driven learning, criteria within the Designed to Affirm Students category, and indicators of evidence for attention to cross-cutting concepts, among others.
- **Assessment System Review**. Different programs take different approaches to their assessment systems. Maryland’s review favors programs that demonstrate assessment coherence, multiple formative assessment opportunities for students to demonstrate their learning, and assessments that are aligned with standards and a three-dimensional phenomenon- or problem-based approach to student learning.
- **Teacher Materials and Student Materials**. The evaluation of instructional materials requires a review of teacher materials, student materials, and ancillary materials. However, where a reviewer might start the process differs based on the program and grade level. A review of teacher materials is required at lower grades as more of the information about what and how students learn is only available for the teacher. As the grade level increases, the location of information about what and how students learn shifts to student materials. At higher grade levels, the reviewer might begin with a focus on the information in the student materials and then shift the review to the teacher materials for additional information about what and how students learn. Different programs take different approaches to how the “what and how” of student learning is communicated.

Grade-Level and Standards Aligned

DOMAIN 1: SENSEMAKING

PHENOMENON- OR PROBLEM-DRIVEN LEARNING AND PERFORMANCE

Instructional materials are organized to center student learning around making sense of phenomena (i.e., specific occurrences in the natural or designed world) and/or problems (i.e., situations people want to change). These materials include all of the following elements:

- **a.** compelling phenomena and/or problems that are specific, meaningful to particular communities, and of the appropriate scope to drive student sensemaking and promote learning of the targeted grade-appropriate standards;
- **b.** opportunities to engage with a range of phenomena, such as everyday occurrences and those that are relevant to society or culturally significant;
- **c.** student questions about phenomena/problems, and experiences (both prior experiences and those cultivated in the moment in class) related to the phenomena/problems, to motivate student sensemaking and/or problem-solving; and
- **d.** instructional activities that help students answer questions they have about the phenomena and surface new questions that future lessons will help them answer.

Indicators of Evidence

- Materials center phenomena and problems that are specific, can authentically connect to students' lives,[1] and are of the appropriate scope to drive student sensemaking and promote learning of the targeted, three-dimensional standards at the appropriate grade level (K-5) or grade band (6-12).[2]
- Materials provide opportunities to engage with a range of phenomena, such as everyday occurrences and those that are relevant to society or are culturally significant (i.e., meaningful to students' lives and cultural practices).[3] [4]
- Materials utilize student-generated questions about phenomena and problems, and experiences (both prior experiences and those cultivated in the moment in class) related to the phenomena and problems, to motivate student sensemaking and problem-solving.

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[1] NextGenScience. (2021). Toward NGSS Design: EQuIP Rubric for Science Detailed Guidance. WestEd. https://www.nextgenscience.org/sites/default/files/EQuIPDetailedGuidanceMarch2021.pdf

[2] National Research Council. 2012. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* Washington, DC: The National Academies Press. https://doi.org/10.17226/13165

[3] STEM Teaching Tools. (2014). Practice Brief 71: How can you advance equity and justice through science teaching? https://stemteachingtools.org/brief/71

[4] Penuel et al. (2018). *Selecting Anchoring Phenomena for Equitable 3D Teaching*. STEM Teaching Tools. https://stemteachingtools.org/pd/sessione

- Materials provide learning experiences that help students answer questions they have about the phenomena or problem and surface new questions that future learning experiences will help them answer.

- Materials provide opportunities for students to demonstrate their understandings and abilities through performances that are well-matched to the standards and based on the NGSS Performance Expectations (PEs).[5]

Key Definitions:

- **Phenomena**: specific occurrences in the natural or designed world
- **Problems**: situations people want to change; an unwelcome issue through engineering or investigation
- **Sensemaking**: active individual, small group, and whole group processes to describe or explain phenomena and solve problems using the three dimensions (DCIs, SEPs, CCCs)
- **Three-dimensional learning targets**: Science standards which are guided by the three dimensions as defined in the NRC's Framework for K-12 Science Education[6] the three dimensions: Science and Engineering Practice (SEPs), Disciplinary Core Ideas (DCIs), and Crosscutting Concepts (CCCs) the Next Generation Science Standards (NGSS)[7]
- **Performances**: formative or summative assessment opportunities; formative assessment opportunities in which students have opportunities to make sense of phenomena or solve problems, to make their thinking visible, and in which students monitor their own progress and teachers monitor student progress toward three-dimensional learning targets; summative assessment opportunities in which students demonstrate their understanding of three-dimensional learning targets
- **NGSS Performance Expectations (PEs)**: Assessable statements that depict what students should know and be able to do to show proficiency in science by the end of instruction (year or grade bands); PEs provide the learning goals for students but do not dictate the manner or methods used to get there and as such are NOT curriculum[8]

How to Gather Evidence:

- Review student materials for summative assessment opportunities for students to demonstrate their three-dimensional learning through performances.
- Review student materials for formative assessment opportunities for students to make sense of phenomena or solve problems, to make their thinking visible, and in which students monitor their own progress and teachers monitor student progress toward three-dimensional learning targets.

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[5] National Research Council. 2013. *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press. https://doi.org/10.17226/18290

[6] National Research Council. 2012. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* Washington, DC: The National Academies Press. https://doi.org/10.17226/13165

[7] NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press. https://nap.nationalacademies.org/catalog/18290/next-generation-science-standards-for-states-by-states

[8] NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States* (Performance Expectation (PE). Washington, DC: The National Academies Press. https://www.nextgenscience.org/glossary/performance-expectation-pe

- Review student materials for criteria that guide student performances.
- Review teacher materials for examples of questions students might ask about the phenomenon or problem to drive instruction.
- Review teacher materials for an explanation of how student understanding of a phenomenon or problem builds over a unit.
- Review teacher materials for guidance about the student questions that will focus a learning experience or arc of learning experiences.

Examples of Evidence:

See Choice and Voice, Authentic Engagement as a Scientist, Supports and Scaffolds, Relevant Contexts, Pedagogical Content Knowledge, and Design and Functionality for related indicators or evidence for Sensemaking.

- Examples of the range of questions students might ask about the phenomenon or problem of the related phenomena are provided in teacher materials.
- Explanations of how student questions drive instruction are provided in the teacher materials.
- Materials are explicit about prompting students to reflect on the questions they have asked, their progress toward answering them, and more they need to know.
- Materials are explicit about student questions that will *not* be answered through a unit of instruction.
- The questions students seek to answer in a given learning experience or set of experiences are provided by the teacher materials.
- Materials provide prompts to help students connect phenomena and problems from different locations to their own experiences, even if the phenomenon or problem is not local to their region[9] (e.g., when considering criteria and constraints for a dust storm warning system, prompts are provided to think about relevant warning systems in their area and audiences that warning system needs to reach).
- Materials provide guidance for teachers to support students' engagement in phenomena or problems (e.g., use of related phenomena, purpose for each learning experience and its connection to it.
- Materials provide multiple opportunities for students to demonstrate their abilities to use the SEPs, DCIs, and CCCs to describe or explain phenomena and solve problems (e.g., students construct an explanation of a phenomenon using multiple lines of evidence; students engage in argument using evidence to critique an investigation or quality of evidence).
- Materials support students with criteria for performances.
- Rubrics or scoring guides to support analysis of student performances to strengthen teacher's formative feedback or scoring are provided in the teacher materials.

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[9] NextGenScience (2021). *Toward NGSS Design: EQuIP Rubric for Science Detailed Guidance*. WestEd. https://www.nextgenscience.org/sites/default/files/EQuIPDetailedGuidanceMarch2021.pdf

- **Grades 6-12**: The materials provide well-sequenced learning experiences in which students gather multiple lines of evidence and make sense of these different lines of evidence to figure out and explain phenomena or design solutions for problems using the three dimensions.

Red Flags:

- Phenomena or problems serve as a “hook” for generating student interest (i.e., a unit or lesson begins with a story or a videoclip to generate interest), but are not used to drive instruction (i.e., materials do not provide multiple opportunities make sense of the phenomenon or solve the problem).
- Phenomena or problems are limited in their ability to generate prolonged student engagement or cycles of sensemaking and could be answered after a single lesson (i.e., searching online will yield a quick answer for students).
- The description of explanation of the phenomenon or the solution to the problem requires use of elements of the SEPs, DCIs, and/or CCCs that are not grade-level or grade band appropriate (e.g., students use elements of the SEPs that are below grade level; students need to use DCIs that are above grade level).
- Student assessments are one-dimensional or two-dimensional without opportunities to demonstrate three-dimensional performances.

THREE DIMENSIONS DEVELOPMENT

Instructional materials build student understanding of explicit, grade-appropriate elements of SEPs, DCIs, and CCCs through engagement with the phenomena/problems. Moreover, the identified dimensions are required to explain the selected phenomenon or solve the identified problem.

Indicators of Evidence

- Materials build student understanding of explicit, grade band-appropriate elements of SEPs, DCIs, and CCCs.
- Materials use phenomena or problems to drive three-dimensional student learning.
- Materials require students' use of the targeted elements to describe or explain the phenomenon or solve the program.
- Teacher materials provide lesson-level, element-specific three-dimensional learning targets[10] that build over time and reflect student engagement with the phenomena and problems.

Key Definitions:

- **Elements**: SEPs, DCIs, and CCCs are described by components that differentiate the dimension by grade band and describe what students are doing and thinking about for each SEP, DCI, and CCC within the grade band and as a K-12 progression[11]
- **SEPs**: science and engineering practices; describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems
- **DCIs**: disciplinary core ideas; focus K–12 science curriculum, instruction, and assessments on the most important aspects of science
- **CCCs**: crosscutting concepts; have application across all domains of science
- **Three-dimensional**: standards, performance expectations, learning objectives, outcomes, learning experiences, performances, and assessments that require learning of combinations of the SEPs, DCIs, and CCCs[12]

[10] EdReports (2024) *Core Content Review Criteria v2.0, Science, Grades 6-8 (Criterion 1.2: Three-Dimensional Learning and Assessment).* https://cdn.edreports.org/media/2024/11/Science-Grades-6-8-Draft-of-v2.0-Tools_-Review-Criteria.pdf?_gl=1*ycma8n*_gcl_au*MTc3MzUxOTk3MC4xNzMyMTk5MDgz

[11] NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press. https://nap.nationalacademies.org/catalog/18290/next-generation-science-standards-for-states-by-states

[12] NextGenScience. (n.d.). *Three-dimensional learning*. https://www.nextgenscience.org/three-dimensional-learning

How to Gather Evidence:

- Review teacher materials for the identification of targeted grade-level or grade band appropriate SEPs, DCIs, and CCCs for each unit of instruction.
- Review student materials to verify that the targeted grade-level or grade band appropriate SEPs, DCIs, and CCCs for each unit of instruction are developed by students as they describe or explain phenomena or solve problems.
- Review student materials to verify that learning experiences or lessons are grounded in three-dimensions.

Examples of Evidence:

See Three-Dimensional Coherence, K-12 Progressions, Supports and Scaffolds, and Three-Dimensional Performance Progress Monitoring for related indicators or evidence for Three Dimensions Development.

- Teacher materials provide three-dimensional, element-level learning targets for each lesson. Element-level learning targets may be found within lesson guidance or in unit level documents that outline targeted elements by lesson.
- Students use combinations of elements of the SEPs, DCIs, and CCCs to describe or explain phenomena or solve problems.
- Rubrics and scoring guides in the teacher materials include explicit references to the targeted elements of the SEPs, DCIs, and CCCs.
- Rubrics and scoring guides in the teacher materials describe a range of performance based on the targeted elements of the SEPs, DCIs, and CCCs.

Red Flags:

- Materials refer to top-level SEP or CCC rather than explicitly identify the targeted element (e.g., developing and using models rather than the element, identify limitations of models (3-5 grade band) or evaluate merits and limitations of two different models of the same proposed tool, process, mechanism, or system in order to select or revise a model that best fits the evidence or design criteria (9-12 grade band).
- The description of explanation of the phenomenon or the solution to the problem requires use of elements of the SEPs, DCIs, and/or CCCs that are not grade-level or grade band appropriate (e.g., students use elements of the SEPs that are below grade level; students need to use DCIs that are above grade level).
- Student materials provide explanations and solutions before students have had multiple opportunities for sensemaking of phenomena or seeking solutions to problems or in ways that limit opportunities for student sensemaking and problem-solving.

SCIENTIFIC ACCURACY

Instructional materials use scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning.

Indicators of Evidence

- Materials include scientifically accurate representations and text.
- Materials are scientifically accurate and grade-level appropriate in their use of SEPs, DCIs, and CCCs.,
- Lessons and units support students in developing scientifically accurate understanding through their descriptions or explanations of phenomena and solutions to problems.
- Teacher materials identify common student ideas.

Key Definitions:

- **Representations**: illustrations, pictures, models, examples, diagrams, graphs, drawings
- **Common student ideas**: misconceptions, naive conceptions, or incomplete ideas students may hold based on personal experiences

How to Gather Evidence:

- Review the quality and accuracy of representations and texts.
- Review teacher materials for the identification of common student ideas.

Examples of Evidence:

See Authentic Engagement as a Scientist, K-12 Progressions, and Pedagogical Content Knowledge for related indicators or evidence for Scientific Accuracy.

- Student materials include opportunities for them to evaluate the strengths and limitations of models at the appropriate element level.
- Teacher materials include the identification of common student ideas.
- Materials include examples that highlight the value of community knowledge about how the natural world works that are relevant and valuable in understanding phenomena and solving problems.

Red Flags:

- Materials prompt students to gather evidence to prove their claim.
- Language or representations used in the materials promote common student ideas (e.g., orbital path of Earth around the Sun is drawn with high eccentricity; the actual eccentricity of Earth's orbit is less than .02 or nearly circular).
- **Grades K-2**: Scientifically inaccurate or elements of the three-dimensions are presented below grade level in an effort to make materials accessible to young scientists.

NATURE OF SCIENCE DEVELOPMENT

Instructional materials organize learning around using the SEPs, CCCs, DCIs, and nature of science together in service of sensemaking. Nature of science expectations in the Next Generation Science Standards offer a route to building an understanding of the history and inequities in science.[13] Instructional materials build students' understanding of the nature of science elements, explicitly connected to understanding. These materials include all of the following elements:

- **a.** how specific scientific understandings have been constructed;
- **b.** who has been included and excluded in scientific activities and communication of findings;
- **c.** the impact of how science has been, and is, done on a range of human and nonhuman communities and environments; and
- **d.** connections between the nature of science and problem/question definition and critical interpretation of findings.

Indicators of Evidence

- Materials provide opportunities for students to learn how scientific understandings have been constructed.
- Materials support students in learning how science investigations use a variety of methods and tools to gather data and are guided by a set of principles to ensure accuracy of measurements, observations, and objectivity of findings.
- Materials support students in learning how people from different social, cultural, and ethnic backgrounds work as scientists and engineers.
- Materials support students in learning that women and non-white individuals have been excluded from acknowledgement and formal participation in science activities, collaboration, achievement, and communication.
- Materials support students in learning how science has been and continues to be done, in ways that impact a range of human and nonhuman communities and environments.
- Materials support students in understanding that science distinguishes itself from other disciplines through the use of empirical evidence, argumentation, and skepticism to identify and address problems and develop explanations of the natural world.

[13] NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States* (APPENDIX H – Understanding the Scientific Enterprise: The Nature of Science in the Next Generation Science Standards). Washington, DC: The National Academies Press. https://www.nextgenscience.org/sites/default/files/Appendix%20H%20-%20The%20Nature%20of%20Science%20in%20the%20Next%20Generation%20Science%20Standards%204.15.13.pdf

Key Definitions:

- **Problem/question definition**: science, as an enterprise, is driven by observations of the natural or designed world, the questions that scientists and engineers pose, and the problems they try to solve
- **Critical interpretation**: science, as an enterprise, requires analysis of data and information to identify evidence that can be used to answer questions; analysis is often preceded by thoughtful research of the existing literature base and careful scientific investigation to gather data and information

How to Gather Evidence:

- Review materials for learning experiences that support students in learning how scientific understandings have been constructed.
- Review materials for a range of methods and tools used in investigations and in the development of models and explanations.
- Review units for learning experiences that promote the use of logic, objectivity, and skepticism focused on gathering and using empirical evidence.
- Review units for examples of how science has impacted specific communities, both positively and negatively.
- Review units for the meaningful inclusion of individuals from a broad range of communities, their contributions to science and multiple systems of knowing (e.g., indigenous knowledge).

Examples of Evidence:

- Teacher materials provide explicit guidance on how the learning experiences in the units vary the ways students engage in doing science.
- Prompts provide opportunities for students to consider the role of empirical evidence in science to support claims and explanations.
- Learning experiences include opportunities and strategies to support students' engagement in discussions around data they have collected and/or the explanations they have constructed.
- Materials include specific examples of how the processes or applications of science have harmed specific communities and environments.
- Materials include multiple examples in the lessons and units of how society restricted which individuals were able to engage in the scientific enterprise.
- Materials include examples of individuals or communities from non-dominant cultures that have provided important perspectives to the development of science knowledge (e.g., indigenous knowledge of medicinal plants).

Red Flags:

- Science is depicted as a linear process (e.g., *the* scientific method).
- The first set of learning experiences focus on teaching the scientific method or science skills rather than learning to use the SEPs through authentic engagement alongside DCIs and CCCs.
- Materials consistently provide step-by-step instructions for carrying out investigations with limited opportunities to plan investigations.
- Materials represent individuals who are doing science as primarily white and/or male.
- Materials include no examples of the application or processes of science harming communities or the environment.

HANDS ON

Instructional materials provide students with the opportunity to regularly take part in hands-on investigation, modeling, and engineering. Learning experiences emphasize students' thinking as scientists with opportunities to pose questions; plan and carry out investigations that include the collection, organization, and analysis of data; develop and use models to construct and represent their understanding; and develop explanations and arguments based on evidence.

Indicators of Evidence

- Materials provide hands-on learning opportunities.
- Materials provide learning experiences that promote scientific ways of knowing, scientific thinking, and scientific ways of communicating.
- Materials support students to engage in scientific inquiry and develop the ability to use logical reasoning in a scientific context.
- Materials support students' hands-on engagement with elements of grade level or grade band appropriate elements of the science and engineering practices of developing and using models and planning and carrying out investigations to make sense of phenomena and solve problems.
- Materials provide both broad and more specific safety guidance to teachers and students.

Key Definitions:

- **Hands on**: direct and active engagement with equipment, manipulatives, or other physical materials that require the use of the science and engineering practices of developing and using models and planning and carrying out investigations to figure out phenomena and solve problems
- **Scientific ways of knowing**: approaches to developing new knowledge based on empirical evidence that include systematic observations and collection, organization, and analysis of data; may include scientific inquiry
- **Scientific thinking**: approaches that involve the critique of observations, methods, explanations, and models using reasoning and logic
- **Scientific ways of communicating**: approaches to communication that promote scientific ways of knowing and that rely on the use of evidence, reasoning, and logic; may include representations, text-based, and spoken language

How to Gather Evidence:

- Review materials for opportunities for students to have “first-hand” experiences (i.e., hands-on, investigations) with phenomena and problems.
- Review materials for routines and strategies that promote students in pursuing scientific ways of knowing, engaging in scientific thinking, and in communicating in scientific ways.
- Review materials for routines and strategies that support students in using evidence, reasoning, and logic.
- Review teacher materials for explicit identification of grade-band appropriate elements of the SEPs, particularly those required for hands-on engagement, developing and using models and planning and carrying out investigation.
- Review materials to verify student learning experiences provide hands-on engagement in developing and using models and planning and carrying out investigation.

Examples of Evidence:

See Authentic Engagement as a Scientist for related indicators or evidence for Hands On.

- Students develop questions related to a phenomena or problems that will be investigated across a unit of instruction.
- Students are provided opportunities to plan and carry out investigations to generate data related to figuring out the phenomenon or problem.
- Students organize and represent data (tables, graphs, visualization, statistical analysis) and identify significant features and patterns in the data.
- Students develop their own explanations based on multiple sources of evidence.
- Students develop and use scientific arguments to compare, and evaluate competing ideas, explanations, and methods.
- Students construct and use a wide variety of models to help develop explanations of natural phenomena or solve problems.
- Materials identify the need for personal protective equipment (PPE), chemical management, or specific safety equipment during student activities or investigations.
- Materials provide guidance for safe and efficient procedures for outside activities and investigations.
- Materials include discussion of expendable and permanent equipment and materials necessary to conduct activities and guidance on obtaining those materials inexpensively.
- If animals are to be used as part of learning, the materials provide animal safety guidance.

Red Flags:

- Materials emphasize simulations and paper-pencil learning experiences rather than planning and carrying out investigations.
- Materials treat science as a body of knowledge, rather than as a way of developing new knowledge.
- Materials dictate how students should engage in the science and engineering practices and provide limited opportunities for students to make decisions about their use.
- Materials do not provide opportunities for students to increase their understanding and use of the science and engineering practices over the course of the unit.
- Materials include safety guidance only for teachers or missing.
- Materials include only general safety overview and do not provide specific guidance related to safety equipment or procedures for the hands-on investigation in lessons.
- Digital materials are reading-centric and lack hands-on investigations.

DOMAIN 2: COHERENCE

LESSON AND UNIT COHERENCE

Instructional materials include logical sequences within units, across units, and within a grade band. Lessons and units in the materials build on prior lessons and experiences by addressing questions raised in previous lessons and leading students to pose new questions that will be explored in subsequent lessons. In doing so, the materials build understanding toward a defined set of three-dimensional expectations.

Indicators of Evidence

- Materials provide a clear, concise, and logical scope and sequence of units and learning experiences or lessons by grade-level or grade bands that make sense to students and support students in constructing the storyline.
- Materials provide resources and questions that build on prior learning so that students are making links between units and lessons to figure out phenomena and solve problems using the three dimensions.
- Teacher materials include alignment to three-dimensional expectations across units and lessons by grade, grade bands and course.

Key Definitions:

- **Storyline:** a generic term in this context that describes a logical and coherent sequence of three-dimensional learning targets and experiences across units and lessons that match the Maryland science standards and will make sense to students[14] [15]

How to Gather Evidence:

- Review the teacher materials for the three-dimensional scope and sequence by unit and consider the extent to which the sequence will make sense from the student perspective.
- Review student materials for multiple opportunities to learn the intended storyline.
- Review teacher materials for routines, strategies, and supports that promote coherence from the student perspective.
- Review materials for the quality of the phenomena or problems to drive student learning and the extent to which their use promotes coherence across lessons and units.

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[14] Roth, K. J., Bintz, J., Wickler, N. I. Z., Hvidsten, C., Taylor, J., Beardsley, P. M., Caine, A., & Wilson, C. D. (2017). Design principles for effective video-based professional development. *International journal of STEM education*, *4*(1), 31. https://doi.org/10.1186/s40594-017-0091-2

[15] Reiser, B. J., & Novak, M. (2018). *How Do We Make NGSS Storylines Work by Pushing Students to Go Deeper*.

Examples of Evidence:

See K-12 Progressions and Program Coherence for related indicators or evidence for Lesson and Unit Coherence.

- Student materials offer explicit connections or offer prompts and/or questions that help students link back to prior lessons or that forecast upcoming areas of study.
- Routines and strategies are provided to the teacher that help them and/or students link learning experience to one another, link learning experiences to science content (i.e., SEPs, DCIs, and CCCs), or link lessons across the unit.
- Phenomena or problems drive student learning in ways that help students construct the intended storyline.

Red Flags:

- Materials sequence science learning from the perspective of an expert rather than in a sequence that will make sense to students.
- There are learning experiences that do not connect back to the phenomena or problems that drive learning across the unit.
- Units tend to be activity-centric with limited "connective tissue" or are made up of disconnected activities that focus on facts.

THREE-DIMENSIONAL COHERENCE

Instructional materials build DCIs, SEPs, and CCCs progressively from one lesson or unit to the next. In the materials, scaffolding to support student development of SEPs and CCCs decreases over progression to support student independence.

Indicators of Evidence

- Materials provide opportunities for students to demonstrate growth in their understanding of the interconnectedness of the DCIs, SEPs and CCCs in figuring out phenomena and solving problems.
- Materials provide scaffolds to support students towards independence in their use of the SEPs and CCCs.
- Teacher materials include alignment to three-dimensional learning targets across units and lessons by grade, grade bands and course.
- Teacher materials indicate how DCIs, SEPs, and CCCs are connected within and across units and lessons to build student conceptual understanding across all three dimensions.
- Teacher materials indicate how DCIs, SEPs, and CCCs within and across units and lessons support students' abilities to progressively figure out phenomena or solve problems.

Key Definitions:

- **Scaffolding:** instructional practices that support students in making sense of content or process; the support fades over time from teacher or materials guides to student independence

How to Gather Evidence:

- Review teacher materials for the presence of three-dimensional learning targets across units and lessons by grade, grade bands and course.
- Review student materials to verify that students have three-dimensional learning opportunities.
- Review student materials for opportunities for students to draft and revise models, explanations, and arguments; opportunities may include metacognitive prompts to support them in tracking their progress toward learning goals.
- Review teacher materials for explicit references to scaffolds and descriptions or explanations for how to use them, including how the scaffolds fade over time.

Examples of Evidence:

See K-12 Progressions and Three-Dimensional Performance Progress Monitoring for related indicators or evidence for Three-Dimensional Coherence.

- The scope and sequence is described in terms of three-dimensional learning targets in sufficient detail to demonstrate that students' use of SEPs, DCIs, and CCCs progress over time and may describe how the phenomenon is used to drive learning.
- Students are expected to draft and revise explanations with supports that include criteria for students to assess the quality of their work and/or support for students to offer one another peer feedback.

Red Flags:

- The materials use the same scaffolds in the same ways over time (i.e., the scaffolds do not fade).
- Activities are distracting or do not connect to the overall storyline of the lesson or unit.

INSTRUCTIONAL MODEL COHERENCE

Instructional materials include routines and strategies situated within an instructional model that offer coherence in the types of learning experiences and the approach to learning.

Indicators of Evidence

- Teacher materials provide an overview of the instructional model, an evidence-based explanation of its design, and a description of how to use it across units and lessons to support students in figuring out phenomena and solving problems.
- Materials provide opportunities for students to select and use routines and strategies embedded in the instructional model in groups or individually, across lessons and units that support sensemaking.
- Teacher materials indicate or provide evidence and guidance for how the instructional model progressively supports student learning and sensemaking through explicit use of strategies and routines that are consistently used and grow in complexity over time within and across units.

Key Definitions:

- **Instructional model:** guides developers in the design of instructional materials and supports teachers in implementing the materials in ways consistent with the developers' intent

How to Gather Evidence:

- Review the teacher materials for information about the instructional model used by the developers of the materials and how the model supports students' engagement in three-dimensional phenomenon- or problem-driven learning.
- Review the teacher materials for guidance that supports teachers in implementing the materials in ways consistent with the instructional model.
- Review the student materials to verify that the instructional model is used appropriately and consistently throughout the program.

Examples of Evidence:

See K-12 Progressions and Program Coherence for related indicators or evidence for Instructional Model Coherence.

- Background information describes the instructional model and its research base.
- Routines and strategies embedded in the student materials are used in ways that are consistent with the purpose of the phases of the instructional model.

Red Flags:

- The materials are NOT designed based on an instructional model.
- The instructional model used by the developers tends to promote teacher-centered teaching and learning rather than student-centered teaching and learning.
- The instructional model used by the developers limits students' engagement in three-dimensional phenomenon or problem driven learning.

ASSESSMENT COHERENCE

Instructional materials include an approach to assessment that aligns with the approach to instruction.

Indicators of Evidence

- Teacher materials describe the assessment system and approach to assessment used in the materials.
- Materials include unit-level assessments or assessments at the learning experience level that are aligned to Maryland's three-dimensional learning targets by grade, grade band, or course.
- Materials provide unit-level assessments or assessments at the learning experience level that elicit evidence of learning through the use of the three dimensions (DCIs, SEPs and CCCs) to figure out phenomena and solve problems.
- Materials provide guidance, resources, multiple opportunities, and formats to assess learning in groups or individually to support and maintain progress toward figuring out phenomena and solving problems.

Key Definitions:

- None

How to Gather Evidence:

- Review teacher materials for information about the approach to assessment.
- Review teacher materials for a description of the assessment system.
- Verify that the approach to assessment and the assessment system is consistent with the instructional model and supports students' engagement in three-dimensional phenomenon- or problem- driven learning.
- Review teacher materials for alignment of assessments with appropriate grade-level or grade band learning targets.
- Verify that the assessments in the student materials measure the identified learning targets and in the context of phenomena or problems.

Examples of Evidence:

See K-12 Progressions, Three-Dimensional Performance Progress Monitoring, Meaningful Feedback, and Program Coherence for related indicators or evidence for Assessment Coherence.

- The assessment system and approach to assessment are described in teacher background information.
- The assessment system articulates the three-dimensional learning targets for each assessment and that are consistent with Maryland's science performance expectations.
- The complexity of formative assessments build over time and are integrated into the instructional model.

Red Flags:

- The teacher materials provide limited information about the assessment system.
- The assessment system focuses primarily on one- or two- dimensional performances.
- The assessment system has gaps in three-dimensional learning targets across grade, grade bands, or in courses such that users lack confidence that students will do well on large-scale state assessments designed based on Maryland's science performance expectations.

Designed to Affirm Students

DOMAIN 1: CULTURALLY RESPONSIVE-SUSTAINING INSTRUCTION[16]

AFFIRMATION AND CENTERING OF STUDENTS

Instructional materials are designed to encourage students to anchor learning in their individual experiences, backgrounds, and cultural knowledge to support and further their scientific knowledge and skills. These materials include all of the following elements:

a. regular opportunities for students to share who they are and what they know, bringing their unique funds of knowledge to their science experiences;[17]

b. reflection and conversation within the context of the text or topic under study that affirm students' identities and experiences; and

c. authentic and meaningful activities (e.g., scenarios, investigations, tasks) that reflect both the authenticity of the discipline (i.e., how science is done in a variety of real-world contexts) and authenticity to students' lived experiences.

Indicators of Evidence

- Materials provide regular opportunities for students to share who they are and what they know, bringing their unique funds of knowledge to their learning experiences.
- Materials support student reflection and conversation within the context of figuring out phenomena or solving problems that affirm their identities and experiences.
- Materials provide authentic and meaningful activities (e.g., scenarios, investigations, tasks) that reflect both the authenticity of the discipline (i.e., how science is done in a variety of real-world contexts) and are authentic to students' lived experiences.

Key Definitions:

- **Cultural knowledge:** shared customs, practices, beliefs, histories, and languages of a particular group or society
- **Funds of knowledge:** people are competent and have knowledge, and their life experiences have given them that knowledge

[16] This conceptualization of culturally responsive-sustaining instruction is built on the evidence from its predecessors— culturally relevant, responsive, and sustaining pedagogies. This scholarship underscores the importance of leveraging the diverse backgrounds of students as assets in the classroom that can and should be sustained through intentional instructional design. For more information about relevant scholarship, please see the citations section in the Appendix

[17] Moll, L. C., Amanti, C., Neff, D., & González, N. (1992). Funds of knowledge for teaching: Using a qualitative approach to connect homes and classrooms. Theory Into Practice, 31(2), 132–141.

How to Gather Evidence:

- Review grade or course and unit overviews for commitment to representing diverse student voices, perspectives, and experiences with an alignment to those principles throughout the curriculum.
- Review units and lessons for learning experiences that leverage the cultural assets of students and acknowledge their value.
- Review units and lessons for opportunities that encourage students to reflect on and share their personal experiences, backgrounds, and cultural knowledge that are related to a phenomenon or problem.

Examples of Evidence:

- Learning experiences invite students to actively share and integrate personal stories, experiences, and culturally authentic perspectives related to phenomena and problems.
- Students' connections to the phenomena or problems are amplified through instruction (e.g., anchor charts or group discussions) that highlight and build upon students' personal connections and lived experiences.
- **Grades 6-12**: Learning experiences require connecting students' personal experiences and ideas to broader society issues and/or oppressive systems. (Grades K-5 do this with support.)
- End of unit tasks ask students to leverage their cultural and linguistic knowledge alongside the three-dimensional knowledge they have built over a period of study.
- Prompts and activities include considerations for the historical and cultural context of students' identities (e.g., conversation norms around potentially controversial and/or sensitive topics, teacher framing, identifying potential stereotypes, misconceptions, or biases that may arise).

Red Flags:

- Tasks and prompts related to student reflection rarely connect explicitly to students' cultural identities.
- The lens of a single, dominant perspective is used to present scientific discoveries or advances led by historically marginalized groups.

SCIENCE AS A TOOL FOR CIVIC ENGAGEMENT

Instructional materials consistently include phenomena and tasks that prompt students to apply and develop their civic engagement skills and examine social context and current events, using science to question the world and the current status quo.

Indicators of Evidence

- Materials provide opportunities for students to connect their scientific knowledge and practices with societal issues in their communities.
- Materials use science phenomena or problems that connect to social issues and provide students with opportunities to consider potential impact on their communities.
- Materials provide opportunities for students to connect phenomena or problems to their own experiences, their community, or culture.
- Materials provide opportunities for critically examining proposed explanations, models and solutions for influence, bias, and diversity of perspectives and for considering whose voice is elevated and whose is absent.
- Materials provide opportunities for students to take action in their communities.

Key Definitions:

- **Civic engagement:** active participation in communities, society, and government for the betterment of the collective[18]

How to Gather Evidence:

- Review units and lessons for opportunities that prompt and support students applying and developing their three-dimensional learning and problem-solving skills through civic engagement.
- Review units and lessons for opportunities to identify and reflect on the perspective of the author or content.
- Review units and lessons for resources and instruction that provide additional historical and social context for the phenomenon or problem.
- Review units and lessons for resources and instruction that provide supports for students to take action in their communities.

[18] CAST. (2024). Universal design for learning guidelines, version 3.0, consideration 7.2: Optimize relevance, value, and authenticity. https://udlguidelines.cast.org/engagement/interests-identities/relevance-value-authenticity/

Examples of Evidence:

- Units and lessons include opportunities for students to read, analyze, and discuss graphs, models, diagrams, and other scientific texts that provide additional context for the phenomenon or problem.
- Writing and discussion prompts create opportunities for students to reflect, question, and discuss considerations for whose voices are elevated, whose are marginalized or absent, and why.14
- Instructional and supplemental resources (e.g., videos, articles, primary sources) provide adequate historical, social, or cultural context to enrich students' understanding.
- Learning experiences include opportunities for students to utilize knowledge from their communities to figure out phenomena or solve problems.

Red Flags:

- Limited opportunities to acknowledge community histories, interests, or expertise.
- Inaccurate or misleading historical facts and social contexts that can lead to misguided interpretations and harmful assumptions or stereotypes (e.g., downplaying the contributions, achievements, or hardships of historically marginalized groups of people).

REAL-WORLD CONNECTIONS

Instructional materials consistently connect with students' lives, their future goals, their communities, and the world and nurture ways to engage in their own communities and beyond. These materials include all of the following elements:

- **a.** use of phenomena and tasks to connect to current events;
- **b.** collaborative tasks and/or projects that involve real-world problem-solving through meaningful interactions with peers and their local communities;
- **c.** structures (e.g., tasks, classroom activities, routines, assignments) to explore phenomena from current events and data that are relevant to students' lives and communities so that students see themselves in the tasks and understand how they relate to their context and promote a sense of belonging;[19]
- **d.** opportunities for students to reflect on how science phenomena, problems, and activities affect themselves, their families, and their communities and how their specific communities might shape the phenomena/problems/activities; and
- **e.** teacher guidance to support students in developing SEPs and disciplinary knowledge that are relevant to their academic and professional goals.

Indicators of Evidence

- Materials use phenomena and tasks to connect to current events.
- Materials provide collaborative tasks and/or projects that involve real-world problem-solving through meaningful interactions with peers and/or their local communities.
- Materials provide structures (e.g., tasks, classroom activities, routines, assignments) to explore phenomena from current events and data that are relevant to students' lives and communities so that students see themselves in the tasks and understand how they relate to their context and promote a sense of belonging.
- Materials offer opportunities for students to reflect on how phenomena and problems affect themselves, their families, and their communities and how their specific communities might influence the phenomena or problems.
- Teacher materials provide teacher guidance to support students in developing SEPs, DCIs, and CCCs that are relevant to their academic and professional goals.

Key Definitions:

- **Real-world problem-solving:** identifying, analyzing, and resolving authentic problems students encounter in their daily lives and applying critical thinking in the context of their experiences

[19] Tate, W. F. (1995). Returning to the root: A culturally relevant approach to mathematics pedagogy. Theory Into Practice, 34(3), 166–173.

How to Gather Evidence:

- Review for units, lessons, and resources that enable students to make connections to phenomena and/or problems in their lives, interests, and experiences.
- Review units and lessons for collaborative tasks and/or projects that involve real-world problem-solving through meaningful interactions with peers and their local communities.
- Review units and lessons for opportunities to explore phenomena from current events and data that are relevant to students' lives and communities.
- Review learning experiences for opportunities for students to reflect on how science phenomena and problems affect themselves, their families, and their communities and how their specific communities might shape the phenomena or problems.
- Review teacher materials for guidance on how to support students in developing the appropriate elements of the SEPs, DCIs, and CCCs that are relevant to their academic and professional goals.

Examples of Evidence:

See Authentic Engagement as a Scientist, Relevant Contexts, Students' Linguistic and Cultural Assets, Related and Alternative Phenomena, and Surfacing Student Experiences for related indicators or evidence for Real-World Connections.

- Learning experiences engage students in problem-solving activities that involve connections and contributions to positive change, equity, and justice in their communities and society (e.g., letters to leaders, presentations to their community, researching local issues).
- Guidance for teachers to make direct local connections to the phenomenon or problem within learning experiences (e.g., organizations to research or websites to review, data sets or models to contextualize in your community, additional resources to gather).
- Learning experiences offer opportunities for students to navigate aspirations for their future endeavors and establish relevance and meaningful connections between their academic and personal goals, including codifying their generational strengths and ways of knowing (e.g., passions, careers, continued study).[20]
- **Grades 6-12**: Opportunities to identify and reflect on postsecondary goals related to the texts and topics under study.

[20] CAST. (2024). Universal design for learning guidelines, version 3.0, consideration 6.1: Set meaningful goals. https://udlguidelines.cast.org/action-expression/strategy-development/goals/

Red Flags:

- Units and learning experiences are disconnected from students' personal and cultural experiences, interests, and aspirations.
- Materials provide superficial connections to current context and events that impact students' lives, communities, and the world (e.g., avoidance of acknowledging or analyzing lasting impact of historical events and outdated social structure and practices, focus on national advancements without acknowledging the cost of harm inflicted on historically marginalized groups as well as cultural and linguistic erasures).
- Insufficient flexibility and adaptability in instructional design to support diverse interests, strengths, needs, and personalization of students' lived experiences (e.g., phenomena or problems are overly narrow and limiting).

DOMAIN 2: LANGUAGE AFFIIRMING INSTRUCTION

MULTILINGUALISM IN SCIENCE

Instructional materials are deliberately designed to honor and build upon students' language(s) as an asset, encouraging students to use their linguistic repertoire to communicate with one another via reading, writing, speaking, and listening while engaging in scientific learning. These materials include all of the following elements:[21]

- **a.** promoting sustained oral and written communication, including explicit encouragement to use a range of language practices and registers and to use their full language repertoire through translanguaging so all students express themselves in a language they are comfortable with while working to learn science content and meet language objectives in the target language;[22]
- **b.** building vocabulary and understanding of new concepts in English and home language(s), including use of social and academic vocabulary;
- **c.** making cross-linguistic connections, including identifying and comparing similarities and differences between home language(s) and English (e.g., cognates) or registers and registers of instruction;
- **d.** stating clear and specific integrated three-dimensional goals that emphasize the ways students use language for learning and communicating meaning in science;
- **e.** introducing students to new language after students have developed conceptual understanding so they can understand and communicate science ideas.
- **f.** making the purpose of using language to communicate about phenomena clear to students and teachers;
- **g.** offering ongoing discussion opportunities for students to listen actively, express, revisit, and refine their three-dimensional understanding and language over time; and
- **h.** offering ongoing opportunities for students to revisit and refine their three-dimensional understanding and language over time through reading, viewing, writing, and representing.

Indicators of Evidence

- Materials promote sustained oral and written communication, including explicit encouragement to use a range of language practices and registers and to use their full language repertoire through translanguaging so all students express themselves in a language they are comfortable with while making sense of phenomena or solving problems through three-dimensional science learning and meeting language objectives in the target language.
- Materials support students in building vocabulary and understanding of new concepts in English and home language(s), including use of social and academic vocabulary.

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[21] García, O., Johnson, S. I., & Seltzer, K. (2017). The translanguaging classroom: Leveraging student bilingualism for learning. Caslon. For more, see Translanguaging Strategies, English Learner Success Forum.

[22] English Learners Success Forum. (n.d.). Translanguaging strategies. https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/5cca8e1dbfa8f118e41c578a_Translanguaging%20Strategies%20ELA.pdf

- Materials support students in making cross-linguistic connections, including identifying and comparing similarities and differences between home language(s) and English (e.g., cognates) or registers and registers of instruction.
- Materials state clear and specific integrated three-dimensional goals that emphasize the ways students use language for learning and communicating meaning in science.
- Materials introduce students to new language after students have developed conceptual understanding so they can understand and communicate science ideas.
- Materials make the purpose of using language to communicate about phenomena clear to students and teachers.
- Materials offer ongoing discussion opportunities for students to listen actively, express, revisit, and refine their three-dimensional understanding and language over time.
- Materials offer ongoing opportunities for students to revisit and refine their three-dimensional understanding and language over time through reading, viewing, writing, and representing.

Key Definitions:

- **Linguistic repertoire:** full range of linguistic abilities and resources that students possess and can draw upon during their learning experience, including all the vocabulary, syntax, and ways of speaking across languages
- **Translanguaging:** practice of using multiple languages flexibly and strategically for fluid communication, which includes use of students' home language(s) and their full linguistic repertoire
- **Home language:** language(s) that students use most frequently and comfortably in their everyday life, often the language they acquired first and use most often for communication
- **Registers:** the different ways speakers use language in different contexts

How to Gather Evidence:

- Review grade or course and unit overviews for commitment to building upon students' multilingualism with an alignment to those principles throughout the curriculum.
- Review unit overviews and lessons for naming of explicit opportunities for vocabulary development through multilingualism in literacy, including opportunities for sustained oral and written communication.
- Review lesson objectives and instructional strategies for explicit translanguaging opportunities and elevating cross-linguistic connections.
- Assess the overall quality of texts, student-facing resources, and supplemental materials and whether these materials include home language(s) and authentic translations.

Examples of Evidence:

- Learning experiences and tasks create opportunities for students to draw on and make use of their existing language resources (e.g., home language(s), everyday language, gestures) to fluidly demonstrate understanding and learning.[23]
- Opportunities for students to explore vocabulary and linguistic structures used as part of three-dimensional sensemaking around a phenomenon or problem, including social and academic language, and make connections to words in their home language(s) (e.g., word walls, word banks, vocabulary list with visuals for context, tiered vocabulary words, cognates).[24] [25]
- Instructional materials include opportunities for exploration of different languages and dialects to foster positive attitudes, beliefs, and perceptions about multilingualism and language learning (e.g., translated texts, non-English videos with English captions, collect and display all language used to make sense of phenomena, students learning from each other's languages, celebration of linguistic abilities).[26]
- Instructional materials and resources identify similarities and differences between students' home language(s) and the target language (e.g., comparing the way language is used across languages, identifying word and word part similarities and differences through contrastive analysis).
- **Grades K-1**: Utilizing students' full range of language resources when writing or representing their ideas (e.g., gestures, drawings), may include supports in multiple languages (e.g., anchor charts, word walls, dictation) to support student communication.

Red Flags:

- Instructional materials assume monolingual English students, with no attention to students' diverse language assets or goals.
- Identified cognates are not critical to understanding the phenomenon/content objectives.
- Cross-linguistic connections are identified without educator supports for where or how to meaningfully leverage these connections within instruction (e.g., cognate box at the beginning of the learning experience without attention in speaking and writing activities).
- Learning experiences, texts, and tasks perpetuate myths, misconceptions, and biases that equate the English language to intelligence or academic capabilities (e.g., implicit or explicit suggestions that scientists must communicate in academic English).

[23] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners (Area of Focus III: Assessment for Science and Language Learning). https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

[24] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners (Area of Focus V: Metalinguistic and Metacognitive Awareness). https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

[25] CAST. (2024). Universal design for learning guidelines, version 3.0, consideration 2.4: Cultivate understanding and respect across languages and dialects. https://udlguidelines.cast.org/representation/language-symbols/languages-dialects/

[26] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners (Area of Focus V: Metalinguistic and Metacognitive Awareness). https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

- Vocabulary is taught without contextual reference for meaning-making or sufficient opportunities for language acquisition and application (e.g., pre-teaching domain-specific vocabulary, sharing word and definition and asking students to orally repeat).
- Instructional materials, texts, and resources incorporate home language(s) only as a resource to understand the target language, instead of leveraging and placing value on home language(s) as part of science sensemaking.
- Teacher guidance and support resources overlook the ways home language(s) other than English supports comprehension and production in English.
- Vocabulary is taught without contextual reference for meaning-making or sufficient opportunities for language acquisition and application (e.g., pre-teaching domain-specific vocabulary, sharing word and definition and asking students to orally repeat).
- Instructional materials, texts, and resources incorporate home language(s) only as a resource to understand the target language, instead of leveraging and placing value on home language(s) as part of science sensemaking.[27]
- Teacher guidance and support resources overlook the ways home language(s) other than English supports comprehension and production in English.

[27] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners (Area of Focus II: Leveraging Student's Assets). https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

LANGUAGE OBJECTIVES

Instructional materials provide explicit alignment between language and content objectives to ensure that the language goals embedded within the standards are being attended to in every lesson. This includes language objectives for both expressive (writing and speaking) and receptive (listening and reading) communication that are aligned to the science performance expectations.

Indicators of Evidence

- Materials provide language objectives that are specific to the phenomena or problems under study and include the target language skill (speaking, listening, reading, and writing), the communicative purpose, and the three-dimensional science learning expectation.
- Materials include language objectives to develop language intentionally and in tandem with the science learning over the course of a unit (moving from simpler to more complex language, moving towards increasingly precise and complex use of language, culminating in an opportunity to demonstrate language).
- Teacher materials suggest instructional approaches for language development that leverage language goals and language-based supports to meet three-dimensional grade-level science learning goals in the context of making sense of phenomena and designing solutions.

Key Definitions:

- **Language objectives:** specific instructional goals that outline the language targets (speaking, listening, reading, and writing) that support meaning-making and communication in science

How to Gather Evidence:

- Look for language objectives that are specific to the phenomena and/or problems under study and coherently build increasingly complex language over time.
- Review units for instructional strategies, learning experiences, and tasks that elicit expressive (writing and speaking) and receptive (listening and reading) communication skills.
- Examine materials for language objectives embedded in three-dimensional learning experiences that are core to sensemaking and include clear and consistent references to the application of language skills (e.g., reading, writing, speaking, and listening) in the context of doing science.

Examples of Evidence:

- Language objectives are specific to the phenomenon and/or problem under study and include the target language skill (speaking, listening, reading, and writing), the communicative purpose, and the three-dimensional content.
- Language objectives develop language intentionally over the course of a unit by moving from simpler to more complex language; moving towards increasingly precise and complex use of language; and culminating in an opportunity to demonstrate language.
- Language development instruction leverages a phenomenon or problem, language goals, and language-based supports that are directly applicable to core instruction.

Red Flags:

- Language objectives do not connect from learning experience to learning experience to intentionally build students' language.
- Language objectives reduce the rigor of tasks and what students are learning.
- Instructional materials and objectives lack explicit language to specify how language objectives for expressive (writing and speaking) and receptive (reading and listening) communication are aligned to learning experiences to make sense of phenomena and problems.
- Language objectives are only included for some types of activities (e.g., for writing but not for speaking).

PHENOMENA/TEXT SELECTION TO SUPPORT LANGUAGE DEVELOPMENT

Instructional materials use texts that have all of the following elements:

- authentic language;
- rich vocabulary and syntax;
- content that is written in home languages, when possible, and is high-quality (e.g., not poor-quality translations); and
- formats that support meaning-making and language development (e.g., text engineering) and examine social contexts and current events, using science to question the world and the current status quo.

Indicators of Evidence

- Materials provide authentic opportunities to read, listen to, and view texts that are rich in vocabulary and syntax in service of making sense of phenomena and solving problems.
- Texts include varied use of language that increases in complexity and precision as students develop conceptual understanding across the unit.
- Texts are formatted in ways that support sensemaking and language development (e.g., include additional explanations, context, annotations, relevant illustrations or visuals, text chunking, text cognates, nominalization, multiple-meaning words, or vocabulary supports in home languages).
- Texts and resources include high-quality translations that accurately capture the meaning, tone, and nuances of the original text to support students' comprehension.

Key Definitions:

- **Texts:** student-facing resources found within materials that convey information for student use. Texts can be written, spoken or visual (e.g., articles, infographics, videos, audio files, etc.)
- **Authentic language:** real, natural language in materials (including literature, articles, videos, and other media) that reflect linguistic structures and contemporary use of vocabulary that are characteristic of the language used by native speakers in real-world situations

How to Gather Evidence:

- Examine the selection of texts and resources for natural language (e.g., dialogue, descriptions, articles related to the phenomena, problems, content, and purpose in which the language is used) and rich, complex vocabulary and sentence structures.
- Look for texts (e.g., articles, diagrams, representations, videos, audio files) in languages other than English and assess the quality of these texts (e.g., authenticity and complexity of language, strong relationship to content of core instruction).
- Evaluate how text formats (e.g., graphic organizers, layout, multimedia integration) support comprehension and engagement with language development.

Examples of Evidence:

- Texts, topics, and resources include varied use of language, dialogues, and expressions while supporting cultural references and context for real-world communication.
- Instructional materials, texts, and resources provide additional explanations, context, formatting, or support for language development (e.g., annotations, relevant illustrations or visuals, insets, text chunking, text cognates or vocabulary supports in home languages).[28]
- Texts and resources include high-quality translations that accurately capture the meaning, tone, and nuances of the original content to support students' comprehension and learning.

Red Flags:

- Translated texts' low quality hinder potential for use as a scaffold for reading in English or to make cross linguistic connections (e.g., inaccurate; misrepresent the meaning, context, or representation of original work).
- Translated texts do not connect to what students are reading in English.
- Texts are repetitive and use simplistic language structures, expressions, and vocabulary that do not expand students' language proficiency.

[28] CAST. (2024). Universal design for learning guidelines, version 3.0, consideration 2.1: Clarify vocabulary, symbols, and language structures. https://udlguidelines.cast.org/representation/language-symbols/vocabulary-symbols-structure/

Instructional Design

DOMAIN 1: STUDENT AGENCY

METACOGNITIVE PROCESSES

Instructional materials develop and surface students' metacognition by teaching and supporting students to monitor understanding while engaging in science learning. These materials include all of the following elements:

- **a.** setting goals, self-monitoring growth, and reflecting on the impact of students' choices and ongoing development as scientists and engineers;
- **b.** providing opportunities for students to think about how language is used in science for sensemaking, expression of complex relationships, describing phenomenon and problems;
- **c.** providing opportunities to revisit student models, explanations, and designs as part of the process of intentional reflection; and
- **d.** providing strategies to help students understand the relationship between the three dimensions and the variety of language used (e.g., everyday, science specific, home language).[29]

Indicators of Evidence

- Materials provide opportunities and support for students to set goals, self-monitor their growth, and reflect on the impact of their choices in their ongoing development as scientists and engineers.
- Materials provide opportunities for students to think about how the science and engineering practices and crosscutting concepts contribute to sensemaking, figuring out relationships, and describing or explaining phenomena and solving problems.
- Materials provide opportunities for students to think about how language is used in science for sensemaking, expression of complex relationships, and describing or explaining phenomena and solving problems.
- Materials provide students with supports to express their ideas in different ways.
- Materials provide students with supports to evaluate their use of different ways of expressing their learning in order to strengthen their communication of ideas.
- Materials provide opportunities for students to revisit and revise their models, explanations, and designs as part of the process of intentional reflection.
- Materials provide strategies to help students understand the relationship between the three dimensions (SEPs, DCIs, CCCs)[30] and the variety of language used (e.g., everyday, science specific, home language).

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[29] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

[30] National Research Council. 2012. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Washington, DC: The National Academies Press.* https://doi.org/10.17226/13165

Key Definitions:

- **Metacognition:** the ability to self-monitor, self-assess and self-reflect when planning and participating in learning experiences
- **Science learning:** a process by which students "do science" to figure out phenomena and solve problems using the SEPs, DCIs, and CCCs

How to Gather Evidence:

- Review units and lessons for questions by and for students.
- Review units and lessons for opportunities to share thinking in words, models, pictures, symbols, and drawings.
- Review units and lessons for opportunities for students to summarize, make revisions, and connect to prior learning.
- Review units and lessons for questions by and for students so each student can make productive contributions to classroom discourse in a variety of ways for sensemaking as an individual, with peers and the teacher.
- Review units and lessons and supporting resources for opportunities to guide students to organize their thoughts and monitor their understanding.
- Review units and lessons for metacognitive process supports through teacher modeling and student goal-setting cycles.

Examples of Evidence:

See Choice and Voice for related indicators or evidence for Metacognition.

- Guidance and/or suggestions within units and lessons to model and support students' use of metacognitive processes, such as self-questioning, summarizing, or clarifying within the context of the phenomena or problem.
- Guidance includes culturally responsive metacognitive strategies — such as oral reflection, storytelling, and collaborative reasoning, which may align with the strengths of students from non-dominant cultural backgrounds.
- Materials provide prompts for reflection on how the way they describe or explain a phenomena or problem becomes more precise or meaningful with multiple opportunities to discuss and revise individually, with peers, and with teachers.
- Resources within lessons and across units (e.g., model trackers, reflection prompts, formative assessments) guide and support students in organizing their ideas and monitoring their understanding.

- Guidance within lessons to model and provide explicit instruction on cognitive processes to solve problems, regulate attention, organize thoughts and materials, and monitor one's own thinking[31] (e.g., think-alouds to model the selection and organization of materials to answer a science question, modeling thought processes to decide how and where to focus attention when collecting data, explicit instruction to monitor how one's own thinking changes with new evidence).
- Students use illustrations and models to examine, analyze, interpret, and consider their connections to the phenomena or problem and reflect on how the illustrations and models contributed to their science learning (or not).
- Students use models, rubrics, and other reflection tools to support sensemaking individually, with peers, and with teachers.
- **Grades K-2**: Teacher materials provide prompts that support student metacognitive processes (e.g., guidance for collaboratively constructing an ongoing public record using words and images to keep track of what they have figured out and how their ideas have changed over time)..

Red Flags:

- Self-monitoring processes are suggested or modeled by the teacher without connections to authentic student reflection, application, and ownership (e.g., focus on teacher-driven feedback and not student reflection; "Watch me as I…").
- Materials rely heavily on passive learning rather than encouraging active engagement (e.g., worksheets based on rote memorization do not lend themselves to developing metacognitive processes).
- Materials miss opportunities to promote the development of metacognitive processes including goal setting and monitoring progress.
- Materials promote sensemaking interactions with teachers and miss opportunities to promote sensemaking interactions with peers.
- **Grades K-5**: Students read about science with limited opportunities for being metacognitive. Students do not "do science."
- Opportunities to self-monitor are not connected to the three dimensions (SEPs, DCIs, CCCs), making sense of phenomena, or solving problems (e.g., self-assessment on writing skills without intentional student focus on science practices such as constructing explanations or solving problems, arguing from evidence).

[31] High-Leverage Practices for Students with Disabilities. (2024, December 30). The structure (4 domains/22 HLPs). Council for Exceptional Children. https://highleveragepractices.org/structure-4-domains-22-hlps

CHOICE AND VOICE

Instructional materials include a balance of student-choice and teacher-defined tasks and offer a variety of phenomena/problems that support student choice and leverage students' approaches to sensemaking.

Indicators of Evidence

- Learning experiences invite students to pose their own questions in service of describing or explaining a phenomenon or solving a problem.
- Learning experiences support students in pursuing investigations based on their own questions in order to describe or explain a phenomenon or solve a problem.
- Learning experiences invite students to monitor their progress toward answering their own questions related to phenomena or problems.
- Materials provide students with opportunities to identify related phenomena or problems based on experiences, communities and cultures and connect them to the existing phenomena and problems.
- Materials provide students with opportunities for them to choose how to express their ideas to make sense of phenomena and solve problems in ways that best reflect their strengths as learners and their understanding of the three dimensions (SEPs, DCIs, CCCs).
- Materials provide opportunities and supports for the provision and use of peer feedback focused on explanations, models, and designs.

Key Definitions:

- None

How to Gather Evidence:

- Review units and lessons for prompts and tasks that provide opportunities for student choice, feedback, and reflection.
- Review units and lessons for related phenomena and problems that center students' experiences, interests, cultures, and communities while retaining connections to the existing phenomena or problem.
- Review assessments across units and grade levels to identify opportunities for students to choose ways to demonstrate and monitor learning individually and with peers.

Examples of Evidence:

See Phenomenon- or Problem-Driven Learning, Affirmation and Centering of Students, and Metacognitive Processes for related indicators or evidence for Choice and Voice.

- Clear unit and lesson-embedded guidance, prompts and notes so students can pose their own questions, identify related phenomena and problems, and make connections to their personal experiences, communities, and cultures to support sense making.
- Tools and resources within lessons and units that provide examples, exemplars, and guidance for students to develop, create, revise, and share their ideas in multiple formats based on their needs, strengths, and interests to support sensemaking.

- **Grades K-2**: Teacher materials provide guidance on how to offer students choice in posing questions, considering local phenomena or problems, pursuing investigations or solving problems, and monitoring their progress.

Red Flags:

- Teacher guidance limits or eliminates student's opportunities to make choices and voice their ideas and explanations particularly as it relates to their experiences, interests, cultures, and communities.
- Opportunities for student choice interfere with students' ability to engage with grade-level learning experiences focused on figuring out a phenomenon or solving a problem.
- Opportunities for student choice are focused solely on the DCIs without use of the SEPs and CCCs.
- Choice opportunities are framed as "extension" work and not a part of regular instruction.
- **Grades K-2**: Teachers are the primary source of questions to investigate.

AUTHENTIC ENGAGEMENT AS A SCIENTIST

Instructional materials promote productive struggle and the sensemaking process through engaging, relevant phenomena that are sequenced to build conceptual understanding of DCIs, concepts, and practices; provide opportunities to take risks; allow for iterative building of knowledge and multiple approaches; and use misconceptions as opportunities for entry points for learning.

Indicators of Evidence

- Learning experiences are designed and sequenced for students to figure out phenomena or solve problems using the DCIs, crosscutting concepts, and science and engineering practices in ways that promote authentic engagement as scientists.
- Materials provide opportunities within and across lessons for students to use their ideas and questions in a sequence that builds overtime (i.e., prior conceptions, common ideas, science ideas, misconceptions) and abilities as entry points for learning.
- Learning experiences provide a variety of approaches for students to figure out phenomena and solve problems to build knowledge by revisiting and revising their ideas based on empirical evidence identified or collected within the unit or lesson.
- Phenomena- and/or problem-based investigations, models, explanations, arguments, and designs developed by students become more complex over time through an iterative process of individual and group sensemaking.
- Materials provide opportunities for students to make sense of the nature of science and make connections to how their learning experiences are aligned to ways scientists think and work.
- Materials provide opportunities for students to engage in public reasoning as part of collaborative sensemaking.
- Materials normalize mistake-making and learning from one's mistakes.

Key Definitions:

- **Misconceptions:** an idea that is scientifically inaccurate and could be rooted in experiences, beliefs, or a limited understanding of the concept; *note, the Rubric and Companion Guide refer to common student ideas which include misconceptions, naive conceptions, or incomplete ideas*

How to Gather Evidence:

- Review the grade or course scope and sequence for understanding of how units are organized and connected to each other within and between years.
- Review the unit overview and lessons for identification of the presence of explicit teacher guidance about connections to past or future content within the same grade and across grades.
- Review units and lessons for tasks that ask students to identify, connect, and build upon knowledge from previous lessons, units, or grades/courses.

Examples of Evidence:

See Phenomenon- or Problem-Driven Learning, Collaborative Learning, and Meaningful Feedback for related indicators or evidence for Authentic Engagement as a Scientist.

- The materials contain teacher guidance with strategies and routines that draw out individual and whole class student ideas that are used in sensemaking of the phenomenon or problem.
- Units and lessons contain supports for classroom discourse that includes resources, strategies, and routines for explicitly expressing and clarifying student reasoning that is iterative and increases in complexity over time in the context of authentic engagement as a scientist.
- Units and lessons have embedded strategies and routines to support students in sharing their ideas with peers and using what is shared to reconsider their own ideas in the context of authentic engagement as a scientist.

Red Flags:

- Focusing on the SEPs as skills without the requisite use of phenomena or problems and the other dimensions (DCIs and CCCs).
- Focusing on DCIs as "science content" without the requisite use of phenomena or problems and the other dimensions (SEPs and CCCs).
- Materials pose questions with only one right answer or based on rote memorization of facts limiting the students' abilities to develop explanations and solutions supported by evidence-based arguments and reasoning.
- Materials provide pre-planned outcomes for investigations, instead of being driven by student questions with a range of possible outcomes that lead to a deeper understanding of science ideas.
- Materials treat science as canonical knowledge without emphasizing authentic engagement as a scientist.
- **Grades K-2**: Students read about science, but do not get opportunities to "do science."

COLLABORATIVE LEARNING

Instructional materials engage all students in collaborative learning through a variety of routines, structures, and tasks that allow for whole-group, small-group, and independent thinking. Materials explicitly plan for students to demonstrate their curiosity and share their tentative thinking; ask questions; and adjust their understanding by building on one another's ideas through speaking, listening, reading, and writing using the three dimensions (SEPs, DCIs, CCCs).

Indicators of Evidence

- Materials provide opportunities for student collaboration to promote making sense of the phenomenon or problem.
- Materials provide opportunities for student-to-student discourse that include clear discussion structures matched to the purpose of the discussion, prompts, and supports for making sense of the phenomenon/problem (e.g., slides, protocols, anchor charts).
- Materials provide opportunities for students to interact with peers and then revisit their thinking to help them monitor their progress over the course of lessons and across units.
- Materials provide opportunities for student collaboration that include structures to hear, see, and consider ideas shared by their peers.
- Materials provide opportunities for student collaboration that promote public reasoning and authentic engagement as a scientist.

Key Definitions:

- **Collaborative learning:** students working together to learn in small groups and whole class using strategies, routines, and co-developed norms

How to Gather Evidence:

- Review units and lessons for opportunities for students to learn collaboratively through strategies and routines that use the three dimensions (DCIs, SEPs and CCCs) in service of figuring out phenomena, solving problems, and reasoning publicly.
- Review teacher guidance for explicit support and unit or lesson-embedded structures to facilitate collaborative learning and encourage the sharing of ideas (e.g., common ideas, misconceptions, prior knowledge) individually, in small groups and whole class.
- Review teacher guidance for explicit support and unit or lesson-embedded structures to facilitate collaborative learning and encourage the sharing of ideas through reading, writing, speaking, and listening.
- Review introductory lessons in the program for explicit instruction on use of learning routines and structures that promote collaborative sensemaking and later lessons for student opportunities for metacognition–to reflect on their attention to routines and how collaboration influences their learning.

Examples of Evidence:

See Authentic Engagement as a Scientist for related indicators or evidence for Collaborative Learning.

- Frequent opportunities for student collaboration that include a variety of structures and regularly used routines to support figuring out phenomena and solving problems (e.g., frequent partner discussions, revisiting the driving question board, notice and wonder charts, and models).
- Slides or protocols provide students with ongoing opportunities for sensemaking and discourse that include clear discussion structures, prompts, student roles, and resources, such as revisiting anchor charts, for collaborating to figure out phenomena or solve problems.[32]
- Over the course of a unit or lesson, students are prompted to interact with peers and then revisit their ideas by returning to models, explanations, notice and wonder charts, key questions, observations, and/or empirical evidence.
- Students are offered guidance, tools, and/or prompts to interact with each other's ideas as they work towards more complete and sophisticated explanations and/or models.[33]

Red Flags:

- Materials provide limited guidance for supporting student collaborative learning (e.g., "Ask students to discuss in small groups" vs. including guidance on roles, timing, guiding questions, or in-the-moment supports).
- Materials prompt students to interact with one another but miss opportunities for them to develop metacognitive processes through monitoring their progress and/or considering how their work with others influences their science learning.
- Introductory lessons of a program focus on a single dimension or are disconnected from a phenomena or problem (i.e., the first chapter focuses on scientific method or safety).

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[32] CAST. (2024). Universal design for learning guidelines, version 3.0, consideration 8.3: Foster collaboration, interdependence, and collective learning. https://udlguidelines.cast.org/engagement/effort-persistence/collaboration/

[33] CAST. (2024). Universal design for learning guidelines, version 3.0, consideration 8.3: Foster collaboration, interdependence, and collective learning. https://udlguidelines.cast.org/engagement/effort-persistence/collaboration/

DOMAIN 2: MONITORING PROGRESS AND SUPPORTING STUDENTS

K-12 PROGRESSIONS

Instructional materials identify and build on students' prior learning in all three dimensions. These materials include all of the following elements:

- **a.** explicit identification of prior student learning expected for all three dimensions; and
- **b.** clear explanations of how the prior learning will be built upon.

Indicators of Evidence

- Materials support students in accessing and engaging relevant prior knowledge and experience across all three dimensions (SEPs, DCIs, CCCs) explicitly related to that expected from prior grade bands.
- Materials make explicit links to prior learning and experiences in all three dimensions (SEPs, DCIs, CCCs).
- Materials make explicit links to future learning and experiences in all three dimensions (SEPs, DCIs, CCCs).
- Materials provide strategies, routines, or approaches to make student thinking visible.
- Materials support students in monitoring progress toward three-dimensional learning targets in preparation for learning expected in subsequent lessons, units, and grade bands.
- Teacher materials include explicit identification of prior student learning expected for all three dimensions (SEPs, DCIs, CCCs).
- Teacher materials include guidance for how new learning will utilize prior knowledge and uncover and attend to common student ideas across lessons and units.

Key Definitions:

- **Prior knowledge:** ideas students bring to a set of learning experiences and work with throughout a unit as they are figuring out phenomena or solving problems
- **Strategies, routines, or approaches:** grade-level appropriate pedagogical moves that are used consistently throughout a program to support student learning; most likely visible to students

How to Gather Evidence:

- Review teacher materials for each unit or lesson of instruction for
  - learning targets that define expectations for each of the three dimensions (SEPs, DCIs, CCCs);
  - identification of the expected student prior knowledge for each of the three dimensions (SEPs, DCIs, CCCs) and an indication of when that prior knowledge was learned;
  - description of how the learning targets for each of the three dimensions (SEPs, DCIs, CCCs) are connected to subsequent units, grade levels, or grade bands; and
  - description of the intended science content storyline to be developed by students.
- Review teacher materials for a description of the approach the authors take to building on students' prior knowledge.

- Review materials for strategies, routines, or approaches to access and engage students' prior knowledge in each of the three dimensions (SEPs, DCIs, CCCs).
- Review teacher materials for identification of the anticipated range of students' prior knowledge or experience.
- Review teacher materials for anticipated student responses to learning experiences linked to students' prior knowledge and learning targets that move student understanding toward the intended science content storyline.
- Review materials for a unit of instruction for the identification and description of strategies, routines, or approaches to support students in monitoring their progress toward three-dimensional learning targets.
- Review materials for strategies, routines, or approaches that support students in making explicit links of science ideas to other science ideas to learning experiences.

Examples of Evidence:

See Phenomenon- or Problem-Driven Learning, Three-Dimensional Coherence, Instructional Model Coherence, and Program Coherence for related indicators or evidence for K-12 Progressions.

- Teacher materials describe the instructional model used in the design of the program, components of the instructional model (e.g., types and purposes of different kinds of lessons and tasks), and how the instructional model supports students in building on their prior knowledge, sensemaking, and monitoring their progress over time.
- Teacher materials provide a description of how student learning progresses across a unit of instruction. For example, students often begin this unit with the idea that only objects in motion have energy. By investigating changes in motion using the car launcher, a flat track, and a raised track system students figure out the objects may also have potential energy due to position. They represent their understanding by graphing and explaining representations using "energy bars." They use energy bars to show how energy of position is transformed to energy of motion (and vice versa).
- Teacher materials describe the purpose of and how to use strategies, routines, and approaches embedded throughout the materials to make student thinking visible and to support students in constructing the intended science content storyline. For example, they provide step-by-step instructions for how to develop a driving question board and pictures of a driving question board as it is developed and used across lessons.
- Materials identify links between expected learning outcomes to those from previous grade or grade band, earlier unit in the program.
- Teacher materials identify common student ideas relevant to the unit of instruction.
- Teacher materials describe what is *not* expected of student learning in a particular lesson or unit.

Red Flags:

- Materials provide guidance for or refer to accessing students' prior knowledge only at the beginning of a unit of instruction.
- Materials provide guidance or refer to assessing students' prior knowledge, but lack routines, strategies, or approaches to build on their ideas over time.
- Materials include language, representations, and/or models that promote common student ideas.
- Materials utilize a teacher-centered instructional model.
- Materials provide students with explanations of phenomena or solutions to problems.
- Assessments of student progress are inconsistent with intended three-dimensional learning targets.

SUPPORTS AND SCAFFOLDS

Instructional materials are designed to support a variety of student strengths and diverse learning needs in ways that are based in research and do not interfere with their ability to engage with grade-level content. These materials include all of the following elements:

- **a.** guidance on potential individual student needs so that supports, scaffolds, and extensions can be effectively differentiated to support three-dimensional sensemaking;
- **b.** resources that provide acceleration opportunities for students who are not yet proficient in reading, writing, and language grade-level skills;
- **c.** resources that provide extensions for students who have met learning targets to continue growth; and
- **d.** supports and scaffolds that are designed to shift to student independence over time.

Indicators of Evidence

- Materials provide research-based supports and scaffolds for student use that are designed to develop independence by fading over time.
- Materials provide supports and scaffolds for student use that promote the development of more complex models, explanations, arguments, designs, and solutions over time.
- Materials include resources that provide extensions for those students who have met learning targets to continue growth.
- Materials provide reading, writing, and language scaffolds to support each student in grade-level science learning.
- Teacher materials provide guidance for how to differentiate supports, scaffolds, and extensions to support three-dimensional sensemaking based on student needs.
- Teacher materials provide guidance to support students with acceleration opportunities for science concepts and practices when needed so that each student can continue forward with grade-level science content.

Key Definitions:

- **Extensions:** learning experiences designed to challenge students who are exceeding grade-level content and skills or support students who are not yet achieving at grade level
- **Acceleration opportunities:** learning experiences that are designed to keep students moving forward with grade-level science content; supports continued science learning instead of remediation[34]

[34] Learning Forward. (2023). *The Learning Professional* (Vol. 44, No. 3). https://learningforward.org/wp-content/uploads/2023/06/here-we-go-acceleration-keeps-students-moving-forward-how-do-we-do-it.pdf

How to Gather Evidence:

- Review teacher materials for purpose, descriptions, and examples of use of supports and scaffolds that will fade over time to promote student independence.
- Review materials for use of supports and scaffolds and how the use fades over time to promote student independence.
- Review materials for extensions and acceleration opportunities that promote student sensemaking.
- Review materials for reading, writing, and language scaffolds to support each student in grade-level science learning.

Examples of Evidence:

See Three-Dimensional Coherence for related indicators or evidence for Supports and Scaffolds.

- Materials cite the research base (e.g., impact on student learning) for scaffolds and supports.
- Materials provide explicit guidance for teachers to model the use of each scaffold. This may include a partially completed example for students to complete together.
- Materials provide guidance to increase the complexity of the use of some scaffolds consistent with the content or process being developed. For example, the scaffold may increase the emphasis on writing to promote more sophisticated use of the CCC(s) and SEP(s).
- Materials provide guidance for fading the scaffold over time.

Red Flags:

- Materials use the same supports and scaffolds in the same ways over the course of the year.
- Materials use the same supports and scaffolds in the same ways across grade levels and grade bands.
- Scaffolds and supports detract from the use of the science and engineering practices.
- Materials use supports and scaffolds that are inconsistent with science practices. For example, materials prompt students to make a claim and then gather data and/or information as evidence to "prove" the claim.
- Supports and scaffolds are only referenced in teacher materials and are not visible to students.
- Materials utilize below grade level elements of the SEPs or CCCs throughout the program as a way to support students' engagement. Note that some programs may utilize below grade level elements early in the program to support students in developing appropriate grade level elements by the end of the grade level or course.
- **Grades K-5**: Focus primarily on reading with limited engagement in three-dimensional science learning experiences grounded in phenomena or problems.
- **Grades 3-12**: Limited or no lesson-embedded supports for engaging students with grade-level texts; limited or no supplemental resources to specifically support foundational reading, writing, and language skills.
- **Grades 6-12**: Access to extensions are limited because extensions are visible in teacher materials, but not in student materials.

SIMULTANEOUS SCIENCE SENSEMAKING AND LANGUAGE DEVELOPMENT

Instructional materials include intentional language learning opportunities alongside appropriate, research-based supports for multilingual learners and students with diverse learning needs to develop scientific sensemaking and language simultaneously.

Indicators of Evidence

- Materials provide opportunities for students to develop, revisit, and refine their language use in the context of three-dimensional science learning.
- Materials include explicit instruction in reading, writing, speaking, listening, viewing, and representing as students engage in language functions when using science and engineering practices (e.g., describe, compare, explain, argue, etc.).
- Materials embed high-leverage language development supports that align with language patterns and structures needed for scientific sensemaking.
- Materials are designed to develop conceptual understanding before students are introduced to new academic science language.
- Teacher materials explain how opportunities during core learning experiences support the simultaneous development of language and three-dimensional science.

Key Definitions:

- **Language development:** use of language to communicate for specific purposes (e.g., describe, compare, explain, argue, etc.)
- **Language patterns and structures:** recurring language forms (e.g., text structure, sentence structure, words that connect ideas) needed to describe and analyze phenomena across scientific disciplines (e.g., cause and effect, scale, systems, stability, and change, etc.)
- **Conceptual understanding:** learners make sense of evidence and organize ideas to arrive at key concepts in science; may involve the use of home language and translanguaging; moves beyond rote memorization

How to Gather Evidence:

- Review units and lessons for identification of language development supports that meet the language demands and opportunities of three-dimensional science learning experiences and provide access to grade-level work.
- Review units and lessons for instructional strategies that explicitly support student use of key language functions and structures as students engage in use of SEPs and/or CCCs.
- Look across lessons and units to see if and/or how students have opportunities to develop, revisit, and refine their language use in the context of three dimensional science learning over time.

Examples of Evidence:

See Affirmation and Centering of Students and Multilingualism in Science for related indicators or evidence for Simultaneous Science Sensemaking and Language Development.

- Student materials include opportunities for students to read, write, listen, speak, view, and represent for a variety of purposes support simultaneous three-dimensional science and language development (e.g., when synthesizing evidence across lessons, students determine causal relationships and intentionally choose cause-effect language structures to support mechanistic explanations.).
- Explicit language instruction (e.g., sentence construction, text structure, science-specific language forms and functions, multimodal representations like graphs and models) is included in the materials to help students understand how language works in connection to science and engineering practices and crosscutting concepts.
- Embedded scaffolds are included within lessons to support students' scientific reasoning and language skills in the context of making sense of phenomena and designing solutions (e.g., identifying cognates, multiple-meaning words, sentence frames/starters, diagrams, manipulatives).[35] [36]
- Materials provide opportunities to develop conceptual understanding (e.g., through encountering phenomena, connecting to experiences, analyzing data, and engaging in interactive scientific discussions) before students are introduced to new academic science language.[37]
- Teacher materials identify and provide support for language demands and opportunities when doing science (e.g., passive voice, nominalization, technical vocabulary, science-specific language forms and functions, multimodal representations like graphs and models, etc.).[38]
- Teacher materials provide guidance for discourse opportunities that encourage students to use all of their oral language resources while they work collaboratively to develop disciplinary language in science and collaboratively make sense of phenomena and design solutions.

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[35] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners (Area of Focus IV: Supports and Structures for Science and Language Learning). https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

[36] CAST. (2024). Universal design for learning guidelines, version 3.0, consideration 2.1: Clarify vocabulary, symbols, and language structures. https://udlguidelines.cast.org/representation/language-symbols/vocabulary-symbols-structure/

[37] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners (Area of Focus IV: Supports and Structures for Science and Language Learning). https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

[38] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners (Area of Focus IV: Supports and Structures for Science and Language Learning). https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

Red Flags:

- Language supports are treated as add-ons or outside of the context of making sense of a phenomena or designing a solution to a problem (e.g., disconnected language mini-lesson using different content).
- Language supports simplify rather than amplify student language use in science[39] (e.g., provides minimal access to grade-level science content; reduces students' opportunity to use language in a variety of ways).
- Language supports are provided only in teacher materials and are absent from student materials.

[39] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners (Area of Focus IV: Supports and Structures for Science and Language Learning). https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

RELEVANT CONTEXTS

Instructional materials provide contextualized tasks and problems that are relevant to students and their communities and emphasize phenomena and sensemaking that incorporate student and community interests and agency. Instructional materials lift up diverse cultures via asset-oriented narratives.

Indicators of Evidence

- Materials use asset-oriented narratives to lift up diverse cultures in meaningful ways.
- Materials offer opportunities for students to identify and engage with related phenomena or problems, particularly those relevant to them and to their local communities.
- Materials provide opportunities for students to solve community-based problems, emphasizing taking action to build student agency.

Key Definitions:

- **Asset-oriented:** referencing the strengths of a people or culture, rather than focusing on deficits
- **Related phenomena or problems:** related to embedded phenomena and used by students to broaden interest by making connections, asking new questions, and applying learning to a range of events in our world; often identified by students and their communities, related phenomena or problems are used in conjunction with embedded phenomena or problems

How to Gather Evidence:

- Review materials for references to historically marginalized groups of people to determine if text takes an asset-oriented approach and engages students with the references in meaningful ways.
- Review materials for routines or strategies that invite students to identify related phenomena or problems.
- Review materials for routines or strategies that provide students opportunities to revisit and engage with their ideas about related phenomena or problems.
- Review materials for learning experiences that expect students to identify, pose solutions, and take action toward solving community-based problems.

Examples of Evidence:

See Phenomenon- or Problem-Driven Learning and Related and Alternative Phenomenon for related indicators or evidence for Relevant Contexts.

- Materials describe "ways of knowing" used by non-European cultures (e.g., indigenous populations) and provide a learning experience that helps students grapple with the approach.
- Materials describe and support students' use of routines and strategies for students to identify related phenomena or problems.
- Materials prompt students to ask and answer questions about related phenomena or problems.
- Materials prompt students to identify, pose solutions, and take action toward solving community-based problems.

Red Flags:

- Materials offer surface-level references to historically marginalized groups and cultures (e.g., call-out box, picture).
- Materials prompt students to identify related phenomena or problems but never come back to or use student ideas in meaningful ways.
- Materials present phenomena and problems in ways that reinforce a focus on a single, dominant perspective of local and global issues that disproportionately impact historically marginalized groups of people.

THREE-DIMENSIONAL PERFORMANCE PROGRESS MONITORING

Instructional materials embed frequent opportunities to monitor and develop students' progress in scientific sensemaking using the three dimensions and nature of science. These opportunities are fully coherent with instructional design, implying that they reflect students' opportunities to learn, and the same criteria as instructional materials, as appropriate to the scope and nature of the assessment(s). These materials include all of the following elements:

- **a.** consistent multidimensional assessment opportunities that center on making sense of phenomena and addressing problems with the three dimensions and nature of science;
- **b.** embedded and consistent formative assessment practices to surface student understanding and inform instructional decision-making;
- **c.** varied and multiple means of surfacing sensemaking with multiple dimensions that coherently measure and signal what is most valued about student learning in science, including attention to culturally and linguistically responsive practices;
- **d.** routine opportunities to demonstrate understanding at a range of complexity, including simple checks on understanding and more complex performance tasks at appropriate intervals; and
- **e.** routine opportunities to surface data about students' experience and to triangulate this with performance information to inform instruction.

Indicators of Evidence

- Materials provide formative and summative assessment opportunities that center on making sense of phenomena and solving problems using the three dimensions (SEPs, DCIs, CCCs) and nature of science.
- Materials provide opportunities for students to demonstrate understanding of the three-dimensions (SEPs, DCIs, CCCs) with increasing complexity, including simple checks on understanding and more complex performance tasks at appropriate intervals.
- Materials provide formative assessment opportunities to make student thinking visible to students (and teachers).
- Materials provide summative assessment opportunities for students and relevant information to support teachers in monitoring student learning.
- Materials provide opportunities for students to apply their understandings in new contexts (i.e., to related phenomena or problems as transfer tasks).
- Teacher materials provide guidance on how student ideas surfaced through formative assessment practices can be triangulated with student experiences to inform instructional decision-making.
- Teacher materials provide guidance on how to attend to culturally and linguistically responsive practices when monitoring student progress.

Key Definitions:

- **Formative assessment:** assessment opportunities that help students and teachers monitor students' progress toward three-dimensional learning targets and inform next steps for learning for both the teacher and the student
- **Culturally and linguistically responsive practices:** recognize and value student resources in ways that increase relevance and effectiveness of learning experiences, especially for learners whose cultures and linguistic practices have been traditionally excluded from mainstream settings[40]
- **Summative assessment:** assessment opportunities that measure student learning at the end of a unit of instruction or course

How to Gather Evidence:

- Review materials for varied and multiple means to surface student sensemaking in multiple dimensions (SEPs, DCIs, CCCs). Review materials for a phenomenon or problem-based three-dimensional assessment system.
- Review materials for a summary of the assessment system including information about types and purposes of assessments, scoring guides and rubrics, and student work samples.
- Review materials for how formative assessments support students in monitoring their progress toward three-dimensional learning targets including the presence of rubrics available to students.
- Review materials for support for student provision of peer feedback.
- Review units of instruction from early, mid, and late phases of the program for increasing complexity of use of the science and engineering practices and crosscutting concepts.
- Review materials for support for culturally and linguistically responsive practices including opportunities that leverage the cultural assets of students and acknowledge their value.
- Review teacher materials for opportunities to recognize and value student contributions as instructional resources, especially for student groups who historically have been marginalized in science classrooms.

Examples of Evidence:

See Three-Dimensions Development for related indicators or evidence for Three-Dimensional Performance Progress Monitoring.

- Assessments are three-dimensional (SEPs, DCIs, CCCs) and grounded in a phenomenon or problem.
  - For example, in **Grades 9-12**, students analyze and interpret multiple data sets to construct an evidence-based explanation of the causal mechanisms of natural selection in medium ground finches on the Galapagos Islands in the late 1990s and early 2000s.
  - For example, in **Grade 3-5**, students respond to a prompt that asks them to develop a model using words and pictures that uses evidence from their learning experiences to explain the patterns of average temperatures on Earth in different locations at different times of the year.

[40] Ladson-Billings, G. (1995); Gay, G. (2018)

- Assessments measure the three-dimensional (SEPs, DCIs, CCCs) learning targets in the unit of instruction.
- Assessments include supports for teachers and students to monitor progress including rubrics, scoring guides, work samples, and guidance for peer feedback.
- Assessment system provides support for teachers to triangulate results using local assessment platforms.
- Assessments do not assume all students know culturally-specific knowledge and invite students to make personal connections to assessment scenarios (e.g., encouraging student use of home languages, familiar dialects, lived experiences, and preferred modality to express their thinking).[41]
- Learning experiences and assessments invite students to actively share and integrate personal stories, experiences, and culturally authentic perspectives related to the phenomenon or problem and ask students to leverage their cultural and linguistic knowledge alongside the three-dimensional knowledge they have built over a unit of study.
- Guidance for how to interpret a range of possible students responses and possible ideas for instruction to support next steps so each student can move forward in their learning process.[42]

Red Flags:

- Formative assessments serve to monitor student progress, but only for teachers.
- Assessments take a different approach to learning and are not consistent with the instructional design. For example, assessments are one-dimensional and focus only on disciplinary core ideas or science facts.
- Assessments focus on definitions, vocabulary, and terminology rather than on three-dimensional performances.

[41] NextGenScience (2021). Toward NGSS Design: EQuIP Rubric for Science Detailed Guidance. WestEd. https://www.nextgenscience.org/sites/default/files/EQuIPDetailedGuidanceMarch2021.pdf

[42] NextGenScience (2021). Toward NGSS Design: EQuIP Rubric for Science Detailed Guidance. WestEd. https://www.nextgenscience.org/sites/default/files/EQuIPDetailedGuidanceMarch2021.pdf

MEANINGFUL FEEDBACK

Instructional materials provide frequent opportunities for feedback to advance content understanding and disciplinary literacy skills, as appropriate to the type of literacy instruction. These materials include all of the following elements:

- **a.** peer and teacher cycles of feedback, including communicating progress;
- **b.** normalization of mistake-making and affirmation of effort and growth;
- **c.** guidance for explicit, timely, informative, and accessible formative feedback to address partial understandings about tasks, texts, and topics in ways that allow learners to monitor their own progress effectively and to use that information to guide their own effort and practice;
- **d.** focusing of students' attention on sensemaking and/or metacognitive processes; and
- **e.** guidance on how and when to collect data, as well as how to respond to specific student strengths and needs.

Indicators of Evidence

- Materials provide opportunities and supports for peer and teacher cycles of formative feedback.
- Materials support normalization of mistake-making and affirmation of effort and growth.
- Materials support students in recognizing mistakes as a part of learning.
- Materials promote asset-based approaches to providing feedback throughout the learning process (e.g., when making student thinking visible, during sensemaking, and in service of developing metacognitive processes).
- Teacher materials provide opportunities to offer formative feedback that addresses common student ideas revealed through learning experiences.
- Materials offer opportunities for students to interact with feedback in ways that allow students to monitor their own progress and learn from mistakes.
- Teacher materials provide guidance on how and when to collect data, as well as how to respond to specific student strengths and needs.

Key Definitions:

- **Formative feedback:** a process that occurs throughout learning to provide students with information to help them improve their learning

How to Gather Evidence:

- Review materials for prompts to provide cycles of feedback, including peer feedback, and communicate progress throughout the learning process.
- Review materials for supports for providing meaningful feedback and monitoring progress in ways that allow students to use feedback to guide their own effort and practice.
- Review materials for affirmation of effort and growth and recognition that making mistakes is part of learning.

- Review materials for prompts that encourage and support sensemaking and metacognition.
- Review teacher materials for guidance on how and when to collect data, as well as how to respond to specific student strengths and needs.

Examples of Evidence:

See Authentic Engagement as a Scientist for related indicators or evidence for Meaningful Feedback.

- Materials provide students and teachers access to scoring guides and rubrics to support substantive feedback and to support teachers and students in monitoring and communicating progress toward three-dimensional learning targets.
- Teacher materials provide scoring guides and rubrics that explicate partial understanding to support them in providing meaningful feedback to promote student growth and respond to student strengths and needs.
- Teacher materials provide guidance about how to handle feedback regarding common student ideas as they arise during instruction.
- Teacher materials support the provision of different types of feedback (e.g., task related, process, and self-regulation feedback).
- Teacher materials prompt teachers to affirm student effort and growth.
- Materials include guidance for students to provide meaningful peer feedback.

Red Flags:

- Materials emphasize summative assessment.
- Materials emphasize the practice of correcting common student ideas as they arise rather than making student thinking visible and attending to the common ideas as appropriate during the learning process.
- Formative assessment and peer feedback opportunities are only included at the end of a unit of instruction.
- Materials focus on “right” answers.
- Teacher is perceived as the only source of feedback.

Educator Supports

DOMAIN 1: EDUCATOR KNOWLEDGE

EXAMINATION OF SELF

Instructional materials support teachers in examining their own identities, biases, and belief systems to help them understand how these factors might influence instructional choices and the lens through which they interpret student thinking. These materials may include reflection prompts, examples of educator thinking, or embedded professional learning.

Indicators of Evidence

- Teacher materials provide guidance within each grade/unit that invites teachers to identify and reflect on the way their identities, experiences, and knowledge impact how they view students and their thinking/work (e.g., prompts or reflection tasks, sample teacher thinking).
- Teacher materials provide teacher reference callouts and/or reflection opportunities to address, identify, and interrupt biases.

Key Definitions:

- None

How to Gather Evidence:

- Review teacher guidance and resources for inclusion of reflection prompts to explore self-identities, biases, or beliefs that may impact instructional decisions.
- Identify embedded professional learning opportunities (e.g., model lessons, annotated lesson plan, suggested professional reading) to guide teachers to reflect on their interpretation of student thinking.

Examples of Evidence:

- Guidance at the beginning of each grade or unit that invites teachers to identify and reflect on the way their identities, experiences, and knowledge impact how they view student thinking and experiences relative to the unit phenomena.
- Teacher reflection prompts are provided at pivotal points in the lesson related to student discussions and work samples such as students' initial representations of phenomena, investigations, and sensemaking discussions.
- Prompts to address, identify, and interrupt biases (e.g., research summaries, prompts, sample teacher thinking about the inherent capabilities of multilingual learners or students with diverse learning needs).

Red Flags:

- No acknowledgement of users of the instructional materials.
- Materials include a bias toward white, western, non-disabled identities.
- Provided "possible student responses" only reflect dominant identities and belief systems.
- Potentially culturally sensitive phenomena or problems are included in the materials (e.g., decomposing animals; animals living in the home) with no support for teachers to recognize varied experiences and consider how that might impact instructional decisions.

PEDAGOGICAL CONTENT KNOWLEDGE

Instructional materials explicitly support teachers in building students' science understanding by helping educators understand how students learn science. These materials include all of the following elements.

a. explanations, examples, additional conceptual information, and related phenomena to support teachers in building their own knowledge of the targeted phenomena, problems, SEPs, DCIs, and CCCs;

b. explicit guidance for instructional strategies and routines that support authentic student sensemaking (e.g., how to elicit student ideas and surface student questions that drive ongoing learning experiences); and

c. explicit guidance for instructional strategies and routines that are consistent with how students learn science (e.g., rather than simply providing teachers with alternative conceptions or common student ideas, provide information about what experiences young children often have that lead them to believe one thing and how to use that facet of understanding to build a more accurate and complete understanding in grade-appropriate ways).

Indicators of Evidence

- Teacher materials provide support for teachers in building their own knowledge of the targeted phenomena, problems, SEPs, DCIs, CCCs, and nature of science.
- Teacher materials provide background on common student ideas for each unit and provide examples of how students might respond to questions or tasks based on those ideas.
- Teacher materials provide explicit guidance for instructional strategies and routines that support students in making sense of the phenomenon or problem using the targeted SEPs, DCIs, and CCCs.
- Teacher materials provide guidance for strategies and routines that are consistent with how students learn science.
- Teacher materials explain how scaffolds support students' independent use of the SEPs by elements over the course or grade band.

Key Definitions:

- None

How to Gather Evidence:

- Review teacher materials for background information including explanations and examples about
  - phenomena or related phenomena;
  - SEPs, DCIs, CCCs, and nature of science; and
  - additional conceptual information.
- Review teacher materials for background information about common student ideas for each unit including experiences young children often have that lead them to believe one thing and how to use that facet of understanding to build a more accurate and complete understanding in grade-appropriate ways.
- Review teacher materials for how strategies and routines are consistent with how students learn science.

- Review teacher materials for guidance on strategies and routines to elicit and build on student ideas.
- Review teacher materials for explanations and examples of strategies and routines to support students in making sense of phenomena and solving problems using targeted SEPs. DCIS, and CCCs.
- Review teacher materials for explanations and examples of how students deepen their understanding of the nature of science.
- Review teacher materials for examples of how students might respond to prompts or learning experiences based on common student ideas.

Examples of Evidence:

See Supports and Scaffolds for related indicators or evidence for Pedagogical Content Knowledge.

- Teacher materials include a section of text at the beginning of each unit of instruction that provide relevant background information including explanations and examples about
    - phenomena or related phenomena;
    - SEPs, DCIs, CCCs, and nature of science;
    - additional conceptual information;
    - nature of science;
    - common student ideas and the experiences that may contribute to the persistence of those ideas; and
    - how the storyline of the unit surfaces common ideas and builds on them over time.
- Teacher materials explain and provide examples of strategies and routines students use to make sense of phenomena and solve problems using the targeted SEPs, DCIs, and CCCs.

Red Flags:

- Student materials include limited use of strategies and routines, rather the materials focus on vocabulary and disconnected learning experiences.
- Teacher materials are limited in scope and provide little information about the focus of student learning, approach to student learning, and routines and strategies.
- Teacher materials do not differentiate which science ideas related to phenomena or problems fall within grade-level or grade-band and which science ideas are below or beyond grade-level.

STUDENTS' LINGUISTIC AND CULTURAL ASSETS

Instructional materials support educators in understanding how to surface and value diverse sensemaking repertoires and how to leverage students' linguistic and cultural assets in service of scientific sensemaking across the three dimensions. These materials include all of the following elements:

- **a.** integrated structures for educators and prompts for them to learn about and integrate the knowledge, strengths, and resources of students, families, and the community — especially those who have been historically marginalized;
- **b.** diverse examples of how different student experiences and language can be leveraged within specific instructional contexts; and
- **c.** explicit prompts and supports for surfacing student assets within teacher guides or other facilitator materials.

Indicators of Evidence

- Teacher materials are designed with integrated structures for teachers and prompts for them to learn about and integrate the knowledge, strengths, resources, and languaging practices of students, families, and the community—especially those who have been historically marginalized.
- Teacher materials include diverse examples of how different student experiences and language can be leveraged within specific instructional contexts.
- Teacher materials provide explicit prompts and supports for surfacing student assets within and across lessons.
- Teacher materials provide guidance on ways that educators can attend to the assets of students, families, and communities who have been historically marginalized (e.g., centering multilingual students as thought leaders through instruction, prompts to consider inclusion of families of color).

Key Definitions:

- **Student assets:** the unique strengths, skills, knowledge, and cultural experiences that each student brings to a learning opportunity. Student assets include their cultures, languages, and life experiences (e.g., communication styles, family traditions, cultural ways of knowing, etc.

How to Gather Evidence:

- Review program- and grade-level teacher materials for prompts, tasks, or protocols that address student and community assets and how they relate to the unit phenomena.
- Identify additional professional and collaborative learning opportunities for teachers to build asset-based language and community engagement strategies related to student assets related to the unit phenomena and diverse forms of communication (nonstandard dialects, multi-model forms of communication, etc.).

Examples of Evidence:

See Affirmation and Centering of Students and Multilingualism in Science for related indicators or evidence for Students' Linguistic and Cultural Assets.

- Guidance, materials, reflection prompts, and/or resources that support for teachers to use related to their own understanding of student assets (e.g., student surveys, tasks to identify student linguistic and cultural assets) that support student sensemaking throughout the unit.
- Guidance, materials, reflection prompts, and/or resources for teachers to use related to their own understanding of the assets of the learning community (e.g., family letters, family surveys, suggestions for family or community partnerships related to the topic of study) and how these can support student sensemaking across the unit.
- Materials support teachers in identifying collaborative learning opportunities for teachers that may include interactive modules, instructional frameworks, videos, or webinars.
- Particular attention to the ways that teachers can attend to the assets of students, families, and communities who have been historically marginalized (e.g., centering multilingual students as thought leaders through instruction, prompts to consider inclusion of families of color).
- Materials include diverse examples of student experiences related to the phenomenon and provide guidance for how these experiences can be leveraged to support student sensemaking.[43]
- Teacher materials include within lesson prompts that support surfacing student assets that reflect their social and cultural experiences and will aid in learning, including the family's preferred language of communication, schooling experiences in other languages, literacy abilities in other languages, and previous exposure to academic or everyday English.[44]
- Materials include support for teachers to recognize student assets to support student sensemaking related to the unit phenomenon.

[43] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners (Area of Focus IV: Supports and Structures for Science and Language Learning). https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

[44] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners (Area of Focus IV: Supports and Structures for Science and Language Learning). https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

Red Flags:

- Provided content to address the support of students works from a frame of addressing deficits without acknowledging that each student has assets they bring to any learning experience.
- No acknowledgement of student or community assets related to the unit phenomenon.
- Materials reference experiences that few students would recognize such as expensive technology (virtual reality goggles) or sports that often require money (golf, fencing).
- Learning opportunities are limited to individual student learning experiences (no collaboration).
- Materials restrict students' use of their linguistic and cultural assets (e.g., requiring student responses to fit within particular language forms and structures before valued as part of class sensemaking).

SUPPORTING LANGUAGE DEVELOPMENT FOR ALL LEARNERS

Instructional materials build educators' understanding of research-based practices to support language development for all learners, especially for multilingual learners. These materials include all of the following elements:

- **a.** use of home language, translanguaging, and developing cross-linguistic connections to deepen understanding of the linguistic features across languages and registers; and
- **b.** development of oracy skills.

Indicators of Evidence

- Teacher materials support educator understanding of key linguistic features in the science unit in ways that develop cross-linguistic connections.
- Teacher materials provide support for educators to listen and look carefully to language structures used by students at various points in the unit.
- Teacher materials explain how students' language develops over the course of the science unit and includes alignment to oracy and language development standards.
- Teacher materials deepen understanding of instructional strategies that support the simultaneous development of language, content, and literacy skills.
- Teacher materials provide sample student responses within the context of lesson content with a range of language proficiency levels.

Key Definitions:

- **Cross-linguistic connections:** identifying and exploring the ways that languages are the same and different (e.g., sound, spelling, vocabulary, syntax)
- **Registers:** the different ways speakers use language in different contexts

How to Gather Evidence:

- Review program- and grade-level teacher materials for language development that aligns with three-dimensional learning targets through prompts, tasks, or additional professional learning (e.g., model lessons, instructional frameworks, interactive modules).
- Identify teacher guidance and materials that support the development of language through prolonged exposure along with opportunities to negotiate ideas related to the unit phenomenon with increasing comprehension, building background knowledge, and making cross-linguistic connections.
- Review teacher guidance and materials related to how to value and leverage diverse ways students share their ideas and provide appropriate oracy support that builds in conjunction with how students make sense of the scientific phenomenon over the course of a unit.

Examples of Evidence:

See Language Objectives and Phenomena/Text Selection to Support Language Development for related indicators or evidence for Supporting Language Development for All Learners.

- Callouts, readings, instructional videos, Professional Learning Community agendas or learning experiences, or other professional learning opportunities with a focus on language development for each student.
- Support for teachers weaves together the development of language, content, and literacy skills (e.g., identify three-dimensional learning targets, language, and literacy skills for each lesson).
- Instructional strategies that support the simultaneous development of language, content (SEPs, DCIs, CCCs), and literacy skills (e.g., embedding supports for vocabulary and nonlinguistic visual language supports as part of three-dimensional science learning.)
- Resources for teachers that support the development of cross-linguistic connections (e.g., cross-linguistic glossaries, comparisons of linguistic structures, sound/spelling charts in different languages) including references to home languages and translanguaging.
- Support for teachers to learn and develop curiosity about students' linguistic assets.
- Teacher tasks and assessment resources include explicit acknowledgement of the assets of students' full linguistic repertoire (all the languages and registers that students know and use) and learning experiences that represent multilingualism as an asset and as a resource for learning academic content, disciplinary skills, and English simultaneously are provided.[45]
- Resources for teachers that support their use of curriculum spiraling of concepts, skills, and language throughout with increasing sophistication, precision, and/or complexity.[46]

Red Flags:

- Teacher materials silo teachers' understanding of the development of language, content, and literacy skills (e.g., discuss vocabulary development outside of the content that students are learning.
- Materials restrict student use of home languages and other linguistic resources.
- Materials support or require students to use specific vocabulary and academic language structures early in a unit before they have the opportunity to engage in three-dimensional learning and develop understanding of targeted science concepts.
- Students are not provided opportunities to use their home language strategically for learning.

[45] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners (Area of Focus IV: Supports and Structures for Science and Language Learning). https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

[46] English Learners Success Forum. (n.d.). Guidelines for Improving Science and Engineering Materials for Multilingual Learners (Area of Focus II: Leveraging Students' Assets). https://cdn.prod.website-files.com/5b43fc97fcf4773f14ee92f3/63583dfce1ea050576a1b335_ELSF_Science_Guidelines-02b.pdf

INCLUSIVE CLASSROOM ENVIRONMENTS

Instructional materials include specific guidance, instructional strategies, and routines for cultivating classroom cultures in which all students can have a voice and feel a sense of belonging. These materials include all of the following elements:

- **a.** structures for ensuring that all students can share their ideas;
- **b.** opportunities for students to see their ideas as valued elements/expertise within the science classroom setting; and
- **c.** opportunities for students to recognize self and peer assets while celebrating diversity of experiences.

Indicators of Evidence

- Teacher materials provide structures for ensuring that each student can share their ideas and questions, through various modalities.
- Teacher materials provide guidance for how teachers can support students in seeing their ideas and community connections as valued elements/expertise within the science classroom setting.
- Teacher materials provide guidance for how teachers can support students in recognizing self and peer assets while celebrating diversity of experiences.

Key Definitions:

- None

How to Gather Evidence:

- Review program- and grade-level teacher materials for prompts, tasks, or protocols that support students sharing their ideas and respond to the ideas of peers using various modalities (verbal, gestures, drawing) and in ways that promote the collective sensemaking of the unit phenomenon.
- Identify guidance for teachers to support students' view that their ideas are valued and useful towards building an explanation/model of the unit phenomena as are that of their peers.
- Assess materials for the strategies (classroom norms, agreements) that support a classroom environment where students feel welcomed and valued.

Examples of Evidence:

- Materials present a balance of independent, paired, small-group, and whole-class learning experiences.
- Flexible grouping structures are recommended to enhance student learning (e.g., heterogeneous groups, home language groups, groups by level, etc.).
- Resources are provided (e.g., sentence frames, rubrics, discussion protocols) that support students' inviting and responding to the ideas and experiences of their peers, even when different from their own.

Red Flags:

- Teacher materials do not provide guidance for how to support productive student to student interactions (e.g., the turn and talk strategy is used over and over with limited alternatives).
- Materials provide only general communication or collaboration strategies that do specifically match three-dimensional learning targets of the lesson.
- There are limited opportunities identified for students to interact with each other.
- Materials use the same modalities over and over again (e.g., overemphasis on speaking, listening, reading, and writing; limited opportunities for representing and viewing each other's ideas).

DOMAIN 2: SUPPORTING PRINCIPLED ADAPTATION

RELATED AND ALTERNATIVE PHENOMENA

Instructional materials provide guidance for how to identify and use alternative phenomena and problems as part of instructional activities, including locally relevant and compelling phenomena/problems.

Indicators of Evidence

- Teacher materials provide guidance on how to elicit related phenomena or problems from student experiences.
- Teacher materials provide guidance on how to support students in connection to their related phenomena or problems at multiple points across a unit.
- Teacher materials highlight how underlying mechanisms of example related and alternative phenomena or problems are similar and different from phenomena or problems embedded as part of unit design.
- Teacher materials provide guidance on how to maintain lesson and unit coherence if alternative lesson-level phenomena or problems are used.
- Teacher materials include guidance on how to find and evaluate data sets and resources for students to engage in sensemaking if the option of using alternative phenomena or problems is offered in the materials.

Key Definitions:

- **Alternative phenomena or problems:** require additional design work by the teacher or local entity; such phenomena or problems are used in place of embedded phenomena or problems and must rely on the same underlying mechanism and attend to the same DCIs, SEPs, and CCCs. Alternatives may be identified by the instructional materials to support unit coherence and scientific accuracy
- **Underlying mechanisms:** a system of processes or pathways that cause an observable phenomenon

How to Gather Evidence:

- Identify where in the materials students have opportunities to identify and connect to related phenomena or problems.
- Determine whether students have the opportunity to revisit and use their related phenomena as part of their figuring out process.
- Review the materials and identify if the materials offer alternative phenomena or problems and if there is teacher support to locate data sets and resources for student use. Determine whether there is sufficient guidance to support teachers in maintaining lesson and unit coherence if an alternative phenomena or problem is used.
- Review teacher materials to identify supports for teachers to understand how the underlying mechanisms of example related or alternative phenomena are similar and/or different.

Examples of Evidence:

See Phenomenon- or Problem-Driven Learning and Performance and Relevant Contexts for related indicators or evidence for Related and Alternative Phenomena.

- Opportunities in the materials for students to brainstorm related experiences and contexts to ask new questions, make new connections, or transfer learning.
- Various configurations (individual, pair, and small group) are used for students to revisit and discuss connections and ask new wonders about their related phenomena.
- Guidance in the teacher materials to support a class in creating a public representation that organizes students related phenomena that support students in noticing patterns across related phenomena.
- Teacher materials explain how final explanatory models can be used to explain example related phenomena in addition to the anchor phenomena.
- Teacher materials provide options for alternative phenomena or problems and explicitly name what will need to be adapted across the lesson/unit to reach similar three-dimensional learning targets and maintain coherence for students.

Red Flags:

- Materials elicit related phenomena or problems from students, but guidance is not provided for how or when students will use their related phenomena over the course of the unit.
- Teacher materials offer alternative phenomena or problems without providing guidance on how to locate data sets and resources students can use to engage in three-dimensional sensemaking (e.g., students only learn about alternative phenomena or problems through reading and viewing texts versus figuring out through use of science and engineering practices).
- Teacher materials offer the opportunity for alternative phenomena or problems without providing guidance on how to adapt lesson and unit learning experiences to maintain coherence and provide necessary structures and support for each student to reach the three-dimensional learning targets.

SURFACING OF STUDENT EXPERIENCES

Instructional materials include explicit structures for collecting student interest and experience data and triangulating this information with performance/proficiency data to inform possible adaptations of materials needed.

Indicators of Evidence

- Materials provide guidance on when, how, and where in the unit to collect student interest and experience data.
- Materials provide guidance on how to use student interest or experience data with student proficiency and prior knowledge data to inform possible adaptations.
- Materials provide guidance on how to use students' prior conceptions as instructional resources that serve as entry points for learning.

Key Definitions:

- None

How to Gather Evidence:

- Review and identify where the materials provide explicit structures to surface student experiences.
- Identify where and how the materials provide guidance for teachers to use student interest and experience data.
- Review teacher materials to see how distinctions are made between small scale and larger scale adaptations and the level of support needed to make possible adaptations.

Examples of Evidence:

- Materials provide specific examples of how teachers can use student interest or experience data to increase relevance to students.
- Teacher guidance provides opportunities for teachers to consider small scale adaptations for upcoming lessons and learning experiences based on student interest and proficiency data (e.g., If you notice [this] then consider adapting the upcoming lesson in the following ways).
- Materials provide supplementary planning materials and design guidance for adaptation efforts that occur between school years (e.g., prompts and guidance to support local teams in reflecting on the student data collected to make revisions before teaching the unit again in the following school year).

Red Flags:

- Teacher guidance suggests large scale adaptations without naming the time, resources, and effort required for redesigning.
- Materials only surface student experiences, interests, and ideas at the beginning of a unit.
- Materials provide guidance on how to surface student experiences and ideas, but do not provide guidance on how to use that data or information to make instructional decisions within the unit.

STUDENT-CENTERED EXTENSIONS AND ALTERNATIVES

Instructional materials provide guidance for possible extension activities, alternative investigations, or design projects that allow for student choice and adaptation to specific communities and students. These materials may include structures and guidance, with opportunities for teachers and students to have complete autonomy over content, or they may include more structured opportunities, with specific elements that are open to choice and adaptation.

Indicators of Evidence

- Teacher materials provide guidance to help teachers make decisions about the use of student-centered extensions that promote student choice and voice.
- Teacher materials provide guidance for teachers about extension learning experiences that present opportunities for students to select and use science and engineering practices independently.
- Teacher materials explain how possible alternative investigations, design projects, or simulations play an equivalent role to embedded learning experiences.
- Teacher materials explain how alternative investigation or design projects maintain (do not interrupt or detract from) the unit's coherence from students' perspective.
- Teacher materials provide guidance to ensure that each student has the opportunity to meet or exceed grade level learning targets (i.e., student use of an alternative investigation or project does not prevent those students from meeting or exceeding grade level expectations).

Key Definitions:

- **Extensions:** learning experiences beyond embedded learning experiences; not required for unit coherence; can meet a variety of needs and opportunities
- **Alternatives:** learning experiences that change or replace embedded learning experiences; designed to fulfill the same purposes, role, and intended three-dimensional learning targets; planning and/or design time is needed to maintain unit coherence
- **Equivalent:** consistent with the same purposes and intended three-dimensional learning target

How to Gather Evidence:

- Review teacher guidance or supplementary materials for information about possible extensions. Examine how these opportunities allow for student choice and adaptation to specific communities and students.
- Review teacher guidance or supplementary materials for information about possible alternatives. Examine how these opportunities allow for adaptation to specific communities and students. Assess for equivalency to learning experiences the alternatives would replace within the sequence of learning.

Examples of Evidence:

See Phenomenon- or Problem-Driven Learning and Performance, Choice and Voice, and Scaffolds and Supports for related indicators or evidence for Related and Alternative Phenomena.

- Opportunities for students to deepen their learning about a related phenomenon or problem.
- Alternatives provided when students cannot go outside to collect data.
- Guidance on how to support each student in collaborative sensemaking even when students engaged in three-dimensional science learning through different mediums and modalities.

Red Flags:

- Alternative investigations and learning experiences for “adaptation to specific communities and students” do not meet or exceed grade-level standards.
- Alternative investigations, design projects, or simulations interfere with unit coherence.

CLEAR GUIDANCE ON CONSTANT AND VARIABLE FEATURES

Instructional materials are designed such that they assume some local adaptation will be needed to authentically support diverse learners. Instructional materials explicitly support teachers in understanding which elements of the materials should not be adapted (or should be done so very carefully) and which elements have been designed such that teachers and students can modify them with great success (e.g., to connect with local resources and priorities, to be appropriate to available time for instruction).

Indicators of Evidence

- Teacher materials explain how the anchor phenomenon and/or problem was selected based on student interest and data. Materials explain how phenomena or problems, if not local, can support the development of global community members.
- Teacher materials explain which elements may be adapted and why specific elements of the materials should *not* be adapted.
- Materials identify which elements of the materials are designed for adaptation to the local context.
- Materials provide guidance to teachers about how to modify elements of the materials for local contexts.

Key Definitions:

- **Global community members:** people who are connected not just within one country but across a broader global collective[47]

How to Gather Evidence:

- Review teacher materials for support to understand how embedded phenomena or problems were selected based on student interest and data.
- Review teacher guidance and supplementary materials to identify how the materials distinguish between elements of the materials should not be adapted (or should be done so very carefully) and other elements that have been designed for adaptability.
- Examine the supports provided to determine if teachers and students can modify adaptable elements with great success.

Examples of Evidence:

See Phenomenon- or Problem-Driven Learning and Performance, Choice and Voice, Relevant Contexts, and Usability for related indicators or evidence for Clear Guidance on Constant and Variable Features.

- Materials explain why adapting specific elements of the materials is not recommended (e.g., adapting the anchor phenomenon would require careful adaptation of the entire unit, including changing key sensemaking moves like updating initial models).
- Materials provide specific examples of localized lesson-level phenomena that can play an equivalent role in building the science ideas and storyline.
- Materials provide a table of suggested equivalent phenomena for different regions of the United States.

[47] UNESCO. (n.d.) Global citizenship and peace education. https://www.unesco.org/en/global-citizenship-peace-education

Red Flags:

- Materials are not designed based on phenomena- or problems so teachers must revise for local phenomena or problems.
- Materials suggest no local adaptations are needed.
- Materials suggest that all phenomena or problems need to be local.
- Materials suggest that all phenomena or problems need to be global.

DOMAIN 3: USABILITY

DESIGN AND FUNCTIONALITY

Instructional materials are designed to support ease of student and teacher use. These materials include all of the following elements:

- **a.** visually appealing design with an organized and logical format;
- **b.** appropriate pacing;
- **c.** clear and concise educator-facing guidance;
- **d.** a variety of ways to engage with the content, including leveraging current technology and tools;
- **e.** manipulatives that are well organized, with an emphasis on ease of setup; and
- **f.** appropriate guidance for hands-on activities.

Indicators of Evidence

- Teacher and student materials are visually appealing with an organized and logical format.
- Teacher materials provide guidance for appropriate pacing (e.g., time required for each lesson/unit, sequencing).
- Teacher materials offer clear and concise guidance.
- Teacher materials provide a variety of ways to engage with the content, including leveraging current technology and tools.
- Teacher materials provide clear guidance for how to set up the materials and supplies required for investigations. Teacher materials provide kits and/or lists of materials required with specifications for each item.
- Teacher materials provide appropriate guidance for investigations, learning experiences, and hands-on learning experiences.

Key Definitions:

- None

How to Gather Evidence:

- Assess overall materials for layout, typography, and use of images that are user-friendly for students and teachers.
- Review unit overviews, including the scope and sequence documents, for provided pacing, instructional components, and methods of accessing materials.
- Review units and lessons to determine how design, material organization, and language contribute to or detract from usability and functionality.
- Review units and lessons to identify materials and supplies required for investigations and guidance for set up.

- Identify features that support students with diverse learning needs (e.g., alternative formats, compatibility with assistive tools).
- Identify technology features for delivery of content or engagement that enhance learning experiences.

Examples of Evidence:

- Teacher and student materials are available in digital formats that can support text-to-speech or other assistive technology.
- Digital and print resources are clearly marked and organized (e.g., clearly organized digital interface; use of color-coding or visuals; consistent labeling).
- Estimated pacing of learning experiences is adequate (e.g., suggested timing is considered for each individual task; additional time built into unit pacing for teacher-directed adjustments; time built into scope and sequence for necessary teacher adaptations).
- Clear guidance about core instructional components and supplemental components.
- Lessons orient teachers to the most important information (e.g., overview of lesson structure alongside needed materials and preparation).
- Teacher guidance is written in a way that describes learning experiences.

Red Flags:

- Teacher and student materials are only available in non-editable format, creating an unnecessary burden for teachers to adapt for their context.
- Volume of materials or additional optional components with unclear guidance on what is core instruction (and/or variance in the quality of volume of materials).

ADAPTABILITY FOR CONTEXT

Instructional materials contain resources and/or meaningful suggestions for how to adapt for district, school, and/or classroom context. These materials may include varied selections for topics/concepts under study; flexibility to modify tasks to connect to local resources, organizations, or issues; or varied pacing suggestions based on number of school days or minutes of instruction while maintaining coherence of units/lessons.

Indicators of Evidence

- Teacher materials provide guidance for a variety of school and classroom schedules (e.g., instructional minutes, block/traditional schedule).
- Teacher materials are in a format that supports educators in making revisions for local context.
- Teacher materials provide guidance for how and when to make adjustments and modifications to the learning experiences while maintaining coherence and supporting students as they figure out phenomena and solve problems.
- Teacher materials include suggestions within each grade level to attend to local context through phenomena or problems (e.g., suggestions for planning a field trip to a city food center during a unit on ecosystems).

Key Definitions:

- None

How to Gather Evidence:

- Review the grade or course and unit overviews, including the scope and sequence documents, for attention to varied instructional context restraints (e.g., school days and instructional minutes) and options for choice-based or adaptable units of study.
- Review unit and lesson materials, guidance, suggestions, and resources for supporting adaptation.
- Determine whether the presence of these adaptable elements are additional, optional, or required.

Examples of Evidence:

- Materials include clear guidance or adapted lesson materials for varied instructional contexts (e.g., options for a 90- or 120-minute instructional minutes, block or traditional schedule, must do/may do instructional components; extensions).
- Materials offer guidance for how and when to make adjustments that schools and/or teachers could select from (e.g., selecting from two sample units on sustainability—food sustainability and urban renewable energy; a range of research project materials using similar phenomena or problems).
- Invitations within each grade level to attend to local context though task or topic (e.g., suggestions for planning a field trip to a city food center during a unit on farms).

Red Flags:

- Instructional materials are strictly paced for daily instructional minutes and school days that are not feasible for local contexts.
- Modifications or pacing suggestions include options that do not meet the full scope of grade-level science standards.

PROGRAM COHERENCE

Core instructional materials work in concert with (or have the potential to work in concert with) additional supplemental science materials (e.g., Maryland Environmental Literacy Standards Framework, local projects, school-based science/STEM initiatives). These materials include aligned and research-based content and instructional approaches across materials.

Indicators of Evidence

- Teacher materials explain how the instructional model, routines, and strategies build student learning across units.
- Teacher materials provide guidance to link student learning and engagement across units and lessons and across all three dimensions (SEPs, DCIs, CCCs).
- Teacher materials provide an assessment system with teacher guidance for evaluating student performance and determining instructional next steps.
- Teacher materials include explanations and examples of how the concepts and/or standards align to other grade/course levels so that teachers can improve their own knowledge of the subject.
- Teacher materials may include guidance for how to incorporate ancillary resources into the selected program.

Key Definitions:

- **Core instructional materials:** primary instructional materials used to engage students in daily science instruction that are aligned to standards, three dimensional using phenomena or problems
- **Supplemental science materials:** additional materials designed to support students beyond the core instructional materials

How to Gather Evidence:

- Review materials including the assessment system in the selected core program by grade and course to identify how student learning builds across units or lessons to support potential use of supplemental materials; materials provide guidance for incorporation.
- Determine the presence of supplementary materials across grade levels, including how supplemental materials are integrated into the selected program (e.g., remediation, extension materials outside of core instructional materials).
- Review supplemental materials to determine if instructional strategies and approaches are aligned to the design of the core instructional materials.

Examples of Evidence:

See Phenomenon- or Problem-Driven Learning and Performance, Lesson and Unit Coherence, Three-Dimensional Coherence, Instructional Model Coherence, and K-12 Progressions for related indicators or evidence for Program Coherence.

- Core instructional materials provide clear guidance and connections to identified or recommended supplementary materials.
- Supplementary materials can be incorporated with core instructional materials in ways that maintain coherence while addressing students' strengths and needs in ways that build their conceptual understanding.

Red Flags:

- Materials emphasize using supplementary materials in lieu of the core instructional materials or using supplementary materials in ways that diminish the coherence of the core instructional materials.
- Identified supplementary materials are not research-based and aligned to standards (e.g., focus solely on science concepts or SEPs, lack connections to phenomena or problems).
- Core instructional materials require significant use of supplementary materials for students to meet learning targets.

Glossary

The following key terms are referenced frequently throughout the science rubric. The definitions below apply to all instances of each term.

Acceleration opportunities: learning experiences that are designed to keep students moving forward with grade-level science content; supports continued science learning instead of remediation

Alternatives: learning experiences that change or replace embedded learning experiences; designed to fulfill the same purposes, role, and intended three-dimensional learning targets; planning and/or design time is needed to maintain unit coherence

Alternative phenomena or problems: require additional design work by the teacher or local entity; such phenomena or problems are used in place of embedded phenomena or problems and must rely on the same underlying mechanism and attend to the same DCIs, SEPs, and CCCs; alternatives may be identified by the instructional materials to support unit coherence and scientific accuracy

Asset-oriented: referencing the strengths of a people or culture, rather than focusing on deficits

Authentic language: real, natural language in materials (including literature, articles, videos, and other media) that reflect linguistic structures and contemporary use of vocabulary that are characteristic of the language used by native speakers in real-world situations

CCCs: crosscutting concepts; have application across all domains of science

Civic engagement: active participation in local communities, society, and government for the betterment of the collective

Collaborative learning: students working together in small groups and whole class using strategies, routines, and co-developed norms

Common student ideas: misconceptions, naive conceptions, or incomplete ideas students may have based on personal experiences

Conceptual understanding: learners make sense of evidence and organize ideas to arrive at key concepts in science; may involve the use of home language and translanguaging; moves beyond rote memorization

Core instructional materials: primary instructional materials used to engage students in daily science instruction that are aligned to standards, three dimensional using phenomena or problems

Critical interpretation: science, as an enterprise, requires analysis of data and information to identify evidence that can be used to answer questions; analysis is often preceded by thoughtful research of the existing literature base and careful scientific investigation to gather data and information

Cross-linguistic connections: identifying and exploring the ways that languages are the same and different (e.g., sound, spelling, vocabulary, syntax)

Cultural knowledge: shared customs, practices, beliefs, histories, and languages of a particular group or society

Culturally and linguistically responsive practices: recognize and value student resources in ways that increase relevance and effectiveness of learning experiences, especially for learners whose cultures and linguistic practices have been traditionally excluded from mainstream settings

DCIs: disciplinary core ideas; focus K–12 science curriculum, instruction, and assessments on the most important aspects of science

Elements: SEPs, DCIs, and CCCs are described by components that differentiate the dimension by grade band and describe what students are doing and thinking about for each SEP, DCI, and CCC within the grade band and as a K-12 progression

Equivalent: consistent with the same purposes and intended three-dimensional learning targets

Extensions: learning experiences beyond embedded learning experiences; not required for unit coherence; can meet a variety of needs and opportunities

Formative assessment: assessment opportunities that help students and teachers monitor students' progress toward learning goals; the best formative assessments also inform next steps for learning for both the teacher and the student

Formative feedback: a process that occurs throughout learning to provide students with information to help them improve their learning

Funds of knowledge: people are competent and have knowledge, and their life experiences have given them that knowledge

Global community members: people who are connected not just within one country but across a broader global collective

Hands-on: direct and active engagement with equipment, manipulatives, or other physical materials that require the use of the science and engineering practices of developing and using models and planning and carrying out investigations to figure out phenomena and solve problems

Home language: language(s) that students use most frequently and comfortably in their everyday life, often the language they acquired first and use most often for communication

Instructional model: guides developers in the design of instructional materials and supports teachers in implementing the materials in ways consistent with the developers' intent

Language functions: use of language to communicate for specific purposes (e.g., describe, compare, explain, argue, etc.)

Language objectives: specific instructional goals that outline the language targets (speaking, listening, reading, and writing) that support meaning-making and communication in science

Language patterns and structures: recurring language forms (e.g., text structure, sentence structure, words that connect ideas) needed to describe and analyze phenomena across scientific disciplines (e.g., cause and effect, scale, systems, stability, and change, etc.)

Linguistic repertoire: full range of linguistic abilities and resources that students possess and can draw upon during their learning experience, including all the vocabulary, syntax, and ways of speaking across languages

Metacognition: the ability to self-monitor, self-assess and self-reflect when planning and participating in learning experiences

Misconceptions: an idea that is scientifically inaccurate and could be rooted in experiences, beliefs and culture or a limited understanding of the concept; note, the Rubric and Companion Guide refer to common student ideas which include misconceptions, naive conceptions, or incomplete ideas

Additional Resources

GRADE-LEVEL AND STANDARDS ALIGNED INSTRUCTION

- A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, The National Academies Press
- Core Content Review Criteria v2.0 Science Grades 6-8, EdReports
- How Do We Make NGSS Storylines Work by Pushing Students to Go Deeper, Brian Reiser & Michael Novak
- Next Generation Science Standards: For States, By States, The National Academies Press
- Selecting Anchoring Phenomena for Equitable 3D Teaching, William Penuel et al.
- STeLLA Design Principles, Kathleen Roth et al.
- STEM Teaching Tool #71: How can you advance equity and justice through science teaching?, Phillip Bell & Megan Bang

DESIGNED TO AFFIRM STUDENTS

- Culturally Responsive-Sustaining Education Framework, New York State Education Department
- Culturally Responsive Teaching & The Brain, Zaretta Hammond
- Culturally Relevant Pedagogy 2.0, Gloria Ladson-Billings
- Developing Content-Area Literacy for Diverse ELLs/MLLs in Secondary Classrooms, CUNY-NYS Initiative on Emergent Bilinguals
- Teaching Strategies to Develop Cross-Language Connections, District of Columbia, Office of the State Superintendent of Education
- Translanguaging: Practice Briefs for Educators, Joanna Yip and Ofelia García

INSTRUCTIONAL DESIGN

- e2 (Essential X Equitable) Instructional Practice Suite, Student Achievement Partners
- Guidelines for Improving Science and Engineering Materials for Multilingual Learners, English Learners Success Forum (ELSF)
- High-leverage Practices for Students with Disabilities, Council for Exceptional Children
- The Learning Professional Vol. 44 No. 3, Learning Forward
- Toward NGSS Design: EQuIP Rubric for Science Detailed Guidance, NextGenScience
- Universal Design for Learning Guidelines, CAST