Primary Evaluation of Essential Criteria (PEEC) for Next Generation Science Standards Instructional Materials Design

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Cheryl Kleckner, State Science Education Specialist for Oregon (retired)

Phil Lafontaine, State Science Supervisor for California (retired)

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Executive Summary

What is PEEC?

PEEC is an acronym for the Primary Evaluation of Essential Criteria for Next Generation Science Standards (NGSS) Instructional Materials Design. Per the *Guide to Implementing the Next Generation Science Standards*, high-quality instructional materials designed for the NGSS are a critical component of NGSS implementation. PEEC is designed to:

- Bring clarity to the complicated and parallel processes of selecting and developing those instructional materials;
- Help educators and developers to focus on the critical innovations within the NGSS via a process to dig deeply into instructional materials programs to evaluate their presence; and
- Answer the question "How thoroughly are these science instructional materials programs designed for the NGSS?"

PEEC evaluates instructional material programs.

PEEC is intended to evaluate the NGSS design of instructional materials programs built for year-long courses (e.g. high school biology), or programs that span several grade levels (e.g. a K–5 elementary science series, or a middle school sequence for grades 5–8). These instructional materials programs may be commercially available, developed by states or districts, and/or provided as open educational resources. The instructional materials to be evaluated can be organized in any of a variety of digital and print formats (e.g. kits, modules, workbooks, textbooks, textbook series).

PEEC is *not* intended for the evaluation of individual lessons or instructional units. For these smaller grain sizes of instructional materials, it is more appropriate to use the NGSS Lesson Screener or the EQuIP Rubric for Science, which are explicitly designed for this purpose. PEEC is also not intended to be used with supplemental materials or instructional materials compiled from several *different* sources (e.g., a combination of various textbooks, kits, modules, and digital supplements assembled by the user) *unless there is clear guidance* for how the different components will be used in the classroom to address the criteria highlighted in this evaluation.

PEEC describes the NGSS Innovations.

To determine the degree to which an instructional materials program is designed for the NGSS, PEEC focuses on what makes the NGSS new and different from past science standards. These differences were first articulated as "conceptual shifts" in Appendix A of the standards released in 2013, but four years of subsequent implementation has refined our collective understanding of what is unique about the NGSS and has revealed that these are not just *shifts*. These differences represent innovations in science teaching and learning.

The five “NGSS Innovations” are:

1. **Making Sense of Phenomena and Designing Solutions to Problems**. Making sense of phenomena or designing solutions to problems drives student learning.
2. **Three-Dimensional Learning.** Student engagement in making sense of phenomena and designing solutions to problems *requires* student performances that integrate grade-appropriate elements of the Science and Engineering Practices (SEPs), Crosscutting Concepts (CCCs), and Disciplinary Core Ideas (DCIs) in instruction and assessment.
3. **Building K–12 Progressions.** Students’ three-dimensional learning experiences are designed and coordinated over time to ensure students build understanding of *all three dimensions* of the standards, nature of science concepts, and engineering as expected by the standards.
4. **Alignment with English Language Arts and Mathematics.** Students engage in learning experiences with explicit connections to and alignment with English language arts (ELA) and mathematics standards.
5. **All Standards, All Students.** Science instructional materials support equitable access to science education for all students.

Each of these innovations and their implications for instructional materials are described in detail in this document. The NGSS Innovations are the lens that PEEC uses to help educators evaluate instructional materials, and should be the focus of those developing instructional materials for the NGSS.

It should be noted that there are certainly additional criteria for evaluating the quality of instructional materials that are not the primary focus of document, such as cost or ease of use of any technological components. Their omission is not because they are not important, but merely because they are not unique to materials designed for the NGSS. An initial discussion of these issues is found in the Beyond PEEC section on page 47.

PEEC is a process.

PEEC is a process for schools, districts, or other teams of teachers to use to evaluate aspects of instructional materials as described above. The PEEC evaluation process involves three successive phases that are each explained in detail in this document.

1. **PEEC Prescreen:** The prescreen focuses on a small number of criteria that should be readily apparent in instructional materials designed for the NGSS. This allows those selecting materials to take a relatively quick look at a wide range of materials and narrow the number of programs worthy of a closer look.
2. **Unit Evaluation:** If the prescreen of the materials indicates that there is at least the potential that they are designed for the NGSS, the PEEC process uses the EQuIP Rubric for

Science as a sampling tool to evaluate a single unit of instruction for evidence it is designed for the NGSS.

3. **Program-Level Evaluation:** For materials that show sufficient evidence of being designed for the NGSS when they are evaluated with the EQUIP Rubric for Science, the final phase of the PEEC process evaluates the evidence that the NGSS Innovations are embedded across the entire instructional materials program.

PEEC builds on other tools.

To effectively use PEEC, instructional materials evaluators and developers should already be fluent in the language of the *Framework*, be comfortable navigating the NGSS (including the Appendices),and have experience with applying the EQuIP Rubric for Science to evaluate units. Users that are not familiar with these documents can find them and resources to support their use at www.nextgenscience.org. PEEC also draws heavily from the discussions and evaluative criteria in *Guidelines for the Evaluation of Instructional Materials in Science*—a document that describes the research base for evaluative criteria that should be considered in building tools for evaluating instructional materials designed for the NGSS. The criteria for all three phases of PEEC have a close connection to those presented in the *Guidelines*.

PEEC continues to evolve.

PEEC represents the collective input, guidance, and efforts of many science educators around the country. As their work continues, subsequent versions of PEEC will build on and incorporate their experience.

We invite you to share your reactions to and suggestions for subsequent versions of PEEC by emailing peec@achieve.org.

Why PEEC?

PEEC takes the compelling vision for science education as described in *A Framework for K–12 Science Education* and embodied in the NGSS and operationalizes it for two purposes:

1. To help educators determine how well instructional materials under consideration have been designed for the *Framework* and NGSS; and
2. To help curriculum developers construct and write science instructional materials that are designed for the *Framework* and NGSS.

The NGSS do not shy away from the complexity of effectively teaching and learning science. They challenge us all to shift instructional materials to better support teachers as they create learning environments that support all students to make sense of the world around them and design solutions to problems. This vision is summarized in the following paragraph from the *Framework*:

> *By the end of the 12th grade, students should have gained sufficient knowledge of the practices, crosscutting concepts, and core ideas of science and engineering to engage in public discussions on science-related issues, to be critical consumers of scientific information related to their everyday lives, and to continue to learn about science throughout their lives. They should come to appreciate that science and the current scientific understanding of the world are the result of many hundreds of years of creative human endeavor. It is especially important to note that the above goals are for all students, not just those who pursue careers in science, engineering, or technology or those who continue on to higher education.*

This vision is not only aspirational; it is based on scientific advances and educational research about how students best learn science. This research and resulting vision for science education have implications for instructional materials that reach far beyond minor adjustments to lessons, adding callout boxes to margins, crafting a few new activities, or adding supplements to curriculum units. The advances in the NGSS will be more successfully supported if entire science instructional materials programs are *designed* with the innovations described by this evaluation tool and if states, districts, and schools use this tool to ensure that the materials they choose really measure up.

The word "**designed**" is intentionally and deliberately used here—and throughout the PEEC materials—instead of "aligned." This choice was made because *alignment has come to represent a practice that is insufficient to address the innovations in these standards*.

When new standards are released, educators traditionally create a checklist or map in order to determine how well their instructional materials match up with the standards. If enough of the pieces of the standards match up with the pieces in the lessons or units or chapters, the instructional materials are said to be "aligned." In this sense, "alignment" is primarily correlational and, if the correlation is not high enough, the only shift that is needed is to add additional materials or remove particular pieces. This traditional approach to alignment assumes that (1) matching content between the language of the standards and the instructional materials is sufficient for ensuring that students meet the standards, and (2) that all approaches to the way instructional experiences are designed in materials are created equally as long as the content described by the standards appears.

However, the innovations of the *Framework* and NGSS cannot be supported by instructional materials that simply have the same pieces and words as the standards. In the NGSS, academic goals for students are stated as performance expectations that combine disciplinary core ideas, crosscutting concepts, and science and engineering practices. The nature of this multidimensional combination is as important as the presence of the constituent components, and has implications for how students build the knowledge and skills needed to be able to meet multidimensional standards. Thus, the word "designed" was chosen because it reflects the degree to which the innovations represented by the standards are a foundational aspect of both the design and content the instructional materials.

This focus on these innovations speaks to the second purpose of PEEC: to support authors and curriculum developers as they work to produce instructional materials for the NGSS. This support began with NGSS Appendix A (The Conceptual Shifts in the Next Generation Science Standards), and was soon followed by the first version of the Educators Evaluating the Quality of Instructional Products (EQuIP) Rubric for Science that described what these shifts looked like in instructional materials at the lesson and unit level. The EQuIP Rubric for Science has been successively revised based on extensive use and feedback, and is now in its third version. The lessons from EQuIP process have been further articulated and codified to form the NGSS Innovations section of PEEC. While different from the "Publisher's Criteria" that were developed for the Common Core State Standards in scope, format, and structure, the core intent of the innovations is similar: to help curriculum developers and curriculum users think about how the standards should manifest themselves in instructional materials by focusing on the aspects that are most central to meeting the demands of the NGSS and most different from traditional approaches to standards, instruction, and materials. The goal is to help developers more easily create and refine instructional materials, and to do so knowing that their efforts are focused on the same innovations that schools, districts, and states will be using to select instructional materials for use.

PEEC and Other *Framework*-based Standards

Although PEEC was explicitly and specifically designed to evaluate materials designed for the NGSS and there are regular references to the NGSS throughout, the innovations that are part of these standards are fundamentally rooted in the *Framework*. This means that states and districts that did not adopt the NGSS, but that adopted standards based on the three dimensions of the *Framework* should also be able to use it to evaluate instructional materials that are developed for these key innovations.

The NGSS Innovations and Instructional Materials

The NGSS Innovations are the five most significant ways the NGSS advance science teaching and learning, when compared to previous standards and typical instructional and curricular practice in American schools. They build on the conceptual shifts described in Appendix A of the NGSS using lessons learned by educators and researchers since implementation efforts began to bring clarity and focus to what is truly innovative in the NGSS.

As the key ways that the NGSS are new and different, these innovations also provide the intellectual framework PEEC uses to evaluate science instructional materials.

This section describes each of the five NGSS Innovations and provides insight on how these innovations should be expected to appear in instructional materials. Each innovation is described with the following components.

- A summary statement that distills the key idea of the innovation.
- A quote connecting each innovation to the research of the *Framework*.
- A detailed explanation of the innovation, often with links to portions of the NGSS.
- A description what this innovation looks like in instructional materials.
- A table providing concrete examples of the changes this innovation describes instructional materials.

Innovation 1: Making Sense of Phenomena and Designing Solutions to Problems

Summary	Making sense of phenomena or designing solutions to problems drives student learning.

From the *Framework*:

> *The learning experiences provided for students should engage them with fundamental questions about the world and how scientists have investigated and found answers to those questions.*

Though "making sense of phenomena and designing solutions to problems" is not one of the three dimensions of the standards and "phenomenon" or "problem" are not words often found within the performance expectations, a close look will reveal that the ability of students to make sense of phenomena and design solutions to problems is indeed a core feature of these standards. The easiest place to see this explicitly is to look at the foundation boxes connected to each performance expectation, or in Appendix F: Science and Engineering Practices and Appendix G: Crosscutting Concepts. These appendices provide additional detail about learning expectations in these two dimensions of the standards across grade levels and frequently reference making sense of phenomena and/or designing solutions to problems.

Explaining phenomena and engineering design problems are not entirely new to science teaching and learning—laboratory experiments have been a hallmark of science instruction for decades, phenomena have frequently been used to "hook" students into learning, and engineering activities have often been used for engagement or enrichment—but the expectation that they are an organizing force for instruction is an innovation. By organizing instruction around phenomena, students are provided with a reason to learn (beyond acquiring information they are told they will later need) and shifts student focus from *learning about a topic* to *figuring out why or how something happens*. Additionally, the focus on relevant, engaging phenomena and design problems that students can access addresses diversity and equity considerations by providing opportunities for students to make connections with the content based on their own experiences and questions. This leads to deeper and more transferable knowledge and moves everyone closer to the vision of the *Framework*.

Implications for Science Instructional Materials

As with science instruction, phenomena and problems are not new to science instructional materials, but the shift to an expectation that student sense-making and problem-solving is driving instruction means that materials will need to shift as well. In instructional materials programs designed for the NGSS, this shift should be obvious in the organization and flow of learning in student materials and a clear focus of the teacher supports for instruction and monitoring student learning (see Table 1 for additional ways that making sense of phenomena and designing solutions to problems are different in the NGSS). This focus should be clear in even a quick scan through instructional materials designed for the NGSS and, after a closer look, it should be clearly central to student learning within lessons and units and coordinated over the whole program in a way that is coherent for both students and teachers.

For more resources on how making sense of phenomena and designing solutions to problems are important for teaching and learning designed for the NGSS, visit https://www.nextgenscience.org/resources/phenomena.

The following table provides examples of what instructional materials programs designed for this NGSS Innovation include "less" of and "more" of. This is not an exhaustive list, but is intended to call out key evidence that should be looked for in evaluating instructional materials. It should also be noted that "less" does not mean "never" and "more" does not mean "always."

Table 1: Innovation 1—Making Sense of Phenomena and Designing Solutions to Problems

Instructional materials programs designed for the NGSS include:

Less	**More**
Focus on delivering disciplinary core ideas to students, neatly organized by related content topics; making sense of phenomena and designing solutions to problems are used occasionally as engagement strategies, but are not a central part of student learning.	Engaging all students with phenomena and problems that are meaningful and relevant; that have intentional access points and supports for all students; and that can be explained or solved through the application of targeted grade-appropriate SEPs, CCCs, and DCIs as the central component of learning.
Making sense of phenomena and designing solutions to problems separated from learning (e.g., used only as an engagement tool to introduce the learning, only loosely connected to a disciplinary core idea, or used as an end of unit or enrichment activity).	Students using appropriate SEPs and CCCs (such as systems thinking and modeling) to make sense of phenomena and/or to design solutions to give a context and need for the ideas to be learned.
Instructions for students to “design solutions” as a step-by-step directions-following exercise.	Students learning aspects of how to design solutions while engaged in the design process.
Only talking or reading about phenomena or how other scientists and engineers engaged with phenomena and problems.	Students experiencing phenomena directly or through rich multimedia.
Leading students to just getting the “right” answer when making sense of phenomena.	Using student sense-making and solution-designing as a context for student learning and a window into student understanding of all three dimensions of the standards.

Innovation 2: Three-Dimensional Learning

Summary	Student engagement in making sense of phenomena and designing solutions to problems *requires* student performances that integrate grade-appropriate elements of the SEPs, CCCs, and DCIs in instruction and assessment.

From the *Framework*:

> *Instructional materials must provide a research-based, carefully designed sequence of learning experiences that develop students' understanding of the three dimensions and also deepen their insights in the ways people work to seek explanations about the world and improve the built world.*

That there are three dimensions in the NGSS—the science and engineering practices (SEPs), the disciplinary core ideas (DCIs), and crosscutting concepts (CCCs)—is their most recognizable feature. The innovation of these three dimensions, however, lies not just in their existence in the standards, but in *how* they exist in the standards. The NGSS are designed to make the two important parts of this innovation clear: 1) that the all three dimensions are equally important learning outcomes; and 2) that the *integration* of the three dimensions is key for student learning.

It might seem like the existence of the three dimensions is the innovation, but each has a predecessor in prior state standards and all three existed in many of those standards documents in one way or another. Prior to the NGSS, the primary focus of most state standards was on "science content" expected for students to know or understand. This "science content" was the precursor of *disciplinary core ideas*. Many state standards also included at least one standard that highlighted what students needed to know about how scientists do their work—the precursor to the *science and engineering practices*. Often called "inquiry," this was an important component of many state standards documents. The precursors to the *crosscutting concepts* were also included in state standards documents, but were often not in the standards themselves. They were derived from the "Unifying Concepts and Processes" of the National Science Education Standards (NRC 1996), the "Common Themes" of the *Benchmarks for Science Literacy* (AAAS 2009), "themes" in Science for All Americans (AAAS 1989), and "crosscutting ideas" in NSTA's Science Anchors Project (2010).

How this information was organized in prior standards, however, conveyed a difference in the relative importance of these three areas of student learning and these differences had a significant impact on instruction, instructional materials, and assessments in science classrooms. The "science content" portions took up the majority of the standards and because of the sheer breadth of detailed information, most instruction that targeted the standards focused on ways to disseminate this information to students. Though “inquiry” was highlighted in prior standards documents, it was typically a single standard while many more were devoted to science content. The crosscutting concepts predecessors were frequently addressed either in the front matter of the standards documents and/or were buried in standards that were viewed as supplemental to core learning.

The NGSS, on the other hand, include all three dimensions in performance expectations, intentionally signaling that *all three dimensions are equally important for student learning*. Students cannot fully demonstrate understanding of disciplinary core ideas without using the crosscutting concepts while engaging in the science and engineering practices. At the same time, they cannot learn or show competence in practices except in the context of specific content.

Building student proficiency in all three dimensions is a significant innovation all by itself, but the implication of this innovation goes beyond three separate strands of learning that are equally valued. The power of the three dimensions comes in their integration. The fact that these standards are written as three-dimensional performance expectations is significant and intentional, and should be reflected in student learning experiences. The *Framework* makes it clear that, “In order to achieve the vision embodied in the framework and to best support students’ learning, all three dimensions need to be integrated into the system of standards, curriculum, instruction, and assessment” (2012). Students develop and apply the skills and abilities described in the practices, as well as use the CCCs to make sense of phenomena and make connections between different DCIs in order to help gain a better understanding of the natural and designed world. The SEPs and CCCs provide multiple access points for students to approach learning goals, enabling different students in different contexts to access the same ideas. Simply parsing these dimensions back out into separate entities to be learned and assessed in isolation misses the vision of the NGSS and the *Framework*.

It is also important to clarify that the NGSS were designed to be *endpoints* for a grade level (K–5) or grade band (6–8; 9–12), and that they collectively describe what students should know and be able to do at that endpoint. The exact pairings of the dimensions in the PEs should not limit how the dimensions are integrated during classroom instruction and assessment. Because the very architecture of the NGSS models three-dimensionality, a PE might seem like a classroom lesson or unit, but it is **not** the intent of the NGSS to have students simply “do the PEs.” Since the PEs are written as grade-level endpoints, they often contain elements of the dimensions that may need to be taught at different times of the year. For example, a PE may include a DCI that fits early in a year of instruction, but also a more advanced level of a CCC or SEP that students might not be prepared for until the end of that same year. Furthermore, such an endeavor would be impractical and inefficient, as many PEs overlap with and connect to each other. Instead, three-dimensional learning experiences that integrate multiple SEPs, CCCs, and DCIs will be needed to help all students build the needed competencies toward the targeted performance expectations.

Implications for Instructional Materials

Instructional materials built for past science standards were organized just like the standards: inquiry or science process was frequently addressed in an opening chapter, a majority of the text was devoted to imparting "science content" to students, and the crosscutting concepts precursors were generally only implicitly included in materials with little to no emphasis in student learning goals. Instructional materials designed for the NGSS, on the other hand, must communicate the equal value of the three dimensions. This has implications for how student materials are organized and how the dimensions are presented in teacher support materials. This importance can and should be conveyed explicitly, but it is also conveyed by how the dimensions are presented. If one dimension is relegated to only appearing in the margins, appears with much less frequency, is not supported in teacher materials, or significant learning time is not devoted to ensuring student learning related to that dimension, then the materials fall short of what is expected by these standards.

Instructional materials designed for the NGSS will not only value all three dimensions of the standards, but will also integrate the three dimensions in instruction and assessment. For instruction, this means that student learning experiences must be anchored with three-dimensional student performances. It may not be possible for every student learning experience to be three-dimensional, but these 3D performances should be common and central to student learning. As mentioned above, the three dimensions of the standards should be integrated in ways that help students to make sense of the world around them and/or design solutions to problems—driving toward, but not limited by how the dimensions are integrated in the performance expectations. Instructional materials designed for this NGSS Innovation should make it clear which elements of the three dimensions are targeted by a given lesson or unit.

Instructional materials designed for the NGSS will integrate the three dimensions when monitoring student progress with embedded formative and summative assessments. As with instruction, this doesn't mean every assessment task or item, all the time, but it also means more than just an occasional three-dimensional assessment task here or there. The *focus* of measuring student learning should utilize items and tasks that are measuring the dimensions together—in pre-assessments, formative assessments, and summative assessments. Three-dimensional assessment tasks should be embedded throughout instructional experiences, taking advantage of the rich opportunities that are part of instruction during which students make their thinking visible to themselves, their peers, and educators.

Effective assessment of three-dimensional science learning requires more than a one-to-one mapping between the NGSS performance expectations and assessment tasks. It is important to note that more than one assessment task may be required to adequately assess students' mastery of some three-dimensional targets, and any given assessment task may assess aspects of more than one performance expectation. In addition, to assess both understanding of core knowledge and facility with a practice, assessments may need to probe students' use of a given practice in more than one disciplinary context. To adequately cover the three dimensions, assessment tasks will generally need to contain multiple components (e.g., a set of interrelated questions). Developers might focus on individual SEPs, DCIs, or CCCs in some components of an assessment task, but together, the components need to support inferences about students' three-dimensional science learning as described in a given set of three-dimensional learning targets.

For an introduction regarding assessments and the NGSS, see *Seeing Students Learn Science: Integrating Assessment and Instruction in the Classroom* (2017), the STEM Teaching Tool practice briefs on assessment, and Developing Assessments for the Next Generation Science Standards.

For some more concrete examples of what *Innovation 2: Three-Dimensional Learning* looks like in instructional materials programs, see Table 2. As was mentioned with Table 1, this is not an exhaustive list, but is intended to call out key evidence that should be sought in evaluating instructional materials. As a reminder, "less" does not mean "never" and "more" does not mean "always."

Table 2: NGSS Innovation 2—Three-Dimensional Learning

High-quality instructional materials programs designed for the NGSS include:

Less	More
Using science practices and crosscutting concepts only to serve the purpose of students acquiring more DCI information.	Careful design to build student proficiency in all three dimensions of the standards.
Teachers only posing questions that have one correct answer.	Teachers posing questions that elicit the range of student understanding. Students discussing open-ended questions that focus on the strength of evidence used to generate claims.
Administering additional assessments during instruction (e.g., vocabulary checks) that lack a clear feedback process to monitor and/or move student experiences to meet targeted learning goals.	Formative assessment processes embedded into instruction to capture changes in student thinking over time and adjust instruction

Less	**More**
Assessments that focus on one dimension at a time and are mostly concerned with measuring students' ability to remember information.	Assessments within the instructional materials reflect each of the three distinct dimensions of science and their interconnectedness.
Students learning the three dimensions in isolation from each other, i.e.: • A separate lesson or unit on science process/methods followed by a later lessons or units focused on delivering science knowledge. • Including crosscutting concepts only implicitly, or in sidebars with no attempt to build student proficiency in utilizing them. • Rote memorization of facts and terminology; providing discrete facts and concepts in science disciplines, with limited application of practice or the interconnected nature of the disciplines. • Prioritizing science vocabulary and definitions that are introduced before (or instead of) students develop a conceptual understanding.	Integrating the SEPs, CCCs, and DCIs in ways that instructionally make sense, as well as inform teachers about student progress toward the performance expectations, including: • Students actively engaged in scientific practices to develop an understanding of each of the three dimensions. • CCCs are included explicitly, and students learn to use them as tools to make sense of phenomena and make connections across disciplines. • Facts and terminology learned as needed while developing explanations and designing solutions supported by evidence-based arguments and reasoning.

Innovation 3: Building K–12 Progressions

Summary	Students' three-dimensional learning experiences are designed and coordinated over time to ensure students build understanding of *all three dimensions* of the standards, nature of science concepts, and engineering as expected by the standards.

From the *Framework*:

[Instructional materials] based on the framework and resulting standards should integrate the three dimensions—scientific and engineering practices, crosscutting concepts, and disciplinary core ideas—and follow the progressions articulated in this report… In addition, curriculum materials need to be developed as a multiyear sequence that helps students develop increasingly sophisticated ideas across grades K–12.

There are two components to this innovation. This first is what was described in the quote from the *Framework* above: coherently building all three dimensions from kindergarten through the twelfth grade. The second part of this focuses on how both engineering and the nature of science are embedded across all grade levels.

Building the Three Dimensions

While the three dimensions have appeared in past standards, the NGSS are the first standards to build all three dimensions over time. Past standards may have included limited progressions for both science and engineering practices (SEPs) and disciplinary core ideas (DCIs), but the NGSS progressions are more robust in several ways. The precursors to the crosscutting concepts (CCCs), on the other hand, were generally incorporated into the front matter of standards without any indication of how they might be treated over time. Not only are the three dimensions intentionally integrated into the performance expectations, but these progressions are supported with three appendices—Appendix E: Disciplinary Core Ideas, Appendix F: Science and Engineering Practices and Appendix G: Crosscutting Concepts—that add additional clarity to how these dimensions build over time. The appendices break the grade banded expectations for each DCI, SEP, and CCC into smaller *elements* for each to help educators focus on what is unique about that dimension at that grade.

The SEP progressions in the NGSS are different because the more is expected for student engagement in the practices over time. The SEPs specify what is often meant by "inquiry" and address the range of cognitive, social, and physical practices that science and engineering require in ways that were not included in past standards. This means there are more specific expectations at each grade level. Furthermore, past science standards generally just increased the complexity of inquiry standards by adding complexity to what is now one of the SEPs in the NGSS--*planning and carrying out an investigation*. The features that were added over time over time sometimes represent entire SEPs, which, in the NGSS, are built in developmentally appropriate ways starting in kindergarten. For example, in state standards prior to the NGSS, defending the results and conclusions of an investigation might not be mentioned in the standards documents until the high school level. In the NGSS, students are expected to start building the practice of *engaging in argument from evidence* in elementary school and that practice is scaffolded across grades so that high school students are expected to have many opportunities to engage in this practice before even reaching high school. In a similar fashion, all eight practices are developed from kindergarten through high school. The added specificity of the practices provides guidance for how each one builds over time.

The DCIs are more focused than the "science content" of past standards, so the progressions here look different as well. To be included in the *Framework* (and the NGSS), an idea had to: have broad importance across one or more science disciplines; be important for understanding more complex ideas and solving problems; relate to the interests and life experiences of students and the world they live in; and be teachable and learnable over multiple grades with increasing sophistication. The DCIs are driven less by information that we think that students *should* know by a particular grade and more by focusing on the fundamental understanding that will prepare them for their lives beyond high school. As a result, the DCIs have fewer disconnected bits of information and are more focused on building these core ideas.

As was mentioned above, the predecessors to the CCCs were usually included in the front matter of standards rather than in the standards themselves. Their addition to each of the three-dimensional performance expectations of the NGSS means that this dimension of the standards has an expected progression for the first time. The learning expectations of the CCCs are scaffolded across the K-12 standards to help students connect knowledge from the various disciplines into a coherent and scientifically-based view of the world.

Advancing the way that the DCIs and SEPs are built over time while establishing the first progression for the CCCs is a significant innovation of the NGSS.

Implications for Instructional Materials

Instructional materials designed for the NGSS provide sustained learning opportunities from kindergarten through high school for all students to engage in and develop a progressively deeper understanding of each of the three dimensions. Students require coherent, explicit learning progressions both within a grade level and across grade levels so they can continually build on and revise their knowledge and expand their understanding of each of the three dimensions. High-quality NGSS-designed instructional materials must clearly show how they include coherent progressions of learning experiences that support students in reaching proficiency on **all** parts (e.g., all elements of the SEPs, DCIs, and CCCs) of the NGSS by the end of each grade level and across grades. Guidance should also be provided for teachers to adjust instruction of all three dimensions to meet the needs of their students. In programs that extend beyond a single year, these progressions should be coordinated over the full breadth of the instructional materials program.

This means, for example, that the way materials expect students use each science and engineering practice at the beginning of the school year should be significantly different from how they are expected to use each practice by the end of the year. Students should have experiences across the year designed to *develop* specific, grade-appropriate elements of each practice and opportunities to apply these previously developed elements in new situations. There are a variety of ways this might happen—initially providing supports for a practice and then strategically removing them over time; focusing on deliberately developing a small number of elements of a practice in a coordinated fashion throughout the year; practicing already-developed elements of a practice when a different practice is foregrounded—but it should be apparent in student materials how the practice is being used differently and the plan for how the variety of student experiences builds to the full practice should be clearly explained in teacher materials.

In a similar way, the CCCs and DCIs should be coordinated over time so learning of all three dimensions is coherent from a student's perspective and guidance should be provided to teachers that explains how the organization of student learning experiences builds each dimension for students.

See NGSS Appendix E, Appendix F, and Appendix G for more information about the learning progressions for each dimension and how they build over time. For some more concrete examples of what *Innovation 3: Building K-12 Progressions* looks like in instructional materials programs, see Table 3. As was mentioned with earlier innovations, this is not an exhaustive list, but is intended to call out key evidence that should be looked for in evaluating instructional materials. As a reminder, "less" does not mean "never" and "more" does not mean "always."

Table 3: NGSS Innovation 3—Building K-12 Progressions: Building the Three Dimensions

High-quality instructional materials programs designed for the NGSS include:

Less	**More**
Building on students' prior learning only for the DCIs.	Building on students' prior learning in all three dimensions.
Little to no support for teachers to reveal students' prior learning.	Explicit support to teachers for identifying students' prior learning and accommodating different entry points, and describes how the learning sequence will build on the prior learning.
Assuming that students are starting from scratch in their understanding.	Explicit connections between students' foundational knowledge and practice from prior grade levels.
Students engaging in the SEPs only in service of learning the DCIs.	Students engaging in the SEPs in ways that not only integrate the other two dimensions, but also explicitly build student understanding and proficiency in the SEPs over time.

Less	More
CCCs marginalized to callout boxes, comments in the margins, or are implicit and conflated with the other dimensions and therefore do not progress over time.	Students learn the CCCs in ways that not only integrate the other two dimensions, but also explicitly build student understanding and proficiency in the CCCs over time.
Including teacher support that focuses only on the large grain size of each dimension rather than digging down to the element level (e.g. the SEP “Analyzing and Interpreting data” rather than the grade 3–5 element of the same practice “Analyze data to refine a problem statement or the design of a proposed object, tool, or process.”	Including teacher support that clearly explains out how the elements of the practices are coherently mapped out over the course of the instructional materials program.

Embedding Engineering Design and the Nature of Science

The NGSS include engineering design and the nature of science as significant concepts, embedding them throughout the performance expectations. In many ways they are addressed within the progressions of the three dimensions of the three dimensions just described, but there are also specific aspects of each that are highlighted within the NGSS beyond what was included in the three dimensions. Similar to the three dimensions of the standards, engineering design and the nature of science have been included in past science standards, but the degree to which and the way they are incorporated into the NGSS is a distinct part of this innovation of the NGSS.

The NGSS represent a commitment to integrating engineering design into the structure of science education by raising engineering design to the same level as scientific inquiry when teaching science disciplines at all levels, from kindergarten to grade 12. To ensure that this happens coherently across students’ K–12 learning experience, (1) all the SEPs have elements that are explicitly focused on engineering; (2) there are specific engineering design DCIs throughout the standards; and (3) the ideas from the Engineering, Technology, Science, and Society disciplinary core idea in the *Framework* are integrated into the crosscutting concepts in each grade band. (See Chapter 3 in the *Framework* for a detailed description of how the practices are used for both science and engineering. Box 3-2 briefly contrasts the role of each practice’s manifestation in science with its counterpart in engineering.) These engineering concepts and practices are embedded throughout the NGSS in the performance expectations (PEs) that are marked with an asterisk. There are also grade-banded engineering design-specific standards in the NGSS to ensure that student learning about engineering design concepts is coherent and builds over time. More details about how engineering was embedded in the NGSS can be found in Appendix I: Engineering Design in the NGSS and Appendix J: Science, Technology, Society, and the Environment.

A deeper awareness and understanding of the connections between science and engineering helps all students to be prepared for their lives beyond high school. In particular, the increased emphasis of engineering in the NGSS has potential to be inclusive of students who have traditionally been marginalized in the science classroom and do not see science as being relevant to their lives or future. By solving problems through engineering in local contexts (e.g., gardening, improving air quality, or cleaning water pollution in the community), students gain knowledge of science content, view science as relevant to their lives and future, and engage in science in socially relevant ways.

Like engineering, some aspects of the nature of science are integrated directly into the three dimensions of the standards—the integration of scientific and engineering practices, disciplinary core ideas, and crosscutting concepts provide practical experiences for students that set the stage for teaching and learning about the nature of science—but this part of the Building K-12 Progressions innovation also goes beyond just the integration of the three dimensions. In addition to learning experiences that model how science knowledge is acquired, the NGSS incorporate eight major themes about the nature of science into the performance expectations. Four of these themes extend the scientific and engineering practices and four themes extend the crosscutting concepts. Though the nature of science was often addressed somewhere within past standards documents, it has not been embedded in the standards over time the way that it is in the NGSS. These eight themes and exactly how they are built into the standards are explained in more detail in NGSS Appendix H: Understanding the Scientific Enterprise: The Nature of Science in the Next Generation Science Standards.

Implications for Instructional Materials

Though engineering has stand-alone standards for each grade band, it is important for instructional materials not to isolate or separate engineering from science learning. Engineering was intentionally embedded in the standards to ensure that it was not separated out and taught as a separate unit or chapter. All three dimensions of the standards include learning that is relevant to engineering and instructional materials should embed this learning throughout the program and provide clear support for teachers to see how engineering is embedded throughout the program. Instructional materials designed for the NGSS should make sure that engineering is not an enrichment activity or engagement tool, but is incorporated meaningfully with science throughout student learning, and included as explicit and integrated learning targets.

Instructional materials designed for the NGSS should ensure that the eight nature of science themes identified in Appendix H are likewise explicitly embedded throughout student learning experiences and teacher supports, building learning progressions across grade bands.

For more examples of what Embedding Engineering Design and the Nature of Science looks like in instructional materials programs, see Table 4. As was mentioned with earlier innovations, this is not an exhaustive list, but is intended to call out key evidence that should be looked for in evaluating instructional materials. As a reminder, “less” does not mean “never” and “more” does not mean “always.”

Table 4: NGSS Innovation 3—Building K–12 Progressions: Embedding Engineering Design and the Nature of Science

High-quality instructional materials programs designed for the NGSS include:

Less	**More**
Presenting engineering design and the nature of science disconnected from other science learning (e.g., design projects that do not require science knowledge to complete successfully, or an intro unit on the nature of science).	Engaging all students in learning experiences that connect engineering design and the nature of science with the three dimensions of the NGSS; not separated from science DCIs.
Presenting engineering design and/or nature of science in a hit or miss fashion, i.e. they are made apparent to students, but there is no coherent effort to coordinate or improve student understanding or proficiency over time.	Both engineering design and nature of science are thoughtfully woven into the three-dimensional learning progressions so that students receive support to develop their understanding and proficiency.
Introducing students to ideas about engineering design or the nature of science, but not expecting students to retain or apply this information.	Measuring student learning in relation to engineering design and the nature of science across a system of assessments.
Teacher support that only explains the importance of the nature of science and engineering design without a plan for scaffolding student understanding and application.	Teacher support that explains how engineering design and the nature of science are coherently mapped out over the course of the instructional materials program.

Innovation 4: Alignment with English Language Arts and Mathematics

Summary	Students engage in learning experiences with explicit connections to and alignment with English language arts (ELA) and mathematics.

From the *Framework*:

> *…achieving coherence within the system is critical for ensuring an effective science education for all students. An important aspect of coherence is continuity across different subjects within a grade or grade band. By this we mean "sensible connections and coordination [among] the topics that students study in each subject within a grade and as they advance through the grades" [3, p. 298]. The underlying argument is that coherence across subject areas contributes to increased student learning because it provides opportunities for reinforcement and additional uses of practices in each area.*

The NGSS not only build coherence in science teaching and learning but also provide connections with mathematics and ELA that are made explicit on each standards page. This degree of connection across content areas is a significant innovation of the NGSS and, as is highlighted in Appendix L and Appendix M, the NGSS went to great lengths to ensure that the English language arts and mathematics expectations of students were grade-appropriate (as determined by the Common Core State Standards for English Language Arts in Science and Technical Subjects and Mathematics).

Such convergence across content areas strengthens science learning for all students, especially for students whose time for learning science may have been diminished by policies driven by an accountability system dominated by reading and mathematics. Across the three subject areas, students are expected to engage in argumentation from evidence; construct explanations; obtain, synthesize, evaluate, and communicate information; and build a knowledge base through content rich texts. Additionally, students learn the crosscutting concept of *Patterns* not only across science disciplines but also across other subject areas of language arts, mathematics, social studies, etc. Furthermore, the convergence of core ideas, practices, and crosscutting concepts across subject areas offers multiple entry points to build and deepen understanding for these students.

Implications for Instructional Materials

Instructional materials designed for the NGSS will highlight and support teachers in making connections between science, mathematics, and English language arts. Grade-appropriate and substantive overlapping of skills and knowledge helps provide all students equitable access to the learning standards for science, mathematics, and English language arts (e.g., see NGSS Appendix D Case Study 4: English Language Learners).

For examples of NGSS Innovation 4: Alignment with English language arts and Mathematics, see Table 5. As was mentioned with earlier innovations, this is not an exhaustive list, but is intended to call out key evidence that should be looked for in evaluating instructional materials. As a reminder, "less" does not mean "never" and "more" does not mean "always."

Table 5: NGSS Innovation 4: Alignment with ELA and Mathematics

High-quality instructional materials programs designed for the NGSS include:

Less	More
Science learning is isolated from related learning in mathematics and English language arts.	Engaging all students in science learning experiences that explicitly and intentionally connect to mathematics and English language arts learning in meaningful, real-world, grade-appropriate, and substantive ways and that build broad and deep conceptual understanding in all three subject areas.

Innovation 5: All Standards, All Students

Summary	Science instructional materials support equitable access to science education for all students.

From the *Framework*:

> *Communities expect many things from their K-12 schools, among them the development of students' disciplinary knowledge, upward social mobility, socialization into the local community and broader culture, and preparation for informed citizenship. Because schools face many constraints and persistent challenges in delivering this broad mandate for all students, one crucial role of a framework and its subject matter standards is to help ensure and evaluate educational equity.*

The NGSS describe science expectations built on progressions of the disciplinary core ideas (DCIs), the science and engineering practices (SEPs), and crosscutting concepts (CCCs) used together in meaningful ways that both establish high expectations while providing the structure to support students from diverse backgrounds in meeting them. This manifests directly in other innovations of the standards; however, the implications for supporting all students go deeper than those opportunities previously mentioned. As such, this innovation emphasizes those features of implementing the NGSS that directly support all students, and particularly those from traditionally underserved groups, in establishing and maintaining both achievement and agency in science. Whereas innovations 1-4 describe *what* is different in the NGSS, innovation 5 describes *how* the features of the NGSS can be used to support all learners with a focus on implications for instructional materials.

The NGSS pose a vision for science education that goes beyond asking students to know scientific information, or even applying scientific information via practices. To truly meet the vision of the NGSS, all students need to be given the opportunity to *become* scientists and engineers—scientific explainers and problem solvers—within the walls of their classrooms. An important part of helping all students reach achievement in science is ensuring that they both identify as scientists and engineers, and develop scientific agency—that is, they engage with science directly as doers and drivers of scientific endeavors, value the ideas they bring with them, have ownership over science and their learning, and participate in serious, engaging learning experiences that are meaningful to them culturally and socially.

For further information and examples of how to support a range of students, please see NGSS Appendix D and the accompanying case studies.

Implications for Instructional Materials

Instructional materials designed for the NGSS provide opportunities for all learners, and guidance to teachers for supporting diverse student groups, including students from economically disadvantaged backgrounds, students with special needs (e.g., visually impaired students, hearing impaired students), English learners, students from diverse racial and ethnic backgrounds, students with alternative education needs, and talented and gifted students. They do so using a variety of approaches, but also ensure the features of NGSS design are intentionally leveraged to support diverse learners as they develop proficiency, agency, and identity in science.

Specifically, instructional materials that are designed for the NGSS should:

1. Provide substantial opportunities for students to express and negotiate their ideas and prior knowledge, and capitalize on funds of knowledge (see NGSS Appendix D) as they are making sense of phenomena and designing solutions to problems.
2. Include diverse examples of scientists and engineers, including women and members other underserved populations, with whom a range of student groups can identify.
3. Offer meaningful opportunities for science learning experiences to value, respect, and connect to students' home, culture, and community.

4. Regularly provide opportunities for students to have ownership over their learning, as they explore and come to more deeply understand the core scientific ideas described by the standards.
5. Provide multiple access points, representations, and multimodal experiences for students to engage with the science at hand.
6. Provide multiple ways in which to make student thinking visible.
7. Provide teachers with ample tools and supports to help a wide range of students learn the designated content and skills, including through differentiation, engaging multiple scientific competencies, supporting scientific identities, and cultivating scientific agency.

For more examples of NGSS Innovation 5: All Standards, All Students, see Table 6. As was mentioned with earlier innovations, this is not an exhaustive list, but is intended to call out key evidence that should be looked for in evaluating instructional materials. As a reminder, "less" does not mean "never" and "more" does not mean "always."

Table 6: NGSS Innovation 5: All Standards, All Students

High-quality instructional materials programs designed for the NGSS include the following:

Less	**More**
Materials including separate lessons or activities for students with different language or abilities as the only support for these learners.	Instructional materials create learning experiences that students with diverse needs and abilities can connect to and use to make progress toward common learning goals through a variety of student approaches within the same learning sequence.
Use of flashy phenomena as an interesting hook with the assumption that all students will find that compelling.	Inclusion of phenomena and problems that are relevant and authentic to a range of student backgrounds and interests, with supports for modifying the context to meet local needs and opportunities for students to make meaningful connections to the context based on their current understanding, personal experiences, and cultural background.

Less	**More**
Materials providing limited ways of meeting learning goals, such as reading about topics, listening to lectures and note-taking, and following written or oral labs.	Materials engaging the SEPs, CCCs, and DCIs as access points and diverse ways for students to learn (e.g., students using the practice of argumentation and evidence-based discourse to develop scientific understanding; students developing and using modeling to make sense of phenomena and problems as well as make thinking visible in ways that are less dependent on English language proficiency). Materials leverage the active components of the dimensions to provide students with ways to drive their own learning experiences, and identify and capitalize on opportunities for active learning.
Materials focus only on helping students learn and remember “the right answer.”	Materials help students learn the requisite information while also growing students’ ability to see themselves as scientists and engineers by providing students multiple opportunities to make their thinking visible, revisiting ideas, and engaging in scientific discourse with peers.
Teacher materials that focus on delivering information to students without providing support to help teachers value and build on the experiences and knowledge that students bring to the classroom	Teacher materials that include suggestions for how to connect instruction to the students' home, neighborhood, community and/or culture as appropriate, and provide opportunities for students to connect their explanation of a phenomenon and/or their design solution to a problem to questions from their own experience and meaningful components of their own contexts. Teacher materials provide suggestions for how to support students’ through multiple approaches to problems and phenomena.

Less	More
Teacher materials that only offer minimal or non-context specific support for differentiation.	Teaching materials that include: • Appropriate reading, writing, listening, and/or speaking alternatives (e.g., translations, picture support, graphic organizers, etc.) for students who are English learners, have special needs, or read well below the grade level. • Extra support (e.g., phenomena, representations, tasks) for students who are struggling to meet the targeted expectations. • Extensions for students with high interest or who have already met the performance expectations to develop deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts. • Support for how to engage students in ownership of their learning.

Using PEEC to Evaluate Instructional Materials Programs

The *NGSS Innovations* just described form the foundation of the PEEC instructional materials evaluation process. The criteria in PEEC explicitly focus on these innovations and how thoroughly they are represented in instructional materials programs.

The PEEC process involves three phases for each instructional materials program under consideration.

1
- **PEEC Prescreen** - A quick look at instructional materials programs to narrow the scope of materials to be reviewed

2
- **Unit Evaluation** - A close look to verify the thoroughness with which the materials are designed for the NGSS

3
- **Program Level Evaluation** - A broad look to evaluate the degree to which the NGSS Innovations permeate the entire program

PEEC was designed to determine the degree to which instructional materials programs are designed with the innovations of the NGSS. As such, it is useful for both curriculum developers and instructional materials authors as well as by schools, states, and districts seeking to purchase or obtain instructional materials.

Some idea about how PEEC can be used by various audiences are described on the following page:

States and PEEC

PEEC can be used by States to:

- Develop criteria for reviewing and selecting state-adopted or recommended *entire school science instructional materials programs*—school science textbooks, textbook series, kit-based and other instructional materials and support materials for teachers—that are designed for both year-long and K–12 education, that represent comprehensive programs; or
- Describe a process for reviewing and selecting state adopted or recommended *entire school science instructional materials programs*—school science textbooks, textbook series, kit-based and other instructional materials and support materials for teachers—that are designed for both year-long and K–12 education, that represent comprehensive programs; or
- Provide guidance to districts to make strong instructional materials selections.

School Districts and PEEC

PEEC can be used by district and school educators to:

- Describe the process for reviewing and selecting *entire school science programs*—school science textbooks, textbook series, kit-based and other instructional materials and support materials for teachers—that are designed for the NGSS; or
- Evaluate current science instructional materials to identify adaptations and modifications to support NGSS implementation.

Developers, Writers, and PEEC

PEEC can be used by instructional materials developers, authors, writers, and designers to:

- Enhance initial design and planning of an *entire school science programs*—school science textbooks, textbook series, kit-based and other instructional materials and support materials for teachers—so that subsequent development, writing, and field testing best incorporates the NGSS.
- Analyze a program currently in development or in the market to understand if and how the innovations within the NGSS manifest themselves, to make better decisions about revisions or updates.
- Collect, document, and share evidence and claims so other educators can understand how a given set of instructional materials are designed for the NGSS.
- Enhance the capacity of development and sales or marketing teams, so that the people who work with schools, districts, and states on behalf of a vendors understand the NGSS and the innovations the NGSS calls for.

PEEC Phase 1: Prescreen

1. **PEEC Prescreen** - A quick look at instructional materials programs to narrow the scope of materials to be reviewed
2. **Unit Evaluation** - A close look to verify the thoroughness with which the materials are designed for the NGSS
3. **Program-Level Evaluation** - A broad look to evaluate the degree to which the NGSS Innovations permeate the entire program

Summary	PEEC Phase 1: The PEEC Prescreen is a quick look at NGSS design for instructional materials programs.
Process	1. Prepare for the review by identifying the people involved, the components of the instructional materials in question to review, and the evidence to be sought. 2. Apply the PEEC prescreen. Use *Tool 1A: PEEC Prescreen Response Form (Phenomena), Tool 1B: PEEC Prescreen Response Form (Three Dimensions),* and *Tool 1C: PEEC Prescreen Response Form (Three Dimensions for Instruction and Assessment).* 3. Analyze the results. Use *Tool 2: PEEC Prescreen: Recommendation for Review?.*

The purpose of the prescreen is to do a relatively quick survey of an instructional materials program to see if it warrants further review. Phase I offers users a tool and a process to determine if a given set of instructional materials has the potential to be designed for the NGSS. If the evidence for these three criteria is not clear and compelling, the materials are likely not worth the time and capacity necessary to fully evaluate the degree to which the programs are designed for the NGSS.

Applying the prescreen is not a thorough vetting of a resource and is not sufficient to support claims of being designed for the NGSS. However, if these innovations are not clearly visible, it is difficult to imagine that the resource is designed for the NGSS in a way that will support advancing science instruction in the classroom.

The prescreen focuses on three criteria related to the first two NGSS Innovations: *Innovation 1: Making Sense of Phenomena and Designing Solutions to Problems* and *Innovation 2: Three-Dimensional Learning* as shown in Table 7.

Table 7: PEEC Prescreen Summary Table

The instructional materials program is designed to engage all students in making sense of phenomena and/or designing solutions to problems through student performances that integrate the three dimensions of the NGSS.

Innovation 1	**Making Sense of Phenomena and Designing Solutions to Problems** The instructional materials program **focuses** on supporting students to make sense of a phenomenon or design solutions to a problem.
Innovation 2	**Three Dimensions** The instructional materials program is designed so that students develop and use multiple grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs), which are deliberately selected to aid student sense-making of phenomena or designing of solutions. **Integrating the Three Dimensions for Instruction and Assessment** The instructional materials program requires student performances that integrate elements of the SEPs, CCCs, and DCIs to make sense of phenomena or design solutions to problems, and elicits student artifacts that show **direct, observable evidence** of three-dimensional learning.

Preparing to use PEEC

Before beginning a PEEC review process, several questions need to be answered.

Preparation Question 1: Who will be conducting the review?

In the beginning of the review process, a decision needs to be made about who will be applying the prescreen and conducting subsequent parts of the PEEC process. Will it be the whole group that is reviewing materials, or will it be a small leadership group? Applying the prescreen with the full group doing the review can be a way to build a common understanding of the first two innovations before digging in deeper with the Unit Evaluation. However, depending on the number of instructional materials programs being reviewed and the resources available to support the review, it may make sense for only a leadership group to apply the Prescreen to the full scope of materials being considered. Then, once a smaller set of programs have been identified, a larger group of educators can be involved in the remaining two phases of PEEC.

Certainly, refer to state, district, and local laws, rules, and guidance documents to ensure that all requirements are met. Suggestions for potential membership on the instructional materials committee include state, district, and school-level science instruction, assessment, and equity supervisors, district administrators, school principals, elementary, middle, and high school science teachers, higher education and STEM partners, parents, students, and community members.

All committee members need a thorough understanding of the National Research Council's *A Framework for K–12 Science Education*, the Next Generation Science Standards (NGSS), and the NGSS Innovations. They need to be comfortable applying the EQuIP Rubric for Science 3.0. If participants have not received formal professional learning to support using the EQuIP Rubric for Science, that will need to be included in the process.

While it is possible for the prescreen and subsequent phases of the PEEC review to be applied by an individual, the quality review process works best with a team of reviewers as a collaborative process. As more people get involved, the likelihood for better evidence and understanding increases as the additional perspectives can deepen the review process. However, adding more review team members will increase the complexity and costs of a review effort. Working as a group will not only result in a better-informed decision, but the conversations can also bring the group to a common, deeper understanding of what instructional materials designed for the NGSS look like.

Regardless of the number of people involved, the same process works to collect input from individuals to make a collective decision. Just as when using the full EQuIP Rubric for Science, users should follow the sequence of steps below for each instructional materials program under consideration:

1. Individually record criterion-based evidence.
2. Individually use this evidence to make a recommendation about whether to continue review.
3. With team members, discuss evidence, recommendations, and reasoning.
4. Reach a consensus decision about conducting deeper analysis for this instructional materials program in subsequent PEEC phases.

Preparation Question 2: Which components of the instructional materials program will you review?

The NGSS Innovations evaluated by the prescreen should be explicit and obvious, and they should be present in the materials that are in the hands of all students and teachers—not just in optional or ancillary materials. The components of the instructional materials program chosen to review need to be selected in advance and consistent across programs. It is important to **review only what will be available to all teachers and to all students**. Though this is intended to be a quick read-through of materials, it is important—for all the materials reviewed and for each of the criteria—to evaluate both the overall organization of the materials and their content.

For each of the instructional material programs under consideration, teams should identify which components will be included and which ones will not be included in the PEEC review process.

Preparation Question 3: What evidence should be sought?

Before applying the prescreen, it's important that the review group has a common understanding of what qualifies as evidence for the criteria. To establish this understanding, start by reading the "less like, more like" tables in *Tool 1A: PEEC Prescreen Response Form (Phenomena), Tool 1B: PEEC Prescreen Response Form (Three Dimensions),* and *Tool 1C: PEEC Prescreen Response Form (Three Dimensions for Instruction and Assessment*). These are shortened versions of the tables embedded in the NGSS Innovations discussion. If necessary, review the descriptions of NGSS Innovations 1 and 2, and answer the following questions for each criterion in the prescreen:

1. What would it look like for a student or teacher resource to be *organized* in a way that demonstrates this innovation?
2. How would *the content* of a student or teacher resource look different if it were demonstrating this innovation?

Applying the PEEC Prescreen

Once the reviewers have a common understanding of the evidence they are looking for, it is time to examine the instructional materials programs under consideration. For each instructional materials program that is to be reviewed, page through the selected program materials and examine the chapter/unit/overall organization as well as the individual lessons and units. For both the organization of the materials and the content, look for evidence that would indicate that the instructional materials program **is** designed for each criterion as well as for evidence that the program is **not** designed for each criterion.

There are three forms to use, one for each criterion, to collect and articulate this evidence: *Tool 1A: PEEC Prescreen Response Form (Phenomena), Tool 1B: PEEC Prescreen Response Form (Three Dimensions),* and *Tool 1C: PEEC Prescreen Response Form (Three Dimensions for Instruction and Assessment)*. See Table 8 below as an example. The recorded evidence should answer the question in the table, "What was in the materials, where was it, and why is this evidence?" relevant to each criterion.

During this stage of the work, it is important to remember that this is a prescreen and not the full evaluation. It is not necessary to find every piece of evidence in the program; instead, make a relatively quick pass through the materials. In materials that at least show promise for being designed for the NGSS, it should not be difficult to see evidence of at least an attempt to address these innovations. The degree to which these innovations are truly designed into the materials will be evaluated in more detail later in this process.

Table 8: Example Tool 1A: PEEC Prescreen Response Form (Phenomena)

Less Like This	**More Like This**	**Shows promise?**
Evidence this criterion **is not** designed into this instructional materials program. What was in the materials, where was it, and why is this evidence?	Evidence this criterion **is** designed into this instructional materials program. What was in the materials, where was it, and why is this evidence?	

Less Like This	More Like This	Shows prom-ise?
Page iii: table of contents is organized by "typical" science topics; the unit and chapter titles give no indication that students are making sense of phenomena or designing solutions to problems. Page 115 (Unit 4 teacher text) — the teacher support for using the phenomena of this unit only talks about using the phenomena as hooks or engagement; it positions the teacher to explain the phenomena rather than the students.	Pages 15–47 (Unit 1 student text) — though the title of this unit is "cells," it engages students with making sense of a series of phenomena; student explanations of several smaller phenomena support students to explain a larger phenomenon. Pages 124–177 (Unit 5 student text) — this unit explicitly incorporates the engineering design process; it is not just for enrichment, or a culminating activity; it is not just a directions-following activity. Pages 144–147 (Unit 5 teacher text) — there is ample support here for teachers to organize instruction to support student discourse and suitable information for teachers in our district that may not have experience with teaching engineering.	☐

Analyzing Results from A Prescreen

Once the evidence has been recorded on *Tool 1A: PEEC Prescreen Response Form (Phenomena), Tool 1B: PEEC Prescreen Response Form (Three Dimensions),* and *Tool 1C: PEEC Prescreen Response Form (Three Dimensions for Instruction and Assessment)*, it is time to decide if the evidence indicates that the instructional materials program shows promise. There are two levels where this question needs to be answered:

Is there enough evidence to check the "shows promise?" box for each criterion?

Tool 1A: PEEC Prescreen Response Form (Phenomena), Tool 1B: PEEC Prescreen Response Form (Three Dimensions), and *Tool 1C: PEEC Prescreen Response Form (Three Dimensions for Instruction and Assessment*) all include a "shows promise?" checkbox that should be considered once the evidence has been recorded on the tool.

To answer this question, weigh the “More Like This” evidence with the “Less Like This” evidence. This first phase of PEEC is meant to be a quick glance that sorts out instructional materials programs that are not designed for the NGSS—if a program is close, it warrants further review. Checking the box here does not mean that the criterion is thoroughly and appropriately designed into the instructional materials program, but it does mean the program shows promise and it is worth the time to dig deeper. Leaders should trust in the expertise of the educators doing the review—their knowledge of the innovations of the NGSS and their awareness of the needs of students in their classrooms is key to making this decision.

Is there enough evidence across the three criteria to warrant further review?

All three criteria should have their “Shows promise” box checked to indicate that there is sufficient *initial* evidence that the instructional materials program is designed to address these first two key innovations of the NGSS. If instructional materials programs that do not meet this expectation are carried over to the next step in this process, it should be done with the awareness that this will require more time, effort, and energy in the review process.

Wrapping Up a Prescreen

After applying the PEEC Prescreen across the instructional materials programs that are being considered, those that don’t meet the fundamental criteria of the prescreen should be set aside. They can always be analyzed later if none of the initial materials measures up, but the remaining analyses are more time- and resource-intensive, so focus on the programs that have the clearest prescreen evidence of NGSS design.

Each member of the review group should complete *Tool 2: PEEC Prescreen: Recommendation for Review?* to document their final analysis.

PEEC Phase 2: Unit Evaluation

1
- **PEEC Prescreen** - A quick look at instructional materials programs to narrow the scope of materials to be reviewed

2
- **Unit Evaluation** - A close look to verify the thoroughness with which the materials are designed for the NGSS

3
- **Program-Level Evaluation** - A broad look to evaluate the degree to which the NGSS Innovations permeate the entire program

Summary	PEEC Phase 2: Unit Evaluation uses the EQuIP Rubric for Science to dig deep into a given unit of an instructional materials program.
Process	4. Select a single unit from the instructional materials program in question to analyze. Use *Tool 3: Unit Selection Table*. 5. Apply the EQuIP Rubric for Science to the unit you have selected. 6. Connect the EQuIP Rubric for Science to the NGSS Innovations using *Tool 4: EQuIP Rubric Data Summary.*

Once instructional materials programs have been established by the PEEC Phase 1: Prescreen to at least have the appearance of being designed for the NGSS, the next step is to look at a full unit to evaluate evidence for the rest of the NGSS Innovations. Luckily, a tool already exists for this type of evaluation; the Educators Evaluating the Quality of Instructional Products (EQuIP) Rubric for Science provides criteria by which to measure the alignment and overall quality of lessons and units with respect to the NGSS. The EQuIP Rubric for Science guides reviewers to look for evidence of three categories of NGSS Design, as shown in Table 9.

Table 9: Categories of Evidence in the EQuIP Rubric for Science

Cate-gory	Title	Description
1	NGSS Three-Dimensional Design	The unit is designed so students make sense of phenomena and/or design solutions to problems by engaging in student performances that integrate the three dimensions of the NGSS.
2	NGSS Instructional Supports	The unit supports three-dimensional teaching and learning for ALL students by placing lessons in a sequence of learning for all three dimensions and providing support for teachers to engage all students.
3	Monitoring NGSS Student Progress	The unit supports monitoring student progress in all three dimensions of the NGSS as students make sense of phenomena and/or design solutions to problems.

Selecting a Unit

There are a variety of factors to consider in selecting a single unit to represent an instructional materials program in the unit evaluation process. These include: the length of the unit; similarity of units across programs; evaluator expertise; and available resources for review. These features are described in this section. *Tool 3: Unit Selection Table* should be used by groups to make the unit selection.

Different instructional materials programs may define a "unit" in different ways, so it will be important to look across the programs that have cleared the prescreen and select a portion of the program that has a comparable length of instruction. Generally, a unit is a collection of lessons in an intentional sequence tied to a learning goal. Units usually take longer than two weeks classroom time to complete, whereas lessons take a few days.

To be able to effectively apply the EQuIP Rubric for Science, a selected unit should include sufficient length for students to:

- Explain at least one phenomenon and/or design a solution to at least one problem;
- Engage in at least one three-dimensional student performance; and
- Have their learning measured across the three dimensions of the standards.

The unit evaluation should also include the teacher support materials that correspond with the unit of instruction. The only caveat to this would be if these materials will not be available to the teachers who will be implementing the program. In this case, only student materials should be evaluated. The unit for evaluation may correspond with a chapter or unit in a book, or the materials accompanying an online module, but reviewers should strive to select a comparable section for review across programs.

As instructional materials programs are being designed for the NGSS and focusing more on students using the three dimensions to make sense of phenomena and design solutions to problems, it is quite possible that the units may not be as easily comparable in topic and organization as they once were. For example, most current high school biology texts have a single Biology unit focused on photosynthesis. However, as instructional materials programs designed with the NGSS Innovations in mind are developed, the DCI information related to photosynthesis may be spread out through both Chemistry and Biology courses, and the concepts might be developed through several different instructional units. Since developers will likely not all make curriculum design decisions in the same way, finding the right unit to compare may become increasingly difficult. A plan should be made to ensure that a comparable unit is selected across programs.

In considering which unit to review in each program, it is also important to consider the expertise of the review team. Review team members' understanding of the three dimensions of the standards addressed in the unit being reviewed will affect the quality of their reviews. As an obvious example, a physics teachers may not have the deep understanding of cellular respiration needed to evaluate a photosynthesis unit. Similarly, a review team without a deep understanding of the grade-level expectations of a CCC might not catch it when the CCC that is addressed in a unit is at a much lower grade lever. But expertise can cut both ways: reviewers with deep knowledge of the DCIs in the unit may be able to better recognize deficiencies in how the DCIs are addressed, but they also might read between the lines to see connections that are not explicit in the program—they might see connections that teachers implementing the materials may not. It is important to know the review team's expertise, to deliberately to this into account in the selection of the unit for review and to support the team to be aware of their own strengths and weaknesses as they are reviewing materials.

As always, these factors will need to be balanced with the resources—people, time, and money—that are available. A longer selection will give a better look at what the program offers, but it will also take more resources to evaluate. Having multiple groups look at each resource and compare their evaluations will provide a more balanced evaluation, and the ensuing conversations, if properly facilitated, can help prepare teachers to implement the materials once they are selected. However, this requires a greater time commitment from those participating in the review.

For each program being reviewed, identify which unit will be reviewed and explain why that unit was selected in the *Tool 3: Unit Selection Table.*

Applying the EQuIP Rubric for Science

Once the unit that will be evaluated within each instructional materials program have been identified, it is time to use the EQuIP Rubric for Science to evaluate each unit. Full support for using the EQuIP Rubric for Science is not included within the PEEC document, but the process for using it is described within the rubric itself and in the EQuIP Professional Learning Facilitator's Guide and associated resources found on the EQuIP Rubric for Science webpage. Reviewers should not be expected to reliably apply this rubric to units without professional learning support. *It is not necessary to use the scoring guide portion of the rubric*, because of how the information from EQuIP is incorporated into PEEC, but it is important to gather specific evidence of each criterion within the unit.

Connecting the EQuIP Rubric for Science to the NGSS Innovations:

Once the EQuIP Rubric for Science has been completed for the unit, transfer the information captured in the "Evidence of Quality?" checkboxes to *Tool 4: EQuIP Rubric Data Summary* and then, based on the pattern of checks and the evidence recorded in the rubric, decide the degree to which the unit appears to have integrated the NGSS Innovations.

PEEC Phase 3: Program-Level Evaluation

1. **PEEC Prescreen** - A quick look at instructional materials programs to narrow the scope of materials to be reviewed
2. **Unit Evaluation** - A close look to verify the thoroughness with which the materials are designed for the NGSS
3. **Program-Level Evaluation** - A broad look to evaluate the degree to which the NGSS Innovations permeate the entire program

Summary	In PEEC Phase 3: Program-Level Evaluation, the NGSS Innovations are evaluated across an entire program.
Process	7. Determine a sampling plan for the instructional materials program in question. 8. Review evidence and associated claims from the sample. 9. Sum up the claims and make a final recommendation.

The EQuIP Rubric for Science provides a close look at a single unit, but in programs designed for the NGSS, the NGSS Innovations need to build across the program. For each of the Innovations, this means looking for evidence beyond just the unit that was evaluated in PEEC Phase 2.

For example, the unit may have provided multiple and varied opportunities for students to ask scientific questions based on their experiences—clearly engaging students in the SEP “Asking Questions and Designing Problems” —but the scope of the unit may have been limited to developing a particular element of the SEP (e.g., only asking scientific questions without opportunities to define criteria and constraints associated with the solution to a problem) or to developing student facility with a particular element to a certain degree (e.g., appropriately removing scaffolds for development within the unit but not for the full expression of the SEP; only beginning to connect this SEP to other relevant SEPs). It is also important that that elements of that practice are effectively incorporated throughout the instructional year. As is described in *Innovation 3: Building Progressions*, an instructional materials program designed for the NGSS will not only engage students in the practices, but will also build their understanding and use of each practice over time. If the unit evaluated in PEEC Phase 2 is either the only time that students engage in this practice, or if students engage in the practice the same way every time, then this innovation is not embedded in the program. PEEC Phase 3: Program-Level Evaluation will support reviewers in examining the instructional materials program to determine whether the unit was representative of how well the NGSS Innovations are embedded throughout the instructional materials program.

To do this across the entire instructional materials program, PEEC uses a different lens for evaluation. In this phase of evaluation, the student and teacher materials are evaluated to look for evidence of claims that would be expected to be present in materials designed for the NGSS. This will build on the evidence base of the PEEC Prescreen and Unit Evaluation to move reviewers to a final decision about which program to select.

Creating A Sampling Plan

Reviewing every lesson, unit, and component of an instructional materials program is not feasible in most circumstances; the time and effort for such a task would outweigh the benefit for most users. Instead, PEEC users should develop a sampling plan that articulates which portion of the instructional materials program is subject to review. This is particularly important when comparing instructional materials programs.

A sampling plan is a document that articulates which portions or sections of a set of instructional material programs will be reviewed during PEEC Phase 3: Program-Level Evaluation. Sampling plans generally focus on learning sequences, which would feature four or five classroom lessons. A sampling plan should:

- Focus on learning sequences that span at least 4-5 lessons
- Choose at least three learning sequences
- Ensure the learning sequences come from the beginning, middle, and end of the instructional materials program

An example sampling plan thus might look like the following.

As we use PEEC to review Amazing Science ©2017, we will

1. *Sample three learning sequences consisting of four to five lessons per sequence. Based on our unit analysis in Phase 2, this sample should allow us to look for the development and use of the three dimensions together over time in service of students progressively making sense of phenomena.*

2. *Intentionally select one learning sequence from the beginning third of the program, one in the middle third, and one in the final third to ensure that instructional sequences logically build student proficiency from the beginning to the end of the year (one of these samples could be the unit evaluated in phase 2).*
3. *Select sequences that allow for some connectivity across the year, such as a particular SEP or CCC being foregrounded in all three sequences or sequences that build on related DCIs.*
4. *Select sequences that cover a range of the three-dimensions so that we can evaluate some measure of coverage.*

Reviewing Claims and Evidence from The Sample

Once the sampling evaluation plan has been established, read through the claims in *Tool 5A: Program-Level Evaluation Innovation 1: Making Sense of Phenomena and Designing Solutions to Problems* and then read through the sample identified in the immediately preceding step to determine if there is evidence in the materials that would support the claim. Record evidence you find on the tool.

Once the evidence has been recorded, evaluate the degree to which there is evidence of each criteria. Use the following as guidance for evaluating the categories/samples:

- **No Evidence:** There is not any evidence to support the claim in the sampled materials.
- **Inadequate Evidence:** There are a few instances of evidence to support the claim, but they are intermittent or do not constitute adequate time or opportunity for students to learn the content or develop the ability.
- **Adequate Evidence:** Evidence for this claim is common and there is adequate time and opportunity, and support for all students to learn the content and develop the abilities.
- **Extensive Evidence:** Evidence for this claim is pervasive throughout the program and there is adequate time, opportunity, and support for **all** students to learn the content and develop the abilities.

These ratings of the quality of evidence supporting each claim should be done first individually and then discussed as a group to reach consensus.

Finally, based on the evidence collected and the pattern of checks, complete the bottom portion of the Tool that asks reviewers to decide the degree to which the innovation shows up across the program. For materials that only partially incorporate the innovation, provide suggestions for what will be needed: professional learning; additional lessons, units, or modules; developing a district-wide approach to using the crosscutting concepts (because they are not well represented in the materials); etc.

Repeat this process for the remaining four NGSS Innovations by completing *Tool 5B: Program-Level Evaluation Innovation 2: Three-Dimensional Learning, Tool 5C: Program-Level Evaluation Innovation 3: Building Progressions, Tool 5D: Program-Level Evaluation Innovation 4: Alignment* *with English Language Arts and Mathematics,* and *Tool 5E: Program-Level Evaluation Innovation 5: All Standards, All Students.*

Summing Up

To finish the PEEC process, complete *Tool 6: PEEC Evidence Summary,* adding information from each phase of the PEEC process for the instructional materials program in question. Finally, complete *Tool 7: Final Evaluation* to articulate your final recommendation.

Beyond PEEC

It is important to reiterate that there are certainly additional criteria for evaluating the quality of instructional materials that are not discussed in this document. Their omission is not because they are not important, but merely because they are not unique to materials designed for the NGSS. Examples of these criteria can be found below. The additional criteria required by each district or state can be applied during or after phase 3 of the PEEC evaluation process.

These additional criteria should be present in all high-quality science instructional materials, but are not specific to NGSS.

Does the instructional materials program in question:

Student Instructional Materials

- Adhere to safety rules and regulations?
- Provide high-quality (e.g., durable, dependable, functioning as intended) materials, equipment in kits, technological components, or online resources, where applicable?

Teacher Instructional Materials and Support

- Include precise and usable technology specifications?
- Describe strategies including alternative approaches and delivery that will assist in differentiating instruction to meet the needs of all students (e.g., English learners, special needs students, advanced learners, struggling students)?
- Include a detailed list of needed materials, both consumable (e.g., cotton balls, pinto beans) and permanent (e.g., laboratory equipment), that are to be used throughout the program?
- Provide sufficient description about how to use materials and laboratory equipment, including safety practices and possible room arrangements?

Equitable Opportunity to Learn in Instructional Materials

- Provide the appropriate reading, writing, listening, and/or speaking modifications (e.g., translations, front-loaded vocabulary word lists, picture support, graphic organizers) for students who are English learners, have special needs, or read below the grade level?
- Provide extra support for students who are struggling to meet performance expectations?

Assessment in Instructional Materials

- Include assessments with explicitly stated purposes that are consistent with the decisions they are designed to inform?
- Include assessments with clear systems to help educators use the resulting data for feedback and monitoring purposes?
- Include assessments that are embedded throughout the instructional materials as tools for monitoring students' learning and teachers' instruction?
- Include assessments that use varied methods, languages, representations, and examples to provide teachers with a range of data to inform instruction?
- Include assessments that are unbiased and accessible to all students?

Glossary

The following terms are used throughout PEEC. For additional help with language and terms used here, please see the List of Common Acronyms used by Next Generation Science Standards.

Bundles/Bundling. Grouping elements or concepts from multiple performance expectations into lessons, units, and/or assessments that students can develop and use together to build toward proficiency on a set of performance expectations in a coherent manner. The article available here provides more description and some video examples of bundles and bundling.

Crosscutting Concepts (CCC). These are concepts that hold true across the natural and engineered world. Students can use them to make connections across seemingly disparate disciplines or situations, connect new learning to prior experiences, and more deeply engage with material across the other dimensions. The NGSS requires that students explicitly use their understanding of the CCCs to make sense of phenomena or solve problems.

Disciplinary Core Ideas (DCI). The fundamental ideas that are necessary for understanding a given science discipline. The core ideas all have broad importance within or across science or engineering disciplines, provide a key tool for understanding or investigating complex ideas and solving problems, relate to societal or personal concerns, and can be taught over multiple grade levels at progressive levels of depth and complexity.

EQuIP Rubric for Science. Educators Evaluating Quality in Instructional Products (EQuIP) for science is a tool and accompanying process for evaluating how well an individual lesson or single unit (series of related lessons) is designed to support students developing the knowledge and practice described by the Framework and the NGSS.

The Framework**.** A shortened title for the 2012 foundational report, *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*, published by the National Research Council (NRC) describes the scientific consensus for the science knowledge and skills students should acquire during their K-12 experience. A team of states, coordinated by Achieve, took the Framework and used it to develop the Next Generation Science Standards. *The Framework* is available online in a variety of formats from the National Academies Press.

Instructional Materials. Tools used by teachers to plan and deliver lessons for students. Generally instructional materials include activities for daily instruction (“lessons”), that are organized into sequences (“units”, “chapters”).

Instructional Materials Program. A set of instructional materials that spans a large chunk of time or instruction, generally a full course (e.g. a Biology textbook) or a middle-grades science sequence. Distinguished from instructional materials that are not nearly as comprehensive, such as those that focus on only a few days or weeks of instruction or on a given content area.

Learning Sequence. Several connected and sequential lesson that build student understanding toward a set of learning goals progressively, over the course of weeks (as opposed to days).

Learning sequences target complete three-dimensional learning goals through a variety of classroom experiences.

Lesson. A set of instructional activities and assessments that may extend over several class periods or days; it is more than a single activity.

NGSS Innovations. This document describes five NGSS Innovations that describe and explain what is new and different about the NGSS, particularly regarding instructional materials design and selection. The NGSS Innovations build on the conceptual shifts described in Appendix A of the NGSS.

PEEC. Primary Evaluation of Essential Criteria (PEEC) takes the compelling vision for science education as described in *A Framework for K–12 Science Education* and embodied in the Next Generation Science Standards (NGSS) and operationalizes it for two purposes:

1. to help educators determine how well instructional materials under consideration have been designed for the *Framework* and NGSS, and
2. to help curriculum developers construct and write science instructional materials that are designed for the *Framework* and NGSS.

Performance Expectations (PEs). The NGSS are organized into a set of expectations for what students should be able to do by the end of a period of instruction, generally measured by years of schooling. The performance expectations describe the learning goals or outcomes for students. Each performance expectation describes what students who demonstrate understanding can do, often with a **clarification statement** that provides examples or additional emphasis for individual performance expectation. An **assessment boundary** guides the developers of large-scale assessments. Each performance expectation is derived from a set of disciplinary core ideas, cross-cutting concepts, and science and engineering practices that are defined in the *Framework*. Note that like all sets of standards, the NGSS do not prescribe the methods or curriculum needed to reach these outcomes.

Phenomena. Observable events that students can use the three dimensions to explain or make sense of. Lessons designed for the NGSS focus on explaining phenomena or designing solutions to problems. Some additional resources about phenomena are available on the NGSS website.

Science and Engineering Practices (SEP). The practices are what students *do* to make sense of phenomena. They are both a set of skills and a set of knowledge to be internalized. The SEPs reflect the major practices that scientists and engineers use to investigate the world and design and build systems.

Three-Dimensional Learning. Learning that integrates all three dimensions of the NGSS, that allows students to actively engage with the practices and apply the crosscutting concepts to deepen their understanding of core ideas across science disciplines. Click here to read more.

Three Dimensions. As described in the *Framework*, these are the three strands of knowledge and skills that students should explicitly be able to use to explain phenomena and design solutions to problems. The three dimensions are the Disciplinary Core Ideas (DCIs), Crosscutting

Concepts (CCCs), and Science and Engineering Practices ("the Practices" or SEPs). More information about the three dimensions is available here.

Unit. A set of lessons that extend over a longer time period.

Frequently Asked Questions

The following questions may help clarify some of the specifics about PEEC.

Question 1: Who is the primary audience for PEEC?

PEEC supports educators, developers, and publishers. For educators, the evaluation tool clarifies *what to look for* when identifying or selecting instructional materials programs and assessments for the NGSS. For developers and publishers, PEEC provides guidance on *what to focus on and integrate* when designing instructional materials programs for the NGSS. This tool (1) prepares educators to accurately identify, select, or evaluate resources and (2) helps enable developers and publishers to effectively design resources that meet criteria for the NGSS.

Question 2: How do the five innovations described in PEEC differ from the "conceptual shifts" in Appendix A of the NGSS and the implications of the vision of the Framework and the NGSS from the Guide to Implementing the NGSS?

PEEC focuses on what makes the NGSS new and different from past science standards. These differences were first articulated as conceptual shifts in Appendix A of the standards. These conceptual shifts still hold true today, but four years of standards implementation has refined the understanding of what is unique about the NGSS and has revealed that these shifts represent innovations in science teaching and learning.

The five "NGSS Innovations" described in PEEC are:

1. **Making Sense of Phenomena and Designing Solutions to Problems**. Making sense of phenomena or designing solutions to problems drives student learning.
2. **Three-Dimensional Learning.** Student engagement in making sense of phenomena and designing solutions to problems *requires* student performances that integrate grade-appropriate elements of the Science and Engineering Practices (SEPs), Crosscutting Concepts (CCCs), and Disciplinary Core Ideas (DCIs) in instruction and assessment.
3. **Building K–12 Progressions.** Students' three-dimensional learning experiences are designed and coordinated over time to ensure students build understanding of *all three dimensions* of the standards, nature of science concepts, and engineering as expected by the standards.
4. **Alignment with English Language Arts and Mathematics.** Students engage in learning experiences with explicit connections to and alignment with English language arts (ELA) and mathematics standards.
5. **All Standards, All Students.** Science instructional materials support equitable access to science education for all students.

Question 3: How does PEEC relate to the EQuIP Rubric for Science?

The EQuIP Rubric for Science is designed to evaluate learning sequences and units for the degree to which they are designed for the NGSS. It is embedded within PEEC as the tool for evaluating a sample unit from the program as Phase 2 in the PEEC process. The evaluation from this phase is combined with the PEEC Phase 1: Prescreen and PEEC Phase 3: Program Evaluation to give an overall picture of how well the instructional materials program is designed for the NGSS.

Question 4: Is this a science version of the Publisher's Criteria that was developed for the Common Core State Standards for mathematics?

Both PEEC and the *Publisher's Criteria* documents are intended to inform both the developers of instructional materials and those making the selection of which materials to use. The *NGSS Innovations* in PEEC highlight the key differences in NGSS from previous sets of standards and clarifies how these innovations should be represented in instructional materials.

Question 5: I'm interested in working with Achieve to train my teachers on how to use PEEC to evaluate instructional materials. What should I do?

If you are interested in hiring Achieve to facilitate professional learning to support your district team in using PEEC to select instructional materials, please contact peec@achieve.org. Training for effective use takes a minimum of two days if the entire group has already received professional learning for and are comfortable using EQuIP and a minimum of four days if they are not proficient in using EQUIP.

Question 6: I'm a science teacher. How should I use PEEC?

PEEC is designed to support building and district-level selection of year-long (or longer) instructional materials programs designed for the NGSS. Sometimes this task falls to teachers to coordinate. PEEC provides guidelines for a process that teams can use to evaluate instructional materials programs.

If you are not part of your school or district's instructional materials program selection process, but you want to make sure that the process is focusing on the appropriate criteria, share and discuss this tool with those responsible for making these decisions.

If you are looking for support in transitioning your classroom lessons and units, you may want to review the NGSS Lesson Screener or the EQUIP Rubric for Science.

Question 7: I'm a school principal. How should I use PEEC?

While principals are not the primary audience for PEEC, there are several ways that it might be relevant to your work. Some principals help with the selection of instructional materials for your school or district, and PEEC includes both criteria and a process that can be used for that purpose. If selecting instructional material programs is not a part of your duties, then share and discuss this tool with those science teachers and administrators who are responsible for making these decisions.

Question 8: I'm a district science leader or curriculum coordinator. How should I use PEEC?

If you're in charge of coordinating the selection of science instructional materials, PEEC is built to help your team make good decisions about what materials to purchase (or even to wait to purchase materials until you find something that better matches your expectations): the *NGSS Innovations* described in PEEC will help your selection team to develop a common understanding of what to look for in materials designed for the NGSS; PEEC Appendix A will help you to think about building your team and fitting materials selection into your broader implementation plan for science; and the three phases of the PEEC process will help you to design the process that you use for materials selection. If your team is already well-versed in *A Framework for K-12 Science Education* and the NGSS, anticipate about three full days of professional learning to prepare your team for this effort and then several days to dig in and evaluate the materials (depending on how many materials are evaluated).

Question 9: I'm a developer or publisher of science instructional materials. How should I use the PEEC tool?

The *NGSS Innovations* section of PEEC describes the most significant changes from past science standards to the NGSS and their implications for instructional materials. These innovations should focus the efforts to design materials for the NGSS and should be clearly apparent to those making instructional materials selection decisions. A developer might also use the PEEC processes and tools internally to self-evaluate the program that you are developing.

If you are interested in professional learning for your development staff to better understand the evaluations and apply the rubric, or are interested in a confidential review of your materials, please contact peec@achieve.org to discuss your needs in greater depth.

Question 10: Some instructional materials are more expensive than others. Why doesn't PEEC include cost estimates?

PEEC does not attempt to measure all things that might be considered in selecting instructional materials. It is focused on evaluating how well an instructional materials program is designed for the NGSS and asks reviewers to reflect on what the professional learning lift would be to address any aspects of the innovations that are not well-supported in the materials. There are some additional criteria in PEEC Appendix D that you may want to consider. Of course, purchasers must determine how to weigh quality versus cost considerations in choosing instructional materials.

Question 11: How is this document different from the **Guidelines for the Evaluation of Instructional Materials in Science?**

The *Guidelines for the Evaluation of Instructional Materials in Science* is not a tool or process for evaluating instructional materials; rather, it describes the research base for evaluative criteria that should be considered in building tools and processes for evaluating instructional materials designed for the NGSS. Its development was informed by early versions of EQuIP Rubric for Science and PEEC, and it informed the most recent version of PEEC. The criteria for all three phases of PEEC have a close connection to those presented in the *Guidelines*.

A full description of alignment to the *Guidelines* will be available in PEEC 1.2.

Question 12: This document is listed as "Version 1.1". What's different from version 1.0?

One of the pieces highlighted for revision in version 1.0 was, "Iterating the Innovations. How can the arguments and discussion about the five NGSS Innovations be more clear and straightforward?" We received feedback from users in the field and from field testing that helped us to revise the language of the innovations to better convey their original intent. In particular, version 1.1:

- highlights the importance of equity and access for all students as foundational to all five innovations;
- separates the NGSS Innovations from their implications for instructional materials in the NGSS Innovations section;
- revises the wording of the NGSS Innovations for clarity.

As was the case with the EQuIP Rubric for Science, we expect that as more and more teachers, schools, districts, authors, developers, and publishers use PEEC, the feedback loops in that process will lead to ongoing improvements in PEEC. Please send comments and suggestions to peec@achieve.org.

Question 13: What's coming in subsequent versions of PEEC?

Subsequent versions of PEEC will include the following enhancements:

Guidelines Alignment. Version 1.2 of PEEC will include a full description of alignment to the *Guidelines for the Evaluation of Instructional Materials in Science.*

Sampling. More specific guidance will be provided about how to sample instructional materials programs to best balance both a rigorous review and the time commitment of the reviewer

Evidence. More examples and specifics will be provided about what users should classify as evidence and provide support to determine if the quantity and quality of evidence collected is sufficient to justify a particular claim.

Utility. The forms and tools will be made more useful for users, including templates and fillable forms.

PEEC Professional Learning Facilitator's Guide Coordination. Just like the EQuIP Rubric for Science, a guide is currently under development to support leaders looking to facilitate professional learning for a selection team. Future versions of PEEC will build a tighter connection to the guide under development. This guidance will include:

- **Streamlined processes for time-constrained users.** Guidance will be provided for how to adapt the PEEC tools and processes for situations that do not allow for the full process due to resource limitations
- **Streamlined presentation of the document and related resources.** PEEC's design will be enhanced to better support users that want to adapt their use to meet local needs.
- **Teaming and Decision Making**. More detailed support about how to put together a materials selection team, how to manage and facilitate the decision-making processes within that team, and how to connect instructional materials review to a broader implementation plan.

PEEC is a work in progress. Please send comments and suggestions for improvement to peec@achieve.org.

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Tool 1A: PEEC Prescreen Response Form (Phenomena)

This tool is used during Phase 1: PEEC Prescreen to collect and organize data that describes how a single instructional materials program supports students in making sense of phenomena and designing solutions to problems.

Making Sense of Phenomena and Designing Solutions to Problems: The instructional materials program **focuses** on supporting students to make sense of a phenomenon or design solutions to a problem.

NGSS-designed programs will look *less* like this:	**NGSS-designed programs will look *more* like this:**
Making sense of phenomena and designing solutions to problems are not a part of student learning or are presented separately from “learning time” (i.e. used only as a “hook” or engagement tool; used only for enrichment or reward after learning; only loosely connected to a DCI).	The <u>purpose and focus</u> of a learning sequence is to support students in making sense of phenomena and/or designing solutions to problems. The entire sequence drives toward this goal.
The focus is only on getting the “right” answer to explain a phenomenon or replicating a known solution to a problem.	Student sense-making of phenomena or designing of solutions is used as a window into student understanding of all three dimensions of the NGSS.
A different, new, or unrelated phenomenon is used to start every lesson.	Lessons work together in a coherent storyline to help students make sense of phenomena.

Teachers tell students about an interesting phenomenon or problem in the world.	Students get direct (preferably firsthand, or through media representations) experience with a phenomenon or problem that is relevant to them and is developmentally appropriate.
Phenomena are brought into learning after students develop the science ideas so students can apply what they learned.	The development of science ideas is anchored in making sense of phenomena or designing solutions to problems.

Using the chart below, record evidence that would indicate that the instructional materials program **is** designed for each criterion as well as for evidence that the program is **not** designed for each criterion.

Less Like This Evidence this criterion IS NOT designed into this instructional materials program What was in the materials, where was it, and why is this evidence?	**More like this** Evidence this criterion IS designed into this instructional materials program What was in the materials, where was it, and why is this evidence?	Shows Promise?
		☐

Tool 1B: PEEC Prescreen Response Form (Three Dimensions)

This tool is used during Phase 1: PEEC Prescreen to collect and organize data that describes how a single instructional materials program supports students in three-dimensional learning.

Three Dimensions: Students develop and use grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs), which are deliberately selected to aid student sense-making of phenomena or designing of solutions across the learning sequences and units of the program.

NGSS-designed programs will look *less* like this:	**NGSS-designed programs will look *more* like this:**
A single practice element shows up in a learning sequence.	The learning sequence helps students use multiple (e.g., 2–4) practice elements as appropriate in their learning.
The learning sequence focuses on colloquial definitions of the practice or crosscutting concept names (e.g., “asking questions”, “cause and effect”) rather than on grade-appropriate learning goals (e.g., elements in NGSS Appendices F &G).	Specific grade-appropriate elements of SEPs and CCCs (from NGSS Appendices F & G) are <u>acquired</u>, <u>improved</u>, or <u>used</u> by students to help explain phenomena or solve problems during the learning sequence.
The SEPs and CCCs can be inferred by the teacher (not necessarily the students) from the materials.	Students explicitly use the SEP and CCC elements to make sense of the phenomenon or to solve a problem.

Engineering lessons focus on trial and error activities that don't require science or engineering knowledge.	Engineering embedded in the learning sequence requires students to acquire and use elements of DCIs from physical, life, or Earth and space sciences together with elements of DCIs from engineering to solve design problems.

Using the chart below, record evidence that would indicate that the instructional materials program **is** designed for each criterion as well as for evidence that the program is **not** designed for each criterion.

Less Like This Evidence this criterion IS NOT designed into this instructional materials program What was in the materials, where was it, and why is this evidence?	**More like this** Evidence this criterion IS designed into this instructional materials program What was in the materials, where was it, and why is this evidence?	Shows Promise?
		☐

Tool 1C: PEEC Prescreen Response Form (Three Dimensions for Instruction and Assessment)

This tool is used during Phase 1: PEEC Prescreen to collect and organize data that describes how a single instructional materials program integrates the three dimensions for instruction and assessment.

Integrating the Three Dimensions for Instruction and Assessment: The instructional materials program requires student performances that integrate elements of the SEPs, CCCs, and DCIs to make sense of phenomena or design solutions to problems, and the learning sequence elicits student artifacts that show **direct, observable evidence** of three-dimensional learning.

NGSS-designed programs will look *less* like this:	**NGSS-designed programs will look *more* like this:**
Students learn the three dimensions in isolation from each other (e.g., a separate lesson or activity on science methods followed by a later lesson on science knowledge).	The learning sequence is designed to build student proficiency in at least one grade-appropriate element from each of the three dimensions. The three dimensions intentionally work together to help students explain a phenomenon or design solutions to a problem. All three dimensions are *necessary* for sense-making and problem-solving.
Teachers assume that correct answers indicate student proficiency without the student providing evidence or reasoning.	Teachers deliberately seek out *student artifacts* that show direct, observable evidence of learning, building toward all three dimensions of the NGSS at a grade-appropriate level.

NGSS-designed programs will look *less* like this:	NGSS-designed programs will look *more* like this:
Teachers measure only one dimension at a time (e.g., separate items for measuring SEPs, DCIs, and CCCs).	Teachers use tasks that ask students to explain phenomena or design solutions to problems, and that reveal the level of student proficiency in *all three dimensions*.

Using the chart below, record evidence that would indicate that the instructional materials program **is** designed for each criterion as well as for evidence that the program is **not** designed for each criterion.

Less Like This Evidence this criterion IS NOT designed into this instructional materials program. What was in the materials, where was it, and why is this evidence?	**More like this** Evidence this criterion IS designed into this instructional materials program What was in the materials, where was it, and why is this evidence?	Shows Promise?
		☐

Tool 2: PEEC Prescreen: Recommendation for Review?

This tool is used by a reviewer upon completion of PEEC Phase 1: Prescreen to document their final recommendation for an instructional materials program.

Reviewer Name or ID: ______________________________ Grade: __________ Lesson/Unit Title: ________________________________

Reminder

The purpose of the PEEC Prescreen is to give a quick look at an instructional materials program. There are significant aspects of what would be expected in a fully-vetted program designed for the NGSS that are not addressed in this tool and it should not be used to fully vet resources or claim that the programs are designed for NGSS.

Overall Screening Summary

Recommendation

I recommend this resource to be evaluated by the full PEEC rubric: _________

Tool 3: Unit Selection Table

This tool is used by a group of reviews to select matching or similar units to review from multiple instructional materials programs.

Unit Target	What commonality makes the units comparable? [i.e., they address similar DCI-related topics (clarify which ones); they are designed to have students make sense of a similar phenomenon (clarify what makes the phenomenon similar); the unit is the best example of engineering integration in the program, etc.]		
Unit Description	Instructional Materials Program Name	Unit (title and page numbers)	Why this unit?

Tool 4: EQuIP Rubric Data Summary

This tool is used to summarize the results of the EQuIP Review for Science analysis of a given unit in one instructional materials program as part of PEEC Phase 2: Unit Evaluation.

<table>
<tr><th>Innovation</th><th>EQuIP Criterion</th><th>Evidence of Quality?</th><th>Unit Evaluation (summary)</th></tr>
<tr><td>Making Sense of Phenomena and Designing Solutions to Problems</td><td>I. A. Explaining Phenomena/ Designing Solutions</td><td>☐ None ☐ Inadequate ☐ Adequate ☐ Extensive</td><td>☐ Materials incorporate the innovation.
☐ Materials partially incorporate the innovation.
☐ Materials do not incorporate the innovation.</td></tr>
<tr><td rowspan="3">Three-Dimensional Learning</td><td>I. B. Three Dimensions</td><td>☐ None ☐ Inadequate ☐ Adequate ☐ Extensive</td><td rowspan="3"></td></tr>
<tr><td>I. C. Integrating the Three Dimensions</td><td>☐ None ☐ Inadequate ☐ Adequate ☐ Extensive</td></tr>
<tr><td>III. A. Monitoring 3D Student Performances</td><td>☐ None ☐ Inadequate ☐ Adequate ☐ Extensive</td></tr>
</table>

Innovation	EQuIP Criterion	Evidence of Quality?	Unit Evaluation (summary)
	III. B. Formative	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.
	III. C. Scoring Guidance	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	
	III. E. Coherent Assessment System	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	
Building K–12 Progressions	I. D. Unit Coherence	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.
	II. C. Building Progressions	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	
	II. F. Teacher Support for Unit Coherence	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	
Alignment with English language	I. F. Math and ELA	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	☐ Materials incorporate the innovation.

Innovation	EQuIP Criterion	Evidence of Quality?	Unit Evaluation (summary)
arts and Mathematics			☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.
All Standards, All Students	II. A. Relevance and Authenticity	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.
	II. B. Student Ideas	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	
	II. E. Differentiated Instruction	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	
	II. G. Scaffolded Differentiation over Time	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	
	III. D. Unbiased tasks/item	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	

Innovation	EQuIP Criterion	Evidence of Quality?	Unit Evaluation (summary)
	III. F. Opportunity to Learn	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive	

Narrowing the Field?

Depending on how many programs made it to this phase of the analysis, the EQuIP Rubric for Science evaluations may be used to continue to narrow the field of instructional materials programs being evaluated. After consensus reports have been generated for each unit, the review team should evaluate whether or not all programs are worthy of further review. Unless the separation in quality is very small, it is recommended that only the top two or three programs continue to the final phase of the PEEC process.

Tool 5A: Program-Level Evaluation Innovation 1: Making Sense of Phenomena and Designing Solutions to Problems

This tool is to be used to collect evidence and make claims about how an instructional materials program addresses NGSS Innovation 1: Making Sense of Phenomena and Designing Solutions to Problems.

Directions

Using the sampling evaluation plan, record evidence of where the innovation has been *clearly* incorporated into the materials as well as instances where it does not appear to have been incorporated. Your evidence should include page numbers, a brief description of the evidence, and an explanation of how it either supports or contradicts the claim.

Claim	**Evidence**	**Sufficient evidence to support the claim?**
From the student's perspective, most learning experiences are focused on making sense of phenomena and designing solutions to problems.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive

Claim	Evidence	Sufficient evidence to support the claim?
Guidance is provided to teachers to support students in making sense of phenomena and designing solutions to problems.	*What to look for as evidence:* *One phenomena/problem or a series of related phenomena/problem drive instruction and help maintain a focus for all the lessons in a sequence.* *Guidance is provided to the teacher for how each of the lessons supports students in explaining the phenomena or solving the problem* *Teaching strategies are provided to use student sense-making and solution-designing as a mechanism for making their three-dimensional learning visible.*	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive

Summary and Recommendations

1. Based on the evidence collected, to what degree to the materials incorporate this innovation over the course of the program?

   ☐ Materials incorporate the innovation.
   ☐ Materials partially incorporate the innovation.
   ☐ Materials do not incorporate the innovation.

2. Reviewer Notes/Comments:

3. If this innovation is only partially incorporated, suggest additional professional learning or other support that would be needed for teachers to use the materials in a way that incorporated the innovation in their instruction.

Tool 5B: Program-Level Evaluation Innovation 2: Three-Dimensional Learning

This tool is to be used to collect evidence and make claims about how an instructional materials program addresses NGSS Innovation 2: Three-Dimensional Learning.

Directions

Using the sampling evaluation plan, record evidence of where the innovation has been *clearly* incorporated into the materials as well as instances where it does not appear to have been incorporated. Your evidence should include page numbers, a brief description of the evidence, and an explanation of how it either supports or contradicts the claim.

Claim	Evidence	Sufficient evidence to support the claim?
Student sense-making of phenomena and/or designing of solutions requires student performances that integrate grade-appropriate elements of the SEPs, CCCs, and DCIs.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive
Teacher materials communicate the deliberate and intentional design underpinning the selection of three-dimensional learning goals across the program.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive

Claim	Evidence	Sufficient evidence to support the claim?
Student materials include accessible and unbiased formative and summative assessments that provide clear evidence of students' three-dimensional learning.	*What to look for as evidence in the student materials:* • *Materials regularly elicit direct, observable evidence of three-dimensional learning (SEP, DCI, CCC);* • *Materials include authentic and relevant tasks that require students to use appropriate elements of the three dimensions;* • *Provide a range of item formats, including construct-response and performance tasks, which are essential for the assessment of three-dimensional learning consonant with the framework and the NGSS.*	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive
Over the course of the program, a system of assessments coordinates the variety of ways student learning is monitored to provide information to students and teachers regarding student progress for all three dimensions of the standards.	*What to look for as evidence in the assessment system:* • *Consistent use of pre-, formative, summative, self- and peer-assessment measures that assess three-dimensional learning;* • *Consistent support for teachers to adjust instruction based on suggested formative classroom tasks; and* • *Support for teachers and other leaders to make program-level decisions based on unit, interim, and/or year-long summative assessment data.*	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive

Claim	Evidence	Sufficient evidence to support the claim?
When appropriate, links are made across the science domains of life science, physical science, and Earth and space science.	*What to look for as evidence:* • *Disciplinary core ideas from different disciplines are used together to explain phenomena.* • *The usefulness of crosscutting concepts to make sense of phenomena or design solutions to problems across science domains is highlighted.*	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive

Summary and Recommendations

1. Based on the evidence collected, to what degree to the materials incorporate this innovation over the course of the program?

   ☐ Materials incorporate the innovation.
   ☐ Materials partially incorporate the innovation.
   ☐ Materials do not incorporate the innovation.

2. Reviewer Notes/Comments

3. If this innovation is only partially incorporated, suggest additional professional learning or other support that would be needed for teachers to use the materials in a way that incorporated the innovation in their instruction.

Tool 5C: Program-Level Evaluation Innovation 3: Building Progressions

This tool is to be used to collect evidence and make claims about how an instructional materials program addresses NGSS Innovation 3: Building Progressions.

Directions

Using the sampling evaluation plan, record evidence of where the innovation has been *clearly* incorporated into the materials as well as instances where it does not appear to have been incorporated. Your evidence should include page numbers, a brief description of the evidence, and an explanation of how it either supports or contradicts the claim.

Claim	**Evidence**	**Sufficient evidence to support the claim?**
Students engage in the science and engineering practices with increasing, grade-level appropriate complexity over the course of the program.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive
Students utilize the crosscutting concepts with increasing grade-level appropriate complexity over the course of the program.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive

Claim	Evidence	Sufficient evidence to support the claim?
The disciplinary core ideas are presented in a way that is scientifically accurate and grade-level appropriate.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive
Teacher materials make it clear how each of the three dimensions *builds progressively over the course of the program* in a way that gives students multiple opportunities to demonstrate proficiency in the breadth of the performance expectations addressed in the program.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive
Each unit builds on prior units by addressing questions raised in those units, cultivating new questions that build on what students figured out, or cultivating new questions from related phenomena, problems, and prior student experiences.	*What to look for as evidence:* *For each of the units, look at the transitions into and out of the units. Are the units linked together from a student's perspective?*	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive

Claim	Evidence	Sufficient evidence to support the claim?
Teacher materials clearly explain the design principles behind the sequencing of the storyline.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive
Student materials engage students with the nature of science and engineering, technology, and applications of science over the course of the program.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive
Teacher materials make connections to the nature of science; engineering, technology, and applications of science over the course of the program.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive

Summary and Recommendations

1. Based on the evidence collected, to what degree to the materials incorporate this innovation over the course of the program?

   ☐ Materials incorporate the innovation.
   ☐ Materials partially incorporate the innovation.
   ☐ Materials do not incorporate the innovation.

2. Reviewer Notes/Comments

3. If this innovation is only partially incorporated, suggest additional professional learning or other support that would be needed for teachers to use the materials in a way that incorporated the innovation in their instruction.

Tool 5D: Program-Level Evaluation Innovation 4: Alignment with English Language Arts and Mathematics

This tool is to be used to collect evidence and make claims about how an instructional materials program addresses NGSS Innovation 4: Alignment with English Language Arts and Mathematics.

Directions

Using the sampling evaluation plan, record evidence of where the innovation has been *clearly* incorporated into the materials as well as instances where it does not appear to have been incorporated. Your evidence should include page numbers, a brief description of the evidence, and an explanation of how it either supports or contradicts the claim.

Claim	**Evidence**	**Sufficient evidence to support the claim?**
Materials engage students with English language arts in developmentally-appropriate ways (supporting state English language arts standards)		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive
Materials engage students with mathematics in developmentally appropriate ways (supporting state mathematics standards)		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive

Claim	Evidence	Sufficient evidence to support the claim?
Teacher materials make connections to state mathematics and English language arts standards and incorporate teaching strategies that support this student learning where appropriate.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive

Summary and Recommendations

1. Based on the evidence collected, to what degree to the materials incorporate this innovation over the course of the program?

   ☐ Materials incorporate the innovation.
   ☐ Materials partially incorporate the innovation.
   ☐ Materials do not incorporate the innovation.

2. Reviewer Notes/Comments

3. If this innovation is only partially incorporated, suggest additional professional learning or other support that would be needed for teachers to use the materials in a way that incorporated the innovation in their instruction.

Tool 5E: Program-Level Evaluation Innovation 5: All Standards, All Students

This tool is to be used to collect evidence and make claims about how an instructional materials program addresses NGSS Innovation 5: All Standards, All Students.

Directions

Using the sampling evaluation plan, record evidence of where the innovation has been *clearly* incorporated into the materials as well as instances where it does not appear to have been incorporated. Your evidence should include page numbers, a brief description of the evidence, and an explanation of how it either supports or contradicts the claim.

Claim	**Evidence**	**Sufficient evidence to support the claim?**
Students have substantial opportunities to express and negotiate their ideas, prior knowledge, and experiences as they are using the three dimensions of the NGSS to make sense of phenomena and design solutions to problems.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive
Teacher materials anticipate common student ideas and include guidance to surface and challenge student thinking.		☐ None ☐ Inadequate ☐ Adequate ☐ Extensive

Claim	Evidence	Sufficient evidence to support the claim?
Materials provide suggestions for how to attend to students' diverse skills, needs, and interests in varied classroom settings.	*What to look for as evidence:* • *Appropriate reading, writing, listening, and/or speaking alternatives (e.g., translations, picture support, graphic organizers, etc.) for students who are English learners, have special needs, or read well below the grade level* • *Extra support (e.g., phenomena, representations, tasks) for students who are struggling to meet the targeted expectations* • *Extensions for students with high interest or who have already met the performance expectations to develop deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts*	☐ None ☐ Inadequate ☐ Adequate ☐ Extensive

Summary and Recommendations

1. Based on the evidence collected, to what degree to the materials incorporate this innovation over the course of the program?

   ☐ Materials incorporate the innovation.
   ☐ Materials partially incorporate the innovation.
   ☐ Materials do not incorporate the innovation.

2. Reviewer Notes/Comments

3. If this innovation is only partially incorporated, suggest additional professional learning or other support that would be needed for teachers to use the materials in a way that incorporated the innovation in their instruction.

Tool 6: PEEC Evidence Summary

This tool is to be used to summarize evidence collected in all three phases of PEEC.

Directions

Complete the table below by transferring the data from each of the three phases of PEEC.

Innovation	**Phase 1: Prescreen**	**Phase 2: Unit Evaluation (EQuIP summary)**	**Phase 3: Program-Level Evaluation**
Making Sense of Phenomena & Designing Solutions to Problems	Shows Promise? ☐	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.
Three-Dimensional Learning	Shows Promise? ☐	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.

Innovation	Phase 1: Prescreen	Phase 2: Unit Evaluation (EQuIP summary)	Phase 3: Program-Level Evaluation
Building K–12 Progressions	n/a	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.
Alignment with English Language Arts and Mathematics	n/a	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.

Innovation	Phase 1: Prescreen	Phase 2: Unit Evaluation (EQuIP summary)	Phase 3: Program-Level Evaluation
All Standards, All Students	n/a	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.	☐ Materials incorporate the innovation. ☐ Materials partially incorporate the innovation. ☐ Materials do not incorporate the innovation.

Tool 7: Final Evaluation

This tool is used at the end of the PEEC process to make a final recommendation about an instructional materials program.

Directions

Reflect on the summary table and the other evidence collected to make a final claim about whether the instructional materials program is designed to provide adequate and appropriate opportunities for students to meet the performance expectations of the NGSS. Once this claim is established, explain how the data in *Tool 6: Program-Level Evaluation Evidence Summary* support this conclusion and highlight the most compelling evidence from each of the phases of PEEC to support the claim. After establishing the evidence for the claim, summarize any recommendations for what would need to happen during implementation of the materials to address any weaknesses that were identified in the analysis.

Claim

Title of instructional materials under review: ____ (does/does not) provide adequate and appropriate opportunities for students to meet the performance expectations of the NGSS.

Evidence-Based Response

Recommendations