EQuIP Rubric for Science

How can we make water healthy for living things?

Curriculum Developer: OpenSciEd

GRADE 5 | FEBRUARY 2025

National Science Teaching Association

Category I Rating

A	B	C	D	E	F
Explaining Phenomena/ Designing Solutions	Three Dimensions	Integrating the Three Dimensions	Unit Coherence	Multiple Science Domains	Math and ELA
EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE

Score Category I: 3

Category II Rating

A	B	C	D	E	F	G
Relevance and Authenticity	Student Ideas	Building Progressions	Scientific Accuracy	Differentiated Instruction	Teacher Support for Unit Coherence	Scaffolded Differentiation Over Time
EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE	ADEQUATE

Score Category II: 3

Category III Rating

A	B	C	D	E	F
Monitoring 3D Student Performance	Formative	Scoring Guidance	Unbiased Tasks/Items	Coherent Assessment System	Opportunity to Learn
EXTENSIVE	EXTENSIVE	EXTENSIVE	ADEQUATE	EXTENSIVE	EXTENSIVE

Score Category III: 3

UNIT 2	
Sum Categories	**9**
Rating	**E**

Overall Summary Comments

This unit is designed for the *Next Generation Science Standards* (*NGSS*), including clear and compelling evidence of the following criteria:

- This unit is strong in all three categories evaluated on the EQuIP Rubric. It is clear that it was developed for the *NGSS* and is an example of high-quality *NGSS* design. The unit centers around an engaging phenomenon (water quality) that students get to experience hands-on beginning in Lesson 2. Through the unit, students are making sense of the phenomenon, then using the engineering design process to design solutions to take the unhealthy water samples and make them healthy again. The engineering design process is informed by the physical science DCI elements that the students are exploring as they use physical properties to determine if the water is healthier after filtration. They further extend their exploration of physical science as they explore PS1.B to see how chemical reactions can be used to transform unhealthy water into healthy water. In every lesson, students are integrating the three dimensions for sensemaking and problem solving. Evidence of integration can be found in classroom discussions (scientist circles) and in artifacts that the students create. Student questions and investigation ideas drive the progress of the unit, as the driving question board (DQB) plays a central role. The unit provides extensive support for teachers in integrating Common Core math and ELA standards.
- The unit provides extensive instructional support for teachers as they implement the unit. Most lessons offer a section designed to connect the learning with students' homes, communities, and/or cultures. These connections are not optional additions to the lessons, but play a central role in students' sensemaking and problem solving. Teachers are given support for engaging students in classroom discussions that are productive and not merely call-and-response. Callbacks are included to support linking the learning in this unit to foundational learning in previous units (in fifth grade or earlier grades). Routines are offered to help teachers create a cohesive unit that makes sense to students and builds from lesson to lesson.
- The unit contains a robust system of assessments designed to ensure that learning is progressing throughout the unit. Two summative tasks are provided (Lesson 7 and Lesson 15) in which students demonstrate their learning by sensemaking and problem solving with novel phenomena. While these assessments are designed to assess the learning objectives, elements of the three dimensions, and performance expectations, they do so using novel phenomena. Scoring guidance and alignment to the three dimensions are provided for each summative assessment. Formative assessment opportunities are indicated in each lesson. Teachers are provided with cues to know what to look/listen for, where to look/listen for it, and how to adjust instruction based on student responses. There is a consistent system of assessment and feedback opportunities that work together to ensure student learning across the three dimensions.

Why are there two colors of text in this report?

Black text is used in this report to identify direct quotations or paraphrases of a lesson/unit (the evidence) and why/how this evidence indicates the criterion is being met (the reasoning). (EQuIP Rubric for Lessons & Units: Science (Version 3.1))

Black text is also used for evidence and reasoning that does not affect the rating of the criterion.

Purple text is used in this report to identify direct quotations or paraphrases of a lesson/unit (the evidence) and why/how this evidence indicates that the criterion is NOT being met (the reasoning). (EQuIP Rubric for Lessons & Units: Science (Version 3.1)) The exception to this is when a criterion is rated as "extensive." In those cases, purple is used as a visual cue to *"provide constructive criterion-based feedback and suggestions for improvement to developers"* (EQuIP Rubric for Lessons & Units: Science (Version 3.1)).

CATEGORY I
NGSS 3D Design

I.A. Explaining Phenomena / Designing Solutions

EXTENSIVE

Making sense of phenomena and/or designing solutions to a problem drive student learning.

i. Student questions and prior experiences related to the phenomenon or problem motivate sense-making and/or problem solving.

ii. The focus of the lesson is to support students in making sense of phenomena and/or designing solutions to problems.

iii. When engineering is a learning focus, it is integrated with developing disciplinary core ideas from physical, life, and/or earth and space sciences.

The reviewers found **extensive** evidence that making sense of phenomena and designing solutions to a problem drives student learning. Consistent use of a driving question board means that student questions are central to the learning progression of the unit. Materials are organized so that students are figuring out the central phenomenon: water quality and how to make unhealthy water healthy. Each lesson helps students dive a little deeper into understanding water quality and how to make water healthy again. Student questions and prior experiences related to the phenomenon or problem extensively motivate sense-making and/or problem-solving. When engineering is a learning focus, it is integrated with developing disciplinary core ideas from physical science. While determining how to best purify (make healthy) samples of water, students deepen their knowledge of PS1.A and PS1.B.

i. Student questions and prior experiences related to the phenomenon or problem motivate sense-making and/or problem-solving.

There is extensive evidence that students are at the center of the sense-making and problem-solving in this unit. Student questions throughout the unit offer the "why" behind each investigation. Additionally, students' prior experiences and community connections support the need for problem-solving to make the polluted water healthy again.

Evidence from the materials where the criterion was met,

- 5.2 Matter Properties Unit Front Matter: "Fifth graders were surveyed about their interest in three possible phenomena, and students were interested in the implications that healthy and unhealthy water have for their communities. Educators from our nine partner states also provided feedback in support of the healthy/unhealthy water phenomenon, given the compelling community connections for students throughout the world." (5.2 Matter Properties Unit Front Matter)
- Lesson 1, Connect Section, Step 1: "Consider personal connections to water. Display slide A. Have students popcorn read the headlines about water. If students have initial reactions, allow them to share but note that they will discuss on the next slide. In this unit, we explore different water problems and how to develop possible solutions to them." (Lesson 1, Teacher Guide)
- Lesson 3, Navigate Section, Step 1: "It sounds like we are saying that our goal is to make the water samples healthy and we think we will know that they are healthy when they are clear with no odor and nor color. Let's record that goal on our Healthy/Unhealthy Water Chart so that we can refer back to it as we try to achieve that goal." (Lesson 3, Teacher Guide)
- Lesson 7, Navigate Section, Step 6: "Prompt students to ask more questions. Remind students that so far, we have filtered our water samples to remove some of the matter that is unhealthy. We know that there is still some unhealthy matter in the water samples. Even though our water samples are small, they belong to a larger body of water. Ask, "Filtering a large body of water seems like a very difficult task. What other ideas for making water healthy do you have?" (Lesson 7, Teacher Guide)

- Lesson 15, Connect Section, Step 4. “Develop a model for a healthy habitat. Display Slide E. Tell students that now that they helped Emily with her turtle habitat, they can apply what they know about mixtures, substances, and healthy waters to a plant or animal of their choice. Give students 15-20 minutes to complete Healthy waters for a plant or animal.” (Lesson 13, Teacher Guide)

The learning is consistently student-driven, with students frequently given opportunities to use their questions or prior experiences to feel as if they are driving the learning sequence.

Evidence from the materials where the criterion was met,

- Lesson 1, Synthesize Section, Step 6: “Direct students to look back at the work we’ve done thinking about healthy and unhealthy water. Ask, “What questions do we need to answer to decide if the samples are healthy or unhealthy?” The class creates a driving question board to “gather and organize our scientific questions in a way that will help guide the investigations we do and help us track the ideas we figure out along the way.” (Lesson 1, Teacher Guide)
- Lesson 3, Explore Section, Step 5. “Plan filter design in small groups. Once students are back in their small groups to design a filter, distribute a copy of the Plan our filter design and investigation handout to each student. At the top of the handout, have them write which sample type they are focused on, as well as the design goal that they determined in Lesson 3. As on Slide M, direct them to complete Part A in their groups. Note that this is their initial design and that they’ll have the chance to adjust their design as they’re testing it. Circulate to support their design process, especially around meeting the criteria and constraints.” (Lesson 3, 5.2 Lesson 3 Teacher Guide).
- In Lesson 4, Synthesize Section, Step 5, Teachers are prompted to have students add to their “Growing Ideas” chart by reflecting on what they learned about the engineering design process and the healthiness of their water sample. Students are prompted to add new questions they have, which are used to determine the next steps for trying to make their water sample healthy. (Lesson 4, 5.2 Lesson 4 Teacher Guide).
- Lesson 10, Navigate Section, Step 6: “Then invite students to add new questions to the Driving Questions Board; look for new questions related to adding substances to make water more healthy. Students can also use this opportunity to add questions related to adding substances if they have new questions.” (Lesson 10, Teacher Guide)
- Lesson 13, Navigate Section, Step 7: “Decide where to go next. Display slide G. Say something like, “Today you used what you knew about making water healthier to create possible solutions to these water problems. In our next lesson, what can we do to evaluate our design solutions to see if we need to modify them in order to make sure they help the community’s water problem?” (Lesson 13, Teacher Guide)

ii. The focus of the unit is to support students in making sense of phenomena and/or designing solutions to problems.

There is a close match between the phenomenon and student learning objectives throughout the materials. The learning in the three dimensions targeted by the materials is in service of students making sense of water quality or designing solutions to improve water quality.

Evidence from the materials where the criterion was met,

- Lesson 3, Three-Dimensional Learning Goals: “Identify criteria, constraints, and predicted cause and effect relationships to design an engineered solution that changes the properties of our water samples to be more healthy by removing materials from the mixture.” (Lesson 3, Teacher Guide)
- Lesson 5, Three-Dimensional Learning Goals: “Develop a model that explains how matter that is unhealthy can exist in water even when its particles are too small to be seen.” (Lesson 5, Teacher Guide)

- Lesson 14, Three-Dimensional Learning Goals: "Test possible water solutions using criteria and constraints to compare how well each solution causes the community's water quality to improve (effect)." (Lesson 14, Teacher Guide)
- Lesson 15, Three-Dimensional Learning Goals: "Define a problem happening in a turtle habitat and construct an explanation for how adding a substance to the water in the habitat causes a change in properties that solves the problem." (Lesson 15, Teacher Guide)

iii. When engineering is a learning focus, it is integrated with developing disciplinary core ideas from physical science, life, and/or earth and space sciences.

When students are designing solutions to problems, they are using elements of the physical science DCIs.

Evidence from the materials where the criterion was met,

- Lesson 6, Explore Section, Step 2: Students test water samples for the presence of particles that are too small to be seen with the naked eye (Lesson 6, 5.2 Lesson 6 Teacher Guide). **PS1.A Structure and Properties of Matter**
- Lesson 11, Student Materials, Handout 1: "Add a substance: students gather data before and after adding a substance to a water sample. They use the data to determine if a new substance with different properties was formed" (Lesson 11, 5.2 Lesson 11 Handout 1 Add a Substance). **PS1.B Chemical Reactions**
- Lesson 12, Navigate Section, Step 1: "What did we figure out about adding substances to our water samples in the last lesson? Which properties of the water samples did we notice a change in?" (Lesson 12, Teacher Guide) **PS1.B Chemical Reactions**

Criterion-Based Suggestions for Improvement: N/A

I. B. Three Dimensions

[All 3 dimensions must be rated at least "adequate" to mark "adequate" overall]

EXTENSIVE

Builds understanding of multiple grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) *that are deliberately selected to aid student sense-making of phenomena and/or designing of solutions.*

Document evidence and reasoning, and evaluate whether or not there is sufficient evidence of quality for each dimension separately.

Evidence needs to be at the *element level* of the dimensions (see rubric introduction for a description of what is meant by "element")

The reviewers found **extensive** evidence that the materials give students opportunities to build an understanding of grade-appropriate elements of the three dimensions because students regularly engage in elements of all three dimensions to make sense of water quality and to design solutions to improve water quality. Students engage with elements of PS1.A and PS1.B as they develop an understanding of water quality. They use elements of ETS1.A, ETS1.B, and ETS1.C when they engage in the engineering design process to solve water quality problems both on a small scale in the classroom and on a larger scale in communities. Students use elements of the Science and Engineering Practices (SEPs) Asking Questions and Defining Problems, Planning and Carrying Out Investigations, and Constructing Explanations and Designing Solutions throughout the unit. The focus Crosscutting Concepts (CCCs) for the unit are Cause and Effect; Scale, Proportion, and Quantity; and Energy and Matter.

Rating for Criterion: SEP **EXTENSIVE**

i. Provides opportunities to *develop and use* specific elements of the SEP(s).

The reviewers found **extensive** evidence that the materials provide opportunities to develop and use specific elements of the SEPs. There is a close match between the claimed SEP elements and evidence of their development and use in the materials. Students use the SEP elements that are listed as key learning objectives to make sense of and solve problems related to water quality. Students are supported in developing deep competence in specific elements so that they can be applied to more than one context. There are sufficient SEP elements and time for students to engage in the elements for the length of the materials. All of the SEPs focus on grade-appropriate elements.

AQDP: Asking Questions and Defining Problems

Claimed Element: AQDP-E3: Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.

Claimed in Lesson 1. Evidence was found in Lesson 1. Examples include:

- Lesson 1, Synthesize Section, Step 6: "Direct students to look back at the work we've done thinking about healthy and unhealthy water. Ask, "What questions do we need to answer to decide if the samples are healthy or unhealthy?" (Lesson 1, Teacher Guide)

Claimed Element: AQDP-E5: Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.

Claimed in Lessons 3, 13, and 15. Evidence was found in all claimed lessons. Examples include:

- Lesson 3, Explore Section, Step 4: "Use the prompts below and on Slides H-I to review the terms "criteria" and "constraints" and add these to the word wall. Then elicit students' ideas for criteria and constraints for designing filters, and record them on a class Filter Criteria and Constraints chart." (Lesson 3, Teacher Guide)
- Lesson 13, Lesson 13 Slides, Slide E: "What criteria and constraints do we need to consider? How will you know if your design solutions work?" (Lesson 13, Slides)
- Lesson 15, Explore Section, Step 2: "Tell students that they are going to continue to think about the problem in Mikey's turtle tank and how to solve it using Emily's Turtle Tank." (Lesson 15, Teacher Guide)

INV: Planning and Carrying Out Investigations

Claimed Element: INV-E1: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

Claimed in Lessons 3, 4, 11. Evidence was found in all claimed lessons. Examples include:

- Lesson 3, Explore Section, Step 5: "Introduce a new challenge. Use Slide K to introduce the idea that each group working on the same sample type needs to have a different filter design: when we are engineering, the more design ideas we have to test out, the more we can figure out from our first designs!" (Lesson 5, Teacher Guide)

- Lesson 4, Explore Section, Step 2: "Decide on changes to filter design. Distribute the Optimize, test, and reflect on our filter handout to each student. As on Slide D, provide about ten minutes for groups to determine which changes they want to make to their filter, based on their data on Filter Design and Testing)." (Lesson 4, Teacher Guide)
- Lesson 4, Explore Section, Step 2: "Note with students that in line with controlling variables, they will only make one change at a time. Direct them to choose the top two changes that they want to make to their original filter design and predict the new effects that those changes will cause." (Lesson 4, Teacher Guide)
- Lesson 11, Lesson 11 Slides, Slides F-K: Students are working collaboratively to plan criteria and constraints for the investigation. Then procedures are followed to carry out the investigation of adding a substance to the water samples. (Lesson 11, Slides)

Claimed Element: INV-E3: Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

Claimed in Lessons 2 and 6. Evidence was found in all claimed lessons. Examples include:

- Lesson 2, Explore Section, Step 3: "Work through the procedure for observing the samples and recording the data for drinking water. Referring to the Water Observations, show students that we are going to collect data about each water sample by observing the same properties about each sample. Tell students that we are going to do the drinking water observations together to get an idea of the procedure and then we will do the rest of the samples in small groups. Demonstrate how to make observations for each of the properties using the drinking water sample." (Lesson 2, Teacher Guide)
- Lesson 6, Explore Section, Step 3: "Tell students that now that we have collected this data we can verify with evidence more of the matter that is in the water samples. Display slide G and facilitate a discussion about the types of matter that we now have evidence to prove are in the water samples." (Lesson 6, Teacher Guide)

Claimed Element: INV-E4: Make predictions about what would happen if a variable changes.

Claimed in Lesson 4. Evidence was found in lesson 4. Examples include:

- Lesson 4, 5.2 Student Materials, Handout 1 Optimize, test, and: "Choose two parts of your filter that you want to change to solve the problem of getting stuff that we can see out of the water. In the box below, write or draw your prediction of what that change will do (cause) to get stuff out of the water (effect)." (Lesson 4, 5.2 Lesson 4 Handout 1 Optimize, test, and)

Claimed Element: INV-E5: Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success.

Claimed in Lessons 4 and 14. Evidence was found in all claimed lessons. Examples include:

- Lesson 4, Lesson 4 Slides, G: "Build and test your optimized filter. To control variables, make only one change at a time. Record data for each change you make in Part B." (Lesson 4, 5.2 Lesson 4 Slides)
- Lesson 14, Synthesize Section, Step 3: "Provide peer review and feedback. Display slide F and ensure students the Community Water Problems: Criteria and Constraints chart is still visible to students. Distribute the Revision Ideas handout. Pair students up with someone from a group that has been working on a different community water problem. Remind students that they will need to first provide some background information about the problem using Engineering Design: Community Water Problem from Lesson 13 before explaining their solution to their partner. Encourage students to record revision ideas in words, symbols or pictures as their peers provide feedback on Revision Ideas. Ensure that students have Giving and Receiving Feedback out to help guide their feedback discussions." (Lesson 14, Teacher Guide)

CEDS: Constructing Explanations and Designing Solutions

Claimed Element: CEDS-E2: Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.

Claimed in Lesson 15. Evidence was found in lesson 15. Examples include:

- Lesson 15, Student Materials, Student Assessment 1: "For each part of your explanation, include at least one piece of evidence (measurements, observations, patterns) to support your idea. The evidence you share should also explain a cause and effect relationship." (Lesson 15, 5.2 Lesson 15 Student Assessment Emily's Turtle Tank)

Claimed Element: CEDS-E4: Apply scientific ideas to solve design problems.

Claimed in Lesson 13 and 14. Evidence was found in lesson 13 and 14. Examples include:

- Lesson 13, Student Materials, Handout 2: "Explain how you think your design solution may change the properties of the water to be more healthy. For each part of your explanations, use evidence from our investigations throughout the unit to support your idea." (Lesson 13, 5.2 Lesson 13 Handout 2 Engineering Design Community)
- Lesson 14, Synthesize Section, Step 4: "Reflect on the design process. Display slide I. Students fill out Engineering Reflection, a reflection answering the following questions to demonstrate what they have individually learned through the process of designing this solution:" (Lesson 14, Teacher Guide)

Claimed Element: CEDS-E5: Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

Claimed in Lesson 14. Evidence was found in lesson 14. Examples include:

- Lesson 14, Synthesize Section, Step 3: "Provide peer review and feedback. Display slide F and ensure students the Community Water Problems: Criteria and Constraints chart is still visible to students. Distribute the Revision Ideas handout. Pair students up with someone from a group that has been working on a different community water problem. Remind students that they will need to first provide some background information about the problem using Engineering Design: Community Water Problem from Lesson 13 before explaining their solution to their partner. Encourage students to record revision ideas in words, symbols or pictures as their peers provide feedback on Revision Ideas. Ensure that students have Giving and Receiving Feedback out to help guide their feedback discussions." (Lesson 14, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

Rating for Criterion: DCI **EXTENSIVE**

ii. Provides opportunities to develop and use specific elements of the DCI(s).

The reviewers found **extensive** evidence that the materials provide opportunities to develop and use specific elements of the DCIs. Students use elements of PS1.A and PS1.B to make sense of water quality and use those elements in combination with elements of ETS1.A, ETS1.B, and ETS1.3 as the design solutions for water quality issues in their samples and in the larger context of community water quality problems. Elements of these DCIs are used by students in all lessons.

PS1.A Structure and Properties of Matter:

Claimed Element: 5-PS1.A.1 PS1.A Structure and Properties of Matter: Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5-PS1-1)

Claimed in Lessons 1, 5, and 6. Evidence was found in all claimed lessons. Examples include:

- Lesson 1, Student Materials, Handout 2: Students are drawing initial models of healthy and unhealthy water. Models have zoom-in circles to represent what might be too small to be seen. (Lesson 1, 5.2 Lesson 1 Handout 2 Initial Model).
- Lesson 5, Student Materials, Handout 1: Healthy/Unhealthy Water Organizer: students are asked to "Draw and label the matter that was in the water in the article that you read. Make sure to include any matter that may be in the water, even if it is unseen." (Lesson 5, 5.2 Lesson 5 Handout 1 HealthyUnhealthy Water Organizer).
- Lesson 6, Explore Section, Step 2: Students test water samples for the presence of particles that are too small to be seen with the naked eye (Lesson 6, 5.2 Lesson 6 Teacher Guide).

Claimed Element: 5-PS1.A.2 PS1.A Structure and Properties of Matter: The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2)

Claimed in Lesson 8. Evidence was found in lesson 8. Examples include:

- Lesson 8, Explore Section, Step 2: "Provide data from boiling with the lid on. Use Slide H to share one more data point: the weight of the water after boiling with the lid on. Ask students to identify what happened under these different conditions: the weight stayed approximately the same. Discuss where the water goes when it boils. Use the prompts on Slide H and below to lead to the idea that the water turns to steam as it boils" (Lesson 8, Teacher Guide)
- Lesson 8, Synthesize Section, Step 4: Energy and Matter callout: "Students are using this crosscutting concept as they consider why the water samples decreased in weight when they were boiled. The water particles change from a liquid to a gas." (Lesson 8, Teacher Guide)

Claimed Element: 5-PS1.A.3 PS1.A Structure and Properties of Matter: Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3)

Claimed in Lessons 2, 3, 7, and 9. Evidence was found in all claimed lessons. Examples include:

- Lesson 2, Explore Section, Slide F: "Use the Water Property Observations chart and the Property and Material Key handout to help you identify what might be in the water samples." (Lesson 2, 5.2 Lesson 2 Slides).
- Lesson 3, Student Materials, Handout 2: Students record properties before and after filtering to identify cleaner/healthier water. (Lesson 3, 5.2 Lesson 3 Handout 2 Filter Design and Testing).
- Lesson 7, Student Materials, Student Assessment 2: Student Assessment: students use a variety of properties to identify what materials are in a water sample before and after filtering (Lesson 7, 5.2 Lesson 7 Student Assessment 2 Student Assessment).
- Lesson 9, Explore Section, Step 3: "Make sense of data. Use Slide I to prompt students to respond to talk with a partner or in small groups about how the solar still changed over time, and what the data means for where the clear water in the jar came from." (Lesson 9, Teacher Guide).

PS1.B Chemical Reactions:

Claimed Element: 5-PS1.B.1 PS1.B Chemical Reactions: When two or more different substances are mixed, a new substance with different properties may be formed. (PS1.B-E1)

Claimed in Lesson 11, 12, and 15. Evidence was found in all claimed lessons. Examples include:

- Lesson 11, Student Materials, Handout 1: "Add a substance: students gather data before and after adding a substance to a water sample. They use the data to determine if a new substance with different properties was formed" (Lesson 11, 5.2 Lesson 11 Handout 1 Add a Substance).
- Lesson 12, Navigate Section, Step 1: "What did we figure out about adding substances to our water samples in the last lesson? Which properties of the water samples did we notice a change in?" (Lesson 12, Teacher Guide)
- Lesson 15, Student Materials, Student Assessment 1: "Did a new substance form in Mikey's water?" (Lesson 15, 5.2 Lesson 15 Student Assessment 1 Emily's Turtle Tank).

Claimed Element: 5-PS1.B.2 PS1.B Chemical Reactions: No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5-PS1-2)

Claimed in Lesson 8 and 9. Evidence was found in lessons 8 and 9. Examples include:

- Lesson 8, Explore Section, Step 2: "Discuss where the water goes when it boils. Use the prompts on Slide H and below to lead to the idea that the water turns to steam as it boils" (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 3: "The weight of the solar still stayed the same or slightly decreased (the example solar still decreased by 8 grams, likely due to evaporating out of the sides of the plastic wrap that were not fully sealed; your solar still may experience a similar small decrease in weight). Notably, the weight of the solar still did not increase, so no new matter entered the system." (Lesson 9, Teacher Guide).

ETS1.A Defining Engineering Problems

Claimed Element: ETS1.A.1 ETS1.A Defining Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (ETS1.A-E1).

Claimed in Lessons 1, 3, 4, 9, 10, 13 and 14. Evidence was found in all claimed lessons. Examples include:

- Lesson 1, Student Materials, Handout 2: “Based on your model of the least healthy water, draw or write a plan for how the water could become healthy again.” (Lesson 1, 5.2 Lesson 1 Handout 2 Initial Model).
- Lesson 3, 5.2 Student Materials, Handout 2: “In your small group: Review the criteria and constraints that you decided on as a class. Decide together on the filter design and materials that will work best for your water sample and write/draw these ideas below.” (Lesson 3, 5.2 Lesson 3 Handout 2 Filter Design and).
- Lesson 4, 5.2 Student Materials, Handout 1: “How well did your optimized filter meet the criteria and constraints, getting materials that we can see out of the water?” (Lesson 4, 5.2 Lesson 4 Handout 1 Optimize, test, and)
- Lesson 9, Explore Section, Step 2: “Display slide E. Review how the still might help meet the criteria and constraints that the class decided on in Lesson 4 for filtering the samples: simple materials, easy to build, helps get matter out of the water. (Reference the class Filter Criteria and Constraints chart from Lesson 4 as needed.)”(Lesson 9, Teacher Guide)
- Lesson 9, Synthesize Section, Step 6: “Display slide P. To remind students of the criteria and constraints. Use the prompts below to guide students through a discussion and update the healthy/unhealthy water sample chart. Give students time to consider how well the solar still meets our criteria and constraints. Does it meet our design goal? Was it able to remove the unhealthy matter?” (Lesson 9, Teacher Guide)
- Lesson 10, Connect Section, Step 5: “Return to our healthy/unhealthy water chart. Display Slide L and direct students’ attention to the class Healthy/Unhealthy Water chart. Say something like, ‘In order to consider what we should add to our water samples, let’s check back in with our Healthy/Unhealthy Water chart to remind ourselves of our design goal that tells us if our water samples are healthy or not yet and what types of matter are still in our samples. Let’s see if we can recall what is still in our samples.’ Help students remember that there is still baking soda, vinegar, chlorine, and iron in the water samples. Then look back at the design goal: We want our water samples to be clear, with no visible materials or colors or odors. It should have a normal acidity level and have no unseen matter in it. Ask something like, ‘Using the Healthy/Unhealthy Water chart as evidence, are our water samples healthy enough?’” (Lesson 10, Teacher Guide)
- Lesson 13, Student Materials, Handout 2: “Explain how you think your design solution may change the properties of the water to be more healthy. For each part of your explanations, use evidence from our investigations throughout the unit to support your idea.” (Lesson 13, 5.2 Lesson 13 Handout 2 Engineering Design Community)
- Lesson 14, Student Materials, Handout 3: Students are defining a water problem and then designing a solution to make the water healthier. Then they are reflecting on how well the solution meets the success criteria. (Lesson 14, 5.2 Lesson 14 Handout 3 Engineering Reflection)

ETS1.B Developing Possible Solutions

Claimed Element: ETS1.B.2 Developing Possible Solutions: Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (ETS1.B-E2)

Claimed in Lessons 4 and 14. Evidence was found in all claimed lessons. Examples include:

- Lesson 4, 5.2 Lesson 4 Slides, J: "Look at other groups water sample Identify the observable properties Is the sample healthy now that it is filtered? If the water is not healthy still, what more can we do?" (Lesson 4, Slides)
- Lesson 4, Lesson 4 Slides, G: "Build and test your optimized filter. To control variables, make only one change at a time. Record data for each change you make in Part B." (Lesson 4, 5.2 Lesson 4 Slides)
- Lesson 14, Synthesize Section, Step 3: "Provide peer review and feedback. Display slide F and ensure students the Community Water Problems: Criteria and Constraints chart is still visible to students. Distribute the Revision Ideas handout. Pair students with someone from a group that has been working on a different community water problem. Remind students that they will need to first provide some background information about the problem using Engineering Design: Community Water Problem from Lesson 13 before explaining their solution to their partner. Encourage students to record revision ideas in words, symbols or pictures as their peers provide feedback on Revision Ideas. Ensure that students have Giving and Receiving Feedback out to help guide their feedback discussions." (Lesson 14, Teacher Guide)

ETS1.C Optimizing the Design Solution

Claimed Element: ETS1.C.1 Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (ETS1.C-E1)

Claimed in Lessons 4 and 14. Evidence was found in all claimed lessons. Examples include:

- Lesson 4, Explore Section, Step 2: "Build and test the new filter. As groups decide what they will change, allow them to access the supplies to build and test their new design" (Lesson 4, Teacher Guide)
- Lesson 4, Lesson 4 Slides, G: "Build and test your optimized filter. To control variables, make only one change at a time. Record data for each change you make in Part B." (Lesson 4, 5.2 Lesson 4 Slides)
- Lesson 14, Synthesize Section, Step 3: "Provide peer review and feedback. Display slide F and ensure students the Community Water Problems: Criteria and Constraints chart is still visible to students. Distribute the Revision Ideas handout. Pair students up with someone from a group that has been working on a different community water problem. Remind students that they will need to first provide some background information about the problem using Engineering Design: Community Water Problem from Lesson 13 before explaining their solution to their partner. Encourage students to record revision ideas in words, symbols or pictures as their peers provide feedback on Revision Ideas. Ensure that students have Giving and Receiving Feedback out to help guide their feedback discussions." (Lesson 14, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

Rating for Criterion: CCC **EXTENSIVE**

iii. Provides opportunities to *develop and use* specific elements of the CCC(s).

The reviewers found **extensive** evidence that the materials provide opportunities to develop and use specific elements of the CCCs throughout the unit. The following pieces of evidence were selected because they illustrate the use and development of elements of the CCCs to support sensemaking and problem solving throughout the unit. Evidence was found for the use of CCC elements across all lessons in the unit. Suggestions are offered below for making the use of the CCCs more explicit to students in two specific instances in the unit.

CE: Cause and Effect: Mechanism and Explanation

Claimed Element: CE-E1: Cause and effect relationships are routinely identified, tested, and used to explain change.

Claimed in Lessons 1, 2, 3, 4, 10, 11, 14, and 15. Evidence was found in all claimed lessons. Examples include:

- Lesson 1, Lesson 1 Slides, G: "Develop a model to explain: What is causing the water sample to be the healthiest? What is causing the water sample to be the least healthy? For the least healthy water: What could cause the water to become healthy again?" (Lesson 1, 5.2 Lesson 1 Slides).
- Lesson 2, Synthesize Section, Step 6: Cause and Effect callout: "Students are engaging with this crosscutting concept as they share out what materials they think are in the water. Students observed various properties of the water samples that were caused by specific materials in the water samples." (Lesson 2, Teacher Guide)
- Lesson 3, 5.2 Student Materials, Handout 3 Filter Design and Testing: "Consider how the properties of the materials you are trying to remove from the water relate to this part of the filter. Be specific about what you think the cause and effect relationship will be" (Lesson 3, 5.2 Handout 3 Filter Design and Testing)
- Lesson 4, 5.2 Student Materials, Handout 1 Optimize, test, and Reflect on Our Filter: "Choose two parts of your filter that you want to change to solve the problem of getting stuff that we can see out of the water. In the box below, write or draw your prediction of what that change will do (cause) to get stuff out of the water (effect)." (Lesson 4, 5.2 Lesson 4 Handout 1 Optimize, test, and Reflect on Our Filter)
- Lesson 10, Connect Section, Step 5: "Determine which substanaces to add to the water samples. Give students time in their groups to identify which substance they think they should add to their sample. The questions below the table on the *Identifying Substances to Add to Our Water Samples* handout are intended to help students consider the specific properties they wish to change in their water sample. If students want to add more than one sample, push them to consider how they would know which substance caused an observable change if they add multiple substances." (Lesson 10, Teacher Guide)
- Lesson 11, Synthesize Section, Step 4: Cause and Effect callout: "To further extend student's thinking of cause-and-effect relationships prompt them to think back to their answers in Part D of Add a Substance Investigation and revise any written or drawn description of what the substance will do when added to your water sample (cause) and to change the water sample (effect)." (Lesson 11, Teacher Guide)
- Lesson 14, Student Materials, Handout 2: "How will this idea for improvement cause the water quality in the community to improve?" (Lesson 14, 5.2 Lesson 2 Revision Ideas)

- Lesson 15, Student Materials, Student Assessment 1: “For each part of your explanation, include at least one piece of evidence (measurements, observations, patterns) to support your idea. The evidence you share should also explain a cause and effect relationship.” (Lesson 15, 5.2 Lesson 15 Student Assessment Emily’s Turtle Tank)

SPQ: Scale, Proportion, and Quantity

Claimed Element: SPQ-E1: Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long time periods.

Claimed in Lesson 6 and 13. Evidence was found in lessons 6 and 13. Examples include:

- Lesson 6, Explore Section, Step 2: “Display slide C and ask students to look back at our Healthy/Unhealthy Water Chart and consider what types of matter we think might still be in the water samples. Facilitate a discussion with students about the kinds of matter we think might be left in our water samples and the tests that we can do to find out if it is in the water. As students share the matter they think could be in the water samples, write it down in the “We think it might be” column of the Healthy/Unhealthy Water Chart.” (Lesson 6, Teacher Guide) The provided discussion prompts elicit possible responses about matter too small to be seen; however, there is not a direct statement connecting to the idea of scale.
- Lesson 13, Synthesize Section, Step 6: Scale, Proportion, and Quantity callout: “Students are intentionally engaged in this crosscutting concept as they think about applying methods used to remove matter that made their small water samples unhealthy to the larger bodies of water read about in Solving Water Problems. They will need to determine if those methods would work the same way at a larger scale.” (Lesson 13, Teacher Guide)

Claimed Element: SPQ-E2: Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

Claimed in Lessons 3, 4, 7, 8, 9, and 12. Evidence was found in all claimed lessons. Examples include:

- Lesson 3, Student Materials, Handout 2: On Part C, students are asked to record: “Total weight in grams,” both before and after filtering (Lesson 3, 5.2 Lesson 3 Handout 2 Filter Design and Testing)
- Lesson 4, 5.2 Lesson 4 Slides, E: “Data Collector: Follow the steps on your investigation plan to measure and record the weight of the sample before and after filtering.” (Lesson 4, Slides)
- Lesson 7, Student Assessment 2: Student Assessment: students use standard units of measure for weight/mass to explain what happened to the sample’s mass during filtration (Lesson 7, 5.2 Lesson 7 Student Assessment 2 Student Assessment)
- Lesson 8, Student Materials, Handout 2: “What changed over time? Calculate the change in grams” (Lesson 8, 5.2 Lesson 8 Handout 2 Analyze and interpret)
- Lesson 9, Student Materials, Handout 1: Students use data in kilograms to calculate weight change, “Starting weight: (kilograms)” (Lesson 9, 5.2 Lesson 9 Handout 1 Analyze Data from)
- Lesson 12, Student Materials, Handout 1: “Record the weights that you measured in your data table from Table 2 in Part B of Add a Substance Investigation in the top row. Make sure to copy the weights, including all decimal places accurately. Then, round each number to the nearest whole number in the row below it.” (Lesson 12, 5.2 Lesson 12 Handout 1 Making sense of our investigation data)

EM: Energy and Matter: Flows, Cycles, and Conservation

Claimed Element: EM-E1: Matter is made of particles.

Claimed in Lessons 5, 8, and 9. Evidence was found in all claimed lessons. Examples include:

- Lesson 5, Student Materials, Handout 1: "Draw and label the matter that was in the water in the article that you read. Make sure to include any matter that may be in the water, even if it is unseen." (Lesson 5, 5.2 Lesson 5 Handout 1 HealthyUnhealthy Water Organizer).
- Lesson 8, Student Materials, Handout 2: What caused the changes that you observed in the sample? Use the box and lines below to draw or write your explanation of what happened to the matter and particles in the water sample as it boiled." (Lesson 8, 5.2 Lesson 8 Handout 2 Analyze and Interpret)
- Lesson 9, Student Materials, Handout 2: The model for the solar still: students create a model of the solar still. The provided key prompts students to include "food dye particles" and "water particles" (Lesson 9, 5.2 Lesson 9 Handout 2 The model for the solar still).

Claimed Element: EM-E2: Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems.

Claimed in Lesson 3. Evidence was found in lesson 3. Examples include:

- Lesson 3, Explore Section, Step 6: "While students may suggest both weight and volume as measurements to consider when testing their filters, focusing on weight can provide a clearer indication of changes in the water sample due to the removal of materials. Students will also use the concept of weight in later lessons as they consider conservation of matter during a chemical reaction." (Lesson 3, Teacher Guide)

Claimed Element: EM-E3: Energy can be transferred in various ways and between objects.

Claimed in Lesson 9. Evidence was found in lesson 9. Examples include:

- Lesson 9, Synthesize Section, Step 6: "Use the sequence of prompts below to lead the Building Understandings Discussion. As students share their ideas about how the solar still works, add their ideas to the model on the class chart "How does the solar still work?" using the example model shown below and in Model of solar still as a reference" (Lesson 9, Teacher Guide) Warming from the sun and heat are mentioned in provided prompts/listen for discussion; however, energy transfer is not explicitly called out for students. Students need to use the idea of energy transfer to successfully explain how the solar still works.

Criterion-Based Suggestions for Improvement: N/A

I.C. Integrating the Three Dimensions

EXTENSIVE

Student sense-making of phenomena and/or designing of solutions requires student performances that integrate elements of the SEPs, CCCs, and DCIs.

The reviewers found **extensive** evidence that student sensemaking and problem solving of water quality issues in this unit require student performances that integrate elements of the SEPs, CCCs, and DCIs. In the unit, students are expected to construct models to explain what is happening to make unhealthy water healthy again. They design, test, and optimize filters to make unhealthy water healthy again; they use chemical reactions to make water healthy; and they apply their sensemaking and problem solving to a larger scale when they design solutions for large-scale community water quality issues. These are a few examples from the unit that require students to use grade-appropriate elements of the three dimensions simultaneously. The three dimensions are not used in isolation; scaffolding and prompts are provided to ensure that students are using elements of all three dimensions in their sensemaking and problem solving. In most activities in the unit, students are expected to figure out something that requires the use of three dimensions working together at grade level.

Learning is integrated

Learning is integrated throughout the unit because students use elements of the three dimensions to make sense of and/or solve problems in each lesson, as evidenced by the selected examples below.

- Lesson 1, Student Materials, Handout 2: Students integrate the use of elements when they create an initial model of healthy and unhealthy water samples and suggest a plan for making the unhealthy water healthy again. **CCC: CE 2.E1 Cause and effect relationships are routinely identified, tested, and used to explain change, DCI: ETS1.A Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.** and **SEP: MOD 2.E2 Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.** (Lesson 1, 5.2 Lesson 1 Handout 2 Initial Model)
- Lesson 4, Student Materials, Handout 2: "During the class discussion about criteria and constraints, and on Part A of Plan our filter design and investigation. Detailed investigation steps that include when, what, and how they will observe/measure their samples, including standard units of measurement (grams) for weight (and optionally: volume). Students also have an opportunity for self-assessment of their filter and investigation design plans in Part C of the handout." **CCC: CE-E1 Cause and effect relationships are routinely identified, tested, and used to explain change**, **DCI: PS1.A3 Structure and Properties of Matter: Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3)**, **SEP: INV-E4: Make predictions about what would happen if a variable changes.** (Lesson 4, 5.2 Lesson 4 Handout 2 Filter Design and)
- In Lesson 5, Synthesize 3, students participate in a discussion, and they work in groups to revise their predictions on the healthiness of the water for humans, plants, and animals. In doing so, they integrate these elements of the three dimensions: **CCC: PAT-E2 Patterns of change can be used to make predictions, DCI: 5-PS1.A.3 PS1.A Structure and Properties of Matter: Measurements of a variety of properties can be used to identify**

materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3), and **SEP INFO-E4 Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.** (Lesson 5, 5.2 Lesson 5 Teacher Guide).

- Lesson 14, Synthesize Section, Step 4: "Optimize Designs Solutions. Display slide H. Remind students that our goal today is to optimize our designs, or to make them the best that we can. Ask students to review the ideas from their Revision Ideas handout and prepare to share those ideas with their group. Have the Community Water Problems: Criteria and Constraints chart visible to support groups as they collaborate to improve their designs using peer feedback." **CCC: CE-E1: Cause and effect relationships are routinely identified, tested, and used to explain change**, **DCI: PS1.A3 Structure and Properties of Matter: Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3), DCI: ETS1.A Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.** , **SEP: CEDS-E2 Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem. INFO-E4 Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.** (Lesson 14, Teacher Guide)

Integration to support student sense-making over time

The three dimensions are integrated to support sense-making over time because the dimensions are not used in isolation and are necessary for students to figure out the phenomenon. In each lesson of the unit, students make sense and/or solve problems using elements of the three dimensions working together at grade level, as shown by the examples below.

- Lesson 1, Synthesize Section, Step 4: "Tell the class that we are going to work together to create a consensus model that represents our ideas about healthy/unhealthy water as a class, at this moment." (Lesson 1, Teacher Guide)
- Lesson 5, Lesson 5 Slides, F: "With your partner Develop a model that explains how the pool water can look clear but make people, other animals and/or plants sick." (Lesson 5, Slides)
- Lesson 13, Student Materials, Handout 2: "Explain how you think your design solution may change the properties of the water to be more healthy. For each part of your explanations, use evidence from our investigations throughout the unit to support your idea." (Lesson 13, 5.2 Lesson 13 Handout 2 Engineering Design Community)

Criterion-Based Suggestions for Improvement: N/A

I.D. Unit Coherence

EXTENSIVE

Lessons fit together to target a set of performance expectations.

i. Each lesson builds on prior lessons by addressing questions raised in those lessons, cultivating new questions that build on what students figured out, or cultivating new questions from related phenomena, problems, and prior student experiences.

ii. The lessons help students develop toward proficiency in a targeted set of performance expectations.

The reviewers found **extensive** evidence that the lessons fit together coherently to target a set of performance expectations because lessons are sequenced logically in a way that is coherent from the students' perspectives. Students can see how what they are trying to figure out in one lesson builds on previous lessons and fits into the larger goal for the unit. Students are supported to build toward all of the three-dimensional learning goals. Questions that arise from one investigation are often used as the focus of the next investigation. Students have regular opportunities to ask questions based on what they have learned so far and revisit their questions in subsequent lessons. Each lesson contains a navigation section to begin and end the lesson that focuses on what questions students have been addressing, what they have figured out, what additional questions they have, and what they might need to investigate next. The sensemaking that they do in the unit is used to inform and support their problem solving as they seek to make unhealthy water healthy again.

i. Each lesson builds on prior lessons by addressing questions raised in those lessons, cultivating new questions that build on what students figured out, or cultivating new questions from related phenomena, problems, and prior student experiences.

- Each lesson begins and ends with a Navigate Section recalling previous lesson understanding and discussing ideas for next steps.
- 5.2 Matter Properties Storyline, Lesson 1: "We have a lot of questions about what is in the water that makes it healthy or unhealthy. We wonder if water can be healthy for some people, plants, or animals but not for others. We want to know how to make water healthier." (5.2 Matter Properties Storyline, Lesson 1)
- 5.2 Matter Properties Storyline, Lesson 4: "Our designed filters were able to remove a lot of the materials that we could see in our water samples, but we are still not sure how healthy the filtered samples are." (5.2 Matter Properties Storyline, Lesson 4)
- 5.2 Matter Properties Storyline, Lesson 14: " Navigation to next lesson: We have used what we have figured out about the health of water and the engineering process to develop solutions for a community water problem." (5.2 Matter Properties Storyline, Lesson 14)

ii. The lessons help students develop toward proficiency in a targeted set of performance expectations.

The lessons help students develop toward proficiency in a targeted set of performance expectations in both PS1 and ETS1. The 4 PS and 3 ETS target Performance Expectations are

5-PS1.A.1 PS1.A Structure and Properties of Matter: Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5-PS1-1)

- Lesson 1, Student Materials, Handout 2: Students are drawing initial models of healthy and unhealthy water. Models have zoom-in circles to represent what might be too small to be seen. (Lesson 1, 5.2 Lesson 1 Handout 2 Initial Model)
- Lesson 5, Student Materials, Handout 1: Healthy/Unhealthy Water Organizer: students are asked to "Draw and label the matter that was in the water in the article that you read. Make sure to include any matter that may be in the water, even if it is unseen." (Lesson 5, 5.2 Lesson 5 Handout 1 Healthy Unhealthy Water Organizer).
- Lesson 6, Explore Section, Step 2: Students test water samples for the presence of particles that are too small to be seen with the naked eye (Lesson 6, 5.2 Lesson 6 Teacher Guide).

5-PS1.A.2 PS1.A Structure and Properties of Matter: The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2)

- Lesson 8, Explore Section, Step 2: "Provide data from boiling with the lid on. Use Slide H to share one more data point: the weight of the water after boiling with the lid on. Ask students to identify what happened under these different conditions: the weight stayed approximately the same. Discuss where the water goes when it boils. Use the prompts on Slide H and below to lead to the idea that the water turns to steam as it boils" (Lesson 8, Teacher Guide)
- Lesson 8, Synthesize Section, Step 4: Energy and Matter callout: "Students are using this crosscutting concept as they consider why the water samples decreased in weight when they were boiled. The water particles change from a liquid to a gas." (Lesson 8, Teacher Guide)

5-PS1.A.3 PS1.A Structure and Properties of Matter: Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3)

- Lesson 2, Explore Section, Slide F: "Use the Water Property Observations chart and the Property and Material Key handout to help you identify what might be in the water samples." (Lesson 2, 5.2 Lesson 2 Slides)
- Lesson 3, Student Materials, Handout 2: Students record properties before and after filtering to identify cleaner/healthier water. (Lesson 3, 5.2 Lesson 3 Handout 2 Filter Design and Testing)
- Lesson 7, Student Materials, Student Assessment 2: Student Assessment: students use a variety of properties to identify what materials are in a water sample before and after filtering (Lesson 7, 5.2 Lesson 7 Student Assessment 2 Student Assessment).
- Lesson 9, Explore Section, Step 3: "Make sense of data. Use Slide I to prompt students to respond to talk with a partner or in small groups about how the solar still changed over time, and what the data means for where the clear water in the jar came from." (Lesson 9, Teacher Guide)

5-PS1.B.2 PS1.B Chemical Reactions: No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5-PS1-2)

- Lesson 11, Student Materials, Handout 1: "Add a substance: students gather data before and after adding a substance to a water sample. They use the data to determine if a new substance with different properties was formed" (Lesson 11, 5.2 Lesson 11 Handout 1 Add a Substance).
- Lesson 12, Navigate Section, Step 1: "What did we figure out about adding substances to our water samples in the last lesson? Which properties of the water samples did we notice a change in?" (Lesson 12, Teacher Guide)
- Lesson 15, Student Materials, Student Assessment 1: "Did a new substance form in Mikey's water?" (Lesson 15, 5.2 Lesson 15 Student Assessment 1 Emily's Turtle Tank)

ETS1.A.1 ETS1.A Defining Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (ETS1.A-E1).

- Lesson 3, 5.2 Student Materials, Handout 2: "In your small group: Review the criteria and constraints that you decided on as a class. Decide together on the filter design and materials that will work best for your water sample and write/draw these ideas below." (Lesson 3, 5.2 Lesson 3 Handout 2 Filter Design and Testing).
- Lesson 4, 5.2 Student Materials, Handout 1: "How well did your optimized filter meet the criteria and constraints, getting materials that we can see out of the water?" (Lesson 4, 5.2 Lesson 4 Handout 1 Optimize, test, and reflect on our filter)
- Lesson 9, Synthesize Section, Step 6: "Display slide P. To remind students of the criteria and constraints. Use the prompts below to guide students through a discussion and update the healthy/unhealthy water sample chart. Give students time to consider how well the solar still meets our criteria and constraints. Does it meet our design goal? Was it able to remove the unhealthy matter?" (Lesson 9, Teacher Guide)
- Lesson 10, Connect Section, Step 5: "Return to our healthy/unhealthy water chart. Display Slide L and direct students' attention to the class Healthy/Unhealthy Water chart. Say something like, 'In order to consider what we should add to our water samples, let's check back in with our Healthy/Unhealthy Water chart to remind ourselves of our design goal that tells us if our water samples are healthy or not yet and what types of matter are still in our samples. Let's see if we can recall what is still in our samples.' Help students remember that there is still baking soda, vinegar, chlorine, and iron in the water samples. Then look back at the design goal: We want our water samples to be clear, with no visible materials or colors or odors. It should have a normal acidity level and have no unseen matter in it. Ask something like, 'Using the Healthy/Unhealthy Water chart as evidence, are our water samples healthy enough?'" (Lesson 10, Teacher Guide)
- Lesson 14, Student Materials, Handout 3: Students are defining a water problem and then designing a solution to make the water healthier. Then they are reflecting on how well the solution meet the success criteria. (Lesson 14, 5.2 Lesson 14 Handout 3 Engineering Reflection)

ETS1.B.2 Developing Possible Solutions: Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (ETS1.B-E2)

- Lesson 4, 5.2 Lesson 4 Slides, J: "Look at other groups water sample Identify the observable properties Is the sample healthy now that it filtered? If the water is not healthy still, what more can we do?" (Lesson 4, Slides)
- Lesson 14, Synthesize Section, Step 4: "Provide time for students to collaborate with their groups to improve their designs using Engineering Design: Community Water Problem from Lesson 13 or a sheet of paper. As they work circulate and ask some possible prompts such as those below: How will this revision help to optimize your design? Which criteria or constraint does this revision help to address?" (Lesson 14, Teacher Guide)

ETS1.C.1 Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (ETS1.C-E1)

- Lesson 4, Lesson 4 Slides, G: "Build and test your optimized filter. To control variables, make only one change at a time. Record data for each change you make in Part B." (Lesson 4, 5.2 Lesson 4 Slides)
- Lesson 14, Synthesize Section, Step 3: "Provide peer review and feedback. Display slide F and ensure students the Community Water Problems: Criteria and Constraints chart is still visible to students. Distribute the Revision

Ideas handout. Pair students up with someone from a group that has been working on a different community water problem. Remind students that they will need to first provide some background information about the problem using Engineering Design: Community Water Problem from Lesson 13 before explaining their solution to their partner. Encourage students to record revision ideas in words, symbols or pictures as their peers provide feedback on Revision Ideas. Ensure that students have Giving and Receiving Feedback out to help guide their feedback discussions." (Lesson 14, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

I.E. Multiple Science Domains

EXTENSIVE

When appropriate, links are made across the science domains of life science, physical science, and Earth and space science.

i. Disciplinary core ideas from different disciplines are used together to explain phenomena.

ii. The usefulness of crosscutting concepts to make sense of phenomena or design solutions to problems across science domains is highlighted.

The reviewers found **extensive** evidence that links are made across the science domains when appropriate because in this unit, only one science domain (physical science) is necessary to explain phenomena or design solutions. Physical science elements are used in conjunction with ETS elements as students design solutions.

i. Disciplinary core ideas from different disciplines are used together to explain phenomena.

- In lessons 1-15, only elements of the physical science domain are necessary to explain the phenomenon and develop solutions for the engineering problems presented in the unit. Students use elements of **PS1.A: Structure and Property of Matter** and **PS1.B: Chemical Reactions** for sensemaking and problem solving.

ii.The usefulness of crosscutting concepts to make sense of phenomena or design solutions to problems across science domains is highlighted.

- In lessons 1-15, students use elements of the crosscutting concepts to make sense of phenomena related to the physical science domain. See I.C for evidence of the use of these CCC elements: CE-E1, SPQ-E1, SPQ-E2, SYS-E2, EM-E1, EM-E2, and EM-E3.

Criterion-Based Suggestions for Improvement: N/A

I.F. Math and ELA

EXTENSIVE

Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects.

The reviewers found **extensive** evidence that the materials provide grade-appropriate connections to the Common Core State Standards in Mathematics and English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects because the materials explicitly state the mathematics and ELA standards that are used in the unit and support students to see the connections among content areas. These pieces of evidence were selected because students' learning is connected to the use and learning of mathematics and ELA, and students can understand where these disciplines are useful within their sensemaking. Student reading materials include several different formats, such as narrative stories, articles, and infographics. The Matrix Document explicitly claims the Mathematics and ELA standards that are used in the unit, and evidence was found in those areas. Additional guidance was provided in callout boxes for teacher reference.

ELA

Reading and Informational Text

CCSS.ELA-LITERACY.RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. Claimed in Lessons 8 and 13. Examples include:

- Lesson 8, Connect Section, Step 5: "Discuss how boiling water can make it more healthy. Then lead a brief class discussion about the questions on slide O to share their responses, grounding their claims in the article." (Lesson 8, Teacher Guide)
- Lesson 13, Synthesize Section, Step 4: "Discuss the book. Ask for volunteers to share the information they got from reading about their chosen community. Display the prompts on slide D and start with one book chapter, calling on several volunteers who read the chapter about the community in Texas to share what they learned. Then repeat for the second chapter about the community in Louisiana." (Lesson 13, Teacher Guide) Direct quotes are implied but not explicitly mentioned in the directions.

CCSS.ELA-LITERACY.RI.5.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text. Claimed in Lessons 5, 7, and 13. Examples include:

- Lesson 5, Explore Section, Step 2: "Explain directions for reading. Display slide C and tell students that they and a partner will read about one of the types of water. With their partner, they will place a checkmark on any of the boxes that describe the water in their article and draw and label the matter that was found in that water on Healthy/Unhealthy Water Organizer. Then, after reading, they will discuss with people who read about another type of water to compare and contrast what was found in the water and if it was healthy/unhealthy." (Lesson 5, Teacher Guide)
- Lesson 7, Connect Section, Step 3: "Read what happened to Jarret when he visited his grandparents aloud to the class. Students can follow along on their handout while you are reading. To ensure that all students have made sense of the context for the transfer task, engage in a discussion about the main points of Jarrett's personal account." (Lesson 7, Teacher Guide)
- Lesson 13, Connect Section, Step 3: "Explain that in this book there are water problems that affect two different communities. Each group will get to pick which community's water problem they would like to read about and design a solution for that problem. Encourage groups to pause and answer questions together on Identifying Water Problems together as they read." (Lesson 13, Teacher Guide)

CCSS-ELA-LITERACY.RI.5.5 Compare and contrast the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in two or more texts. Claimed in Lesson 3. Examples include:

- Lesson 3, Explore Section, Step 4: "Define and identify criteria and constraints. Explain that just like people in the book (and optionally, article) who used engineering to solve water problems, the class needs to identify what counts as successful solutions for our problem before starting to design filters." (Lesson 3, Teacher Guide)

CCSS-ELA-LITERACY.RI.5.6 Analyze multiple accounts of the same event or topic, noting important similarities and differences in the point of view they represent. Claimed in Lessons 3, 5, and 10. Examples include:

- Lesson 3, Connect Section, Step 3: "Read the Engineers Solve Problems and Design Solutions article. Tell students that there is a large variety of materials that we could use for filtering the samples, and that in order to choose the right materials, and not waste time and materials, we need to consider our specific needs." (Lesson 3, Teacher Guide)
- Lesson 5, Explore Section, Step 2: "Explain directions for reading. Display slide C and tell students that they and a partner will read about one of the types of water. With their partner, they will place a checkmark on any of the boxes that describe the water in their article and draw and label the matter that was found in that water on Healthy/Unhealthy Water Organizer. Then, after reading, they will discuss with people who read about another type of water to compare and contrast what was found in the water and if it was healthy/unhealthy." (Lesson 5, Teacher Guide)
- Lesson 5, Synthesize Section, Step 3: "Gather in a Scientists Circle. Display slide E. Have students bring their articles to reference and Healthy/Unhealthy Water Organizer as the class forms a Scientists Circle Invite students to engage in a Building Understandings discussion to use what the class figured out from the articles to decide w [sic] come to a consensus on which types of water in the articles we read were healthy and which were not." (Lesson 5, Teacher Guide)
- Lesson 10, Connect Section, Step 5: "Leverage one similarity from the readings. Point out that one similarity students identified is that both people are adding something to the water to treat it, or make it healthier. Ask students, "Is this something you have ever done?" Give students a 1-2 minutes to turn and talk with a partner. Tell them that if neither partner has ever added something to water to make it healthier, they can try to imagine a situation in which they would do this, and what they might add to the water." (Lesson 10, Teacher Guide)

Writing

CCSS-ELA-LITERACY.W.5.2C Link ideas within and across categories of information using words, phrases, and clauses (e.g., in contrast, especially). Claimed in Lesson 15. Examples include:

- Lesson 15, Synthesize Section, Step 3: Literacy Support callout: "As students construct their explanation, encourage students to link their ideas using words and phrases like "in contrast", "as a result", or "especially" to emphasize important components of their explanation. This supports W.5.2C and ensures that students' written explanations include relevant cause and effect details." (Lesson 15, Teacher Guide).

CCSS-ELA-LITERACY.W.5.2D Use precise language and domain-specific vocabulary to inform about or explain the topic. Claimed in Lessons 5 and 15. Examples include:

- Lesson 5, Synthesize Section, Step 4: "Ask students to use their model to explain to the other group why the pool water could make living things unhealthy, even though it looked clear. Encourage students to use the prompts and questions on slide G to guide their sharing. Encourage them to use both words (scientific and everyday) and gestures while they share and ask questions about each others' models." (Lesson 5, Teacher Guide)

- Lesson 15, Connect Section, Step 4: "Develop a model for a healthy habitat. Display Slide E. Tell students that now that they helped Emily with her turtle habitat, they can apply what they know about mixtures, substances, and healthy waters to a plant or animal of their choice. Give students 15-20 minutes to complete Healthy waters for a plant or animal." (Lesson 15, Teacher Guide)

CCSS-ELA-LITERACY.W.5.5 With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. Claimed in Lesson 14. Examples include:

- Lesson 14, Synthesize Section, Step 4: "Ask students to review the ideas from their Revision Ideas handout and prepare to share those ideas with their group. Have the Community Water Problems: Criteria and Constraints chart visible to support groups as they collaborate to improve their designs using peer feedback. Use this assessment to determine how well your students have engaged with designing solutions to make sense of how criteria and constraints can be used to evaluate those solutions. As students work in their groups to revise their design solutions, look for them to compare revision ideas and figure out which revision ideas best address criteria and constraints." (Lesson 14, Teacher Guide)

CCSS-ELA-LITERACY.W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. Claimed in Lesson 4. Examples include:

- Lesson 4, Explore Section, Step 3: "Reflect on the work we have done as a class community. Display slide J. Remind students that we have spent a lot of time with our samples but sometimes other people can provide us new perspectives. Tell students let's see if our peers think the water samples are healthy and how well our filter design was distributed Properties of water samples to all students." (Lesson 4, Teacher Guide) Drawing evidence from texts is implied but not directly referenced in this statement.

Speaking and Listening

CCSS-ELA-LITERACY.SL.5.1B Follow agreed-upon rules for discussions and carry out assigned roles. Claimed in Lesson 1 and 3. Examples include:

- Lesson 1, Synthesize Section, Step 4: "Refer to the Classroom Agreements and ask which one(s) will be especially important while we are working to come to consensus." (Lesson 1, Teacher Guide)
- Lesson 3, Explore Section, Step 7: "Prepare to investigate safely. Use Slide R to review safety instructions (and any related classroom agreements) for working with the materials." (Lesson 3, Teacher Guide)

CCSS-ELA-LITERACY.SL.5.2 Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally. Claimed in Lesson 8 and 13. Examples include:

- Lesson 8, Explore Section, Step 2: "Share observations of the boiling water. Elicit what students noticed about the water by saying, "The water changed as it boiled. What changes did you notice?" As on Slide F, record their observations on the What happens when water boils? Chart." (Lesson 8, Teacher Guide)
- Lesson 13, Synthesize Section, Step 4: "Discuss the book. Ask for volunteers to share the information they got from reading about their chosen community. Display the prompts on slide D and start with one book chapter, calling on several volunteers who read the chapter about the community in Texas to share what they learned. Then repeat for the second chapter about the community in Louisiana." (Lesson 13, Teacher Guide)

CCSS-ELA-LITERACY.SL.5.4 Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace. Claimed in Lesson 11. Examples include:

- Lesson 11, Synthesize Section, Step 4: "Lead a Building Understandings Discussion. Then use the sequence of prompts on Slide M and below to lead the Building Understandings Discussion, focused on using their findings as evidence to answer the question: How did adding a substance change our water samples? Say something like, 'Remember that our investigation was trying to answer the question: How did adding a substance change our water samples. Let's share our investigation results to work to answer this question together.'" (Lesson 11, Teacher Guide)

Language

CCSS-ELA-LITERACY.L.5.5 Demonstrate understanding of figurative language, word relationships, and nuances in word meanings. Claimed in Lesson 10. Examples include:

- Lesson 10, Explore Section, Step 3: "Direct students to notice the title. Suggest breaking the word down into the root that we use frequently, treat. Ask students what the word "treat" means to them. Students may mention treats such as candy or toys, or may mention trick or treating. They may also mention treating an illness or injury. Ask which they think the book title refers to, considering what they have been doing so far in this unit. Ask how our existing idea of treatment of an illness helps us think about what is meant by water treatment. Accept all student ideas, and help direct students toward the idea of improving water quality. Suggest starting the book and seeing if that provides any additional clues." (Lesson 10, Teacher Guide)

Mathematics

Number and Operations in Base Ten

CCSS-MATH-5.NBT.A.4 Use place value understanding to round decimals to any place. Claimed in Lesson 12. Examples include:

- Lesson 12, Student Materials, Handout 1: "Record the weights that you measured in your data table from Table 2 in Part B of Add a Substance Investigation in the top row. Make sure to copy the weights, including all decimal places accurately. Then, round each number to the nearest whole number in the row below it." (Lesson 12, 5.2 Lesson 12 Handout 1 Making Sense of our investigation data)

CCSS-MATH-5.NBT.B.7 Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Claimed in Lesson 12. Examples include:

- Lesson 12, Explore Section, Step 2: "Small group discussions and Making sense of our investigation data provide an opportunity to gather evidence about Learning Goal 12, with the purpose of providing feedback and supporting students in using weight data to explain that even though a change in some properties occurred when substances were mixed together, there was not a change in the total weight of the mixture." (Lesson 12, Teacher Guide)

Criterion-Based Suggestions for Improvement

- Teacher directions could be adjusted in places where the text is purple above to ensure that students are meeting the intent of the specified ELA standard.

CATEGORY II

NGSS Instructional Supports

II.A. Relevance and Authenticity

EXTENSIVE

Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world.

i. Students experience phenomena or design problems as directly as possible (firsthand or through media representations).

ii. Includes suggestions for how to connect instruction to the students' home, neighborhood, community and/or culture as appropriate.

iii. Provides opportunities for students to connect their explanation of a phenomenon and/or their design solution to a problem to questions from their own experience.

The reviewers found **extensive** evidence that the materials engage students in authentic and meaningful scenarios that reflect the practices of science and engineering as experienced in the real world because students experience phenomena or design problems as directly as possible when they engage in the sensemaking of water quality and when they design solutions to make water healthier. The materials include suggestions in every lesson for how to connect instruction to students' homes, neighborhoods, communities, and/or cultures. The materials also provide support for teachers in working with students who may have experienced water-related trauma in the past. The materials do provide opportunities for students to connect their explanation of a phenomenon and/or their design solution to questions from their own experiences when they create warning posters about unhealthy water and when they are encouraged to apply what they know to plants or animals of their choice.

i. Students experience phenomena or design problems as directly as possible (firsthand or through media representations)

- Lesson 1, Explore 2: Make Observations, after students sort images of water: "Tell students that you actually have water samples from each of the bodies of water from the photos to further observe. Invite students to closely observe the five pitchers with water samples (that you prepared before class; see Water Sample Preparation (L1)). Display slide E for students to first discuss the health of the water samples in small groups." (Lesson 1, 5.2 Lesson 1 Teacher Guide).
- Lesson 2, Explore 3: Carry out an investigation: "Closely observe the water samples. Provide each group with a small sample of each of the remaining water samples. Have students work with their group making visual observations of each sample and recording their observations in Columns A and B on Water Observations." (Lesson 2, 5.2 Lesson 2 Teacher Guide).
- Lesson 6, Teacher Guide, Explore 2: Carry out an investigation: "Introduce the plan and data table for testing the water samples. Tell students that we are going to use test strips and magnets to figure out if any of the matter we listed on our Healthy/Unhealthy Water Chart. Let students know that there are specific test strips that test for specific types of matter. Display slide D and review the procedure for testing for each type of matter. Ask students to consider how they will keep track of all of the data they collect. When they suggest a data table, display slide E and distribute Testing the Water Samples and make sure that students are clear on where and how to record the data they collect with their test strips and magnet onto Table 2 on their handout" (Lesson 6, 5.2 Lesson 6 Teacher Guide).
- Lesson 8, Teacher Guide, Explore 2: Make observations: "Observe what happens to drinking water as it boils. We can observe what happens during the boiling process. To make it even faster so that we can see this in our classroom, the scientist took a time-lapse video. Use Slide D to show the time-lapse video (even 2-3 times), prompting students to be prepared to: Share their visual observations of the water as it boils[,] Revisit their predictions about what will happen to the weight of the water after it boils[,] Start to consider what is happening to the water particles as they boil" (Lesson 8, 5.2 Lesson 8 Teacher Guide).

- Lesson 9, Explore 2: Make observations: "Show the parts of the solar still. Use Slide C to show the supplies used to build the solar still. The parts of the still include: A large glass bowl, a smaller collection jar, plastic wrap, gravel or small, round rocks, distilled water, and food dye. Emphasize how you mixed the food dye and water in the bowl, while the small jar inside the bowl was empty. Use Slide D to have students compare how the plastic wrap over the solar still is similar to the lid of a pot of boiling water." (Lesson 9, 5.2 Lesson 9 Teacher Guide).

ii. Includes suggestions for how to connect instruction to the students' home, neighborhood, community, and/or culture as appropriate.

- Lesson 1, Teacher Materials, Reference Cultural. "The chart below gives some different cultural perspectives about water from around the world. To help students develop cultural awareness and competency about the importance of clean and healthy water, use this chart to present them with varying perspectives of the importance and value of water sources and water concepts across the globe. Consider sharing some of these perspectives with students during the class discussion in the Connect about personal connections to water." (Lesson 1, Teacher Reference Cultural Perspectives)
- Lesson 3, Connect Section, Step 2, Broadening Access: "Encouraging students to consider where they have used or encountered the process of filtering in their own lives, both in this step and in subsequent steps in this lesson, help students use their own experiences as sources of knowledge and information. Encourage students to draw from their own experiences and celebrate their ability to leverage those experiences in class. This provides access by supporting engagement." (Lesson 3, Teacher Guide)
- Lesson 7, Connect Section, Step 5: "Connect to student experiences. Display Slide F. Jarrett's story is not uncommon and I have heard of similar stories. Have any of you personally experienced getting a skin irritation from water or has someone you know? Give students time to share and ask questions to each other." (Lesson 7, Teacher Guide)

iii. Provides opportunities for students to connect their explanation of a phenomenon and/or their design solution to a problem to questions from their own experience.

- Lesson 3, Connect Section, Step 2: Broadening Access callout: "Encouraging students to consider where they have used or encountered the process of filtering in their own lives, both in this step and in subsequent steps in this lesson, help students use their own experiences as sources of knowledge and information. Encourage students to draw from their own experiences and celebrate their ability to leverage those experiences in class. This provides access by supporting engagement." (Lesson 3, Teacher Guide).
- Lesson 7, Student Materials, Handout 3 Create a Warning Poster: "If you would rather research a water example near you and create a warning poster for that water you can do that. Just be sure to include the same things that are on the bulleted list above." (Lesson 7, 5.2 Lesson 7 Handout 3 Create a Warning).
- Lesson 15, Connect Section, Step 4: "Develop a model for a healthy habitat. Display Slide E. Tell students that now that they helped Emily with her turtle habitat, they can apply what they know about mixtures, substances, and healthy waters to a plant or animal of their choice." (Lesson 15, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

II.B. Student Ideas

EXTENSIVE

Student Ideas: Provides opportunities for students to express, clarify, justify, interpret, and represent their ideas and respond to peer and teacher feedback orally and/or in written form as appropriate.

The reviewers found **extensive** evidence that the materials provide students with opportunities to share and respond to ideas. Students are able to respond to teacher and student feedback and change their thinking over time. The materials provide opportunities for scientist circles in which students share, clarify, justify, and build on ideas; for students to produce artifacts that showcase their thinking; and for students to use their My Growing Ideas Chart to keep track of their changing thinking across the unit. Artifacts do show evidence of students' reasoning and changes in their thinking over time. There are teacher-to-student and peer-to-peer verbal and written feedback loops to help students improve their filter designs and their solutions to large-scale community water problems.

Student ideas are clarified, justified, and built upon

- Lesson 1, Synthesize Section, Step 6: "Elicit students' questions. Display slide M. Distribute one sticky note to each student (or two if you have extra time or a small class). Direct students to look back at the work we've done thinking about healthy and unhealthy water. Ask, "What questions do we need to answer to decide if the samples are healthy or unhealthy?" Ask students to use a marker to write one question on their sticky note. They should write their questions so they are big and bold—we want to be able to see the questions clearly. Remind students that it is part of our mission in this unit to answer these questions." (Lesson 1, Teacher Guide)
- Lesson 3, Connect Section, Step 2. "Gather ideas about removing materials from the water samples. Elicit students to share ideas from their conversations, both ideas that groups agreed on and ideas that were different from other groups- they are brainstorming all kinds of ways to remove materials from the water samples. Document their ideas on the "How can we remove materials that we can see?" Brainstorm chart." (Lesson 3, Teacher Guide)
- Lesson 6, Synthesize Section, Step 4: "Class discuss the health of the water samples. Gather students in a Scientists' Circle and ask them to bring their copy of Testing the Water Samples. Have the Healthy/Unhealthy Water Chart visible and accessible and a marker ready to write student ideas onto the chart. Present slide K and tell them that we are going to work together to connect our ideas from the articles we read in Lesson 5 and the data we collected in this lesson to determine which of our samples have matter that could be unhealthy in them, even if that matter cannot be seen. Tell students that we are going to discuss our data and what it means together. Facilitate a Building Understandings discussion with students." (Lesson 6, Teacher Guide).
- Lesson 8, Explore Section, Step 2: "As on Slide C, prompt students to discuss with a partner what they predict will happen to the weight of the water as it boils. Accept (and, optionally, record) all answers, pushing for students to explain why they think their predictions will happen." (Lesson 8, Teacher Guide).

Artifacts show evidence of students' reasoning and changes in their thinking over time

- Lesson 4, Synthesize Section, Step 5: "Give students time to update their own chart. Display slide L. Show how this version of the chart is different from the last time they updated during Lesson 3, by asking students to reflect on what they figured out about the Engineering Design Process and their water samples (noting that they will dive deeper into the water samples in Lesson 5)." (Lesson 4, Teacher Guide)
- Lesson 8, Synthesize Section, Step 4: "Display Slide L. Remind students that our goal in a Building Understandings Discussion is to consider how our findings can help us decide if boiling is a good option for removing materials that make the water unhealthy from our water samples. Share what findings mean for the health of our samples. Have

a representative for each water sample briefly share their findings and what they mean about the health of their sample. Since there are multiple groups focused on the same water samples, check in with the other group(s) to see if they came to similar conclusions. If they did not, encourage students to use the prompts on Slide L to compare their findings, based on evidence." (Lesson 8, Teacher Guide)

- Lesson 11, Explore Section, Step 3, Assessment Opportunity: "Self reflection: Students use Part D on My Growing Ideas to use data that they collected from their investigation to reflect on how their thinking about what happens when you add a new substance to their water sample has changed." (Lesson 11, Teacher Guide)
- Lesson 12, Synthesize Section, Step 4: Give students time to update their own Growing Ideas chart. Display Slide E. Distribute *My Growing Ideas* to each student. Encourage students to answer the lesson question from Lesson 11 based on what they figured out in Lesson 11 and just now in Lesson 12. Make clear that the Growing Ideas chart is their space to write and draw their own thoughts and science ideas, not to copy from the teacher or classmates. Throughout the unit, students have had many chances to add to the My Growing Ideas chart and this will be the last time. Give students a chance to add *My Growing Ideas* to their science notebooks. After students have had enough time to add to their Growing Ideas chart, invite them to take a moment to reflect on their Growing Ideas chart and just how much their ideas have grown throughout this unit. (Lesson 12, Teacher Guide)

Students receive feedback and revise their thinking accordingly.

- Lesson 1, Teacher Guide, Synthesize 3: Develop a model: "As students are developing their models, provide them with feedback on the practice by asking them questions like: What does this part of your model represent? How are you representing what is making the water unhealthy? Where can you add arrows to your model to represent movements or relationships? Let's look back at the question you are answering with your model, can you show me where you see that answer represented?" (Lesson 1, 5.2 Lesson 1 Teacher Guide).
- Lesson 2, Synthesize 6: Participate in a discussion: "Come to a consensus on the materials recorded on the Healthy/Unhealthy Water chart. After all of the groups have shared their properties and materials for the class data table, ask the class to review the properties and raise their hand if there is a material they disagree with. Have students from all groups share ideas about whether or not they agree with the property and come to a class consensus about the materials recorded for each test and each water sample. Refer back to the Observation and Measurement Procedures on Water Observations and when necessary." (Lesson 2, 5.2 Lesson 2 Teacher Guide).
- Lesson 5, Teacher Guide, Synthesize 4: Develop a model to explain, Assessment Opportunity callout: "Peer feedback: Students' review of the Modeling Unseen Matter provides an opportunity for them to review their peers model, with the purpose of providing feedback that supports them in improving the accuracy and completeness of their model (i.e., it explains how the unhealthy matter in the water is made of particles that are too small to be seen but can be detected by other means). Students will have an opportunity to use the feedback in the next step to revise their models." (Lesson 5, 5.2 Lesson 5 Teacher Guide).
- Lesson 5, Teacher Guide, Synthesize 4: Develop a model to explain: "Use peer feedback to improve partner models. Ask students to return to their partner with their copy of Modeling Unseen Matter and the feedback provided by their peers. Display slide H and have students review the feedback on their model provided by their peers and consider how they would use it to improve the whole class model we will be creating. In pairs, allow students time to review the feedback and make improvements to their model using the guidance on slide H." (Lesson 5, 5.2 Lesson 5 Teacher Guide).
- Lesson 14, Teacher Guide, Synthesize 3: Compare solutions: "Provide peer review and feedback. Display slide F and ensure students the Community Water Problems: Criteria and Constraints chart is still visible to students. Distribute the Revision Ideas handout. Pair students up with someone from a group that has been working on a different community water problem. Remind students that they will need to first provide some background information

about the problem using Engineering Design: Community Water Problem from Lesson 13 before explaining their solution to their partner. Encourage students to record revision ideas in words, symbols or pictures as their peers provide feedback on Revision Ideas. Ensure that students have Giving and Receiving Feedback out to help guide their feedback discussions." (Lesson 14, 5.2 Lesson 14 Teacher Guide).

- Lesson 14, Teacher Guide, Synthesize 4: Reflect on our work: "Optimize Designs Solutions. Display slide H. Remind students that our goal today is to optimize our designs, or to make them the best that we can. Ask students to review the ideas from their Revision Ideas handout and prepare to share those ideas with their group. Have the Community Water Problems: Criteria and Constraints chart visible to support groups as they collaborate to improve their designs using peer feedback." (Lesson 14, 5.2 Lesson 14 Teacher Guide).

Criterion-Based Suggestions for Improvement: N/A

II.C. Building Progressions

EXTENSIVE

Identifies and builds on students' prior learning in all three dimensions, including providing the following support to teachers:

i. Explicitly identifying prior student learning expected for all three dimensions

ii. Clearly explaining how the prior learning will be built upon.

The reviewers found **extensive** evidence that the materials identify and build upon students' prior learning in all three dimensions. The materials provide this information in several places, including the unit front matter, the matrix, and directly in the lessons via callouts. The materials do explicitly identify prior learning expected for all three dimensions, but this is not always explicitly identified at the element level. The supports to teachers clearly explain how the prior learning will be built upon and provide support for teachers when students do not have the expected prior learning. The materials do provide explicit support to teachers to clarify adult understanding of the potential alternate conceptions that they, or their students, may have during the unit.

i. Explicitly identifying prior student learning expected for all three dimensions

Disciplinary Core Ideas: This information does not specify which DCI element is being addressed.

- 5.2 Matter Properties Unit Front Matter, DCIs Developed in This Unit: "PS1.A: Structure and Properties of Matter: Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.
- Students build off their development of this DCI in *Unit 5.1: How does a nurse log help other things live and grow?* beginning in Lesson 1 initial models of healthy and unhealthy water. Students further build on this DCI when they develop models showing chlorine that is unseen in pool water and when they formally revisit their and add particles to their consensus models in Lesson 7. From that point forward students are expected to incorporate particles in their models to explain what is going on with their water sample." (5.2 Matter Properties Unit Front Matter).

- Unit Front Matter, What ideas and experiences will my students bring that can help them in this unit?: “Chemical Reactions: Students may have previously conducted investigations (whether formally or informally) involving chemical reactions, such as mixing baking soda and vinegar, baking, Mentos in soda, or other types of around-the-house experiments. Elicit and draw on these experiences, and be aware that for some students, this unit may be the first time they are encountering these reactions in a meaningful way and/or scientific context. Lesson 11 provides a specific opportunity to elicit students’ experiences with adding substances to water before they conduct an investigation to do so with their water samples.” (5.2 Matter Properties Unit Front Matter).

Science and Engineering Practices: This information does not specify which SEP element is being addressed.

- Unit Front Matter, What ideas and experiences will my students bring that can help them in this unit?: “Planning & Carrying Out Investigations: Students may have previously planned and carried out investigations. It is likely that they will feel most comfortable carrying out investigations, but this unit will help them build on their ideas about how to plan investigations and how to analyze the data they collect to answer questions and improve designs. They will be given opportunities throughout the unit to plan and carry out investigations and analyze the data in order to determine the effectiveness of their investigations/designs.” (5.2 Matter Properties Unit Front Matter). Lesson 5, Synthesize 4: Develop a model to explain, Developing and Using Models callout: “If students have participated in Unit 5.1: How does a nurse log help other things live and grow?, they will have had a series of opportunities to develop and use models. Students are building on the practice in this lesson, as they use models to visualize unseen matter as particles within the water. They will have more opportunities to build on this practice in subsequent lessons.” (Lesson 5, 5.2 Lesson 5 Teacher Guide).

Crosscutting Concepts: This information does not specify which CCC element is being addressed.

- Unit Front Matter, What ideas and experiences will my students bring that can help them in this unit?: “Cause and Effect: From prior grades and everyday experiences, students may know that cause and effect relationships occur frequently. They can likely think of many different examples of cause and effect relationships, which could be leveraged when cause and effect relationships are introduced in Lesson 2. Students will advance their understanding of cause and effect relationships when they test water samples looking for the presence of materials based on test results, predicting the cause/effect relationship between elements of their filter design and the water sample, and analyzing their data to determine the effect various filter designs had on the water samples.” (5.2 Matter Properties Unit Front Matter).
- Lesson 5, Synthesize 4: Develop a model to explain, Energy and Matter callout: “While this is the first time in this unit that students are naming that matter is made of particles in this unit, if they have participated in the Unit 5.1: How does a nurse log help other things live and grow? unit, they will have had multiple opportunities to represent matter as particles prior to this lesson. In addition, students will continue to build on this concept in subsequent lessons as they make sense of the types of unseen matter that are found in some of the water samples.” (Lesson 5, 5.2 Lesson 5 Teacher Guide).

ii. Clearly explaining how the prior learning will be built upon.

- 5.2 Matter Properties Unit Front Matter, What ideas and experiences will my students bring that can help them in this unit?: “From prior grades and everyday experiences, students may know that cause and effect relationships occur frequently. They can likely think of many different examples of cause and effect relationships, which could be leveraged when cause and effect relationships are introduced in Lesson 2. Students will advance their understanding of cause and effect relationships when they test water samples looking for the presence of materials based on test results, predicting the cause/effect relationship between elements of their filter design and the water sample, and analyzing their data to determine the effect various filter designs had on the water samples.” (5.2 Matter Properties Unit Front Matter)

- Lesson 1, Synthesize Section, Step 3 Developing and Using Models Callout: "Students previously developed models to represent relationships in Unit 5.1: How does a nurse log help other things live and grow?. They build on those experiences when they represent initial ideas about what causes water to be healthy or unhealthy. Students also represent what can cause unhealthy water to become healthy. Students will continue to build on these representations in subsequent lessons in this unit. Use the prompts in the Use the Noticing Student Ideas in Models teacher reference for examples of the expansive ways students can represent ideas in their models." (Lesson 1, Teacher Guide)
- Lesson 6, Lesson Assessment Guidance: "If students have already engaged in Unit 5.1: How does a nurse log help other things live and grow? you may consider drawing on their experiences with inflating the basketball and modeling the air particles or any other moment in which matter was modeled as particles within the nurse log ecosystem." (Lesson 6, Teacher Guide)

Criterion-Based Suggestions for Improvement

- Consider identifying prior learning at the element level across the unit whenever prior learning is addressed.

II.D. Scientific Accuracy

EXTENSIVE

Scientific Accuracy: Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning.

The reviewers found **extensive** evidence that students do use scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning. The student-facing materials have precise, grade-appropriate wording to help students scaffold their understanding of concepts in all three dimensions, so creating misconceptions is avoided. Science ideas and representations are accurate. Students are encouraged to express their scientific ideas in light of new evidence.

- Lesson 2, Synthesize Section, Step 6: "Explain that scientists use the word mixture to describe when something is made of more than one material. Add mixture to the Word Wall and explain that using this term will make it easier to explain what is going on with their water sample, especially as we try to get the unhealthy materials out." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 4: "Define and identify criteria and constraints. Explain that just like people in the book (and optionally, article) who used engineering to solve water problems, the class needs to identify what counts as successful solutions for our problem before starting to design filters." (Lesson 3, Teacher Guide)
- Lesson 10, Synthesize Section, Step 4: "Say something like, "So since the scientist and engineer we read about have different water problems, with different properties, they need to add different things with different properties to make their water healthier." Use Slide K to explain that scientists use the word substance to describe a material that has specific properties. Students may recall that we defined material in a similar way. Tell students that the important difference is that a material can be more than one thing, or made up of more than one substance, but a substance is always one single thing. Some substances have the ability to form a new substance when they are mixed together, which can make water healthier. Add substance to the Word Wall and explain that using this term will make it easier to explain why the health of the water might change when adding substances." (Lesson 10, Teacher Guide)

- Lesson 6, Explore Section, Step 3: "Discuss the data from the investigation as a class. Continue to have the Healthy/Unhealthy Water Chart visible to students and make sure they have *Testing the Water Samples* available. Tell students that now that we have collected this data we can verify with evidence more of the matter that is in the water samples. Display slide G and facilitate a discussion about the types of matter that we now have evidence to prove are in the water samples." (Lesson 6, Teacher Guide)

Criterion-Based Suggestions for Improvement

- Avoid using the word "prove" when discussing the use of evidence. Consider substituting "suggests" or "supports" for "prove."

II.E. Differentiated Instruction

EXTENSIVE

Provides guidance for teachers to support differentiated instruction by including:

i. Supportive ways to access instruction, including appropriate linguistic, visual, and kinesthetic engagement opportunities that are essential for effective science and engineering learning and particularly beneficial for multilingual learners and students with disabilities.

ii. Extra support (e.g., phenomena, representations, tasks) for students who are struggling to meet the targeted expectations.

iii. 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.

The reviewers found **extensive** evidence for teachers to support differentiated instruction because the materials explicitly clarify how teachers anticipate the needs of students who might struggle with any of the three dimensions within a particular activity. Throughout a majority of the materials, multiple and varied individualized learning strategies that support three-dimensional sensemaking are supplied. These learning strategies are presented in supporting material like the Additional Accessibility Resources and directly in the teacher's material for each lesson. These supports provide detailed guidance describing how individual students with a variety of needs can be supported to access and engage in each specific learning activity. The materials provide a common learning sequence for all learners, ensuring students with diverse needs and abilities can access instruction. Materials suggest that teachers should provide multiple modalities for students to learn. The materials provide guidance describing how individual students with a variety of needs can be supported to access and engage in some learning activities, including extra supports for students who are struggling to meet the targeted expectations and some extensions for students with high interest or who have already met the performance expectation in the three dimensions.

i. Supportive ways to access instruction, including appropriate linguistic, visual, and kinesthetic engagement opportunities are essential for effective science and engineering learning and particularly beneficial for multilingual learners and students with disabilities.

- Unit Front Matter, What unit-specific strategies: "There are many ways differentiation occurs in classroom settings. You can address students' diverse learning needs in terms of student readiness, interest, and special learning needs and can make adjustments in terms of the content, the learning processes, and the student products that result from a learning experience. All Teacher Guides include UDL and differentiation guidance via callouts titled Broadening

Access, Community Connections, Teaching Tips, and Literacy and Math Supports. Many other strategies to support differentiation are more fully described in these sections of the Teacher Handbook:" (Unit 5.2, 1 5.2 Matter Properties Unit Front Matter)

- Additional Accessibility Resources provides seven specific accessible learning strategies to address students who may need extra support--multiple ways to communicate; extended time; repeat orally words that are written on shared representations; utilize text-to-speech and speech-to-text; utilize descriptive transcripts, alt text, and closed captioning; adjusting color; and accessing alternative formats of student files (Additional Accessibility, OpenSciEd Elementary & Accessibility).

Differentiation strategies address the needs of students when an obvious need arises: Emerging multilingual students learning English:

- Lesson 1, Explore Section, Step 2 Broadening Access Callout: "Supporting Equitable Student Discussions: Placing the pictures of water) in the middle of the circle for students to refer to supports equitable student discussion and enhances their sensemaking. The pictures of the water can help elicit ideas as they engage students by stimulating their visual, auditory, and tactile senses, making learning and discussions more accessible and memorable. When engaging in discussion about how students will investigate and collect data in today's lesson, encourage students to use the water pictures in the center of the circle if needed to support the ideas they share." (Lesson 1, Teacher Guide)
- Lesson 7, Synthesize Section, Step 2 Broadening Access Callout: "Supporting Equitable Discussions: To support equitable discussions for all learners, encourage students to share their thinking in a variety of ways. Validate and invite all the ways we communicate our ideas, such as with gestures or body movements, pointing at the photos, models, drawings (if helpful), and words from any languages your students use. This is especially beneficial for multilingual learners, but provides an opportunity for all learners to review their developing thoughts and explanations that allow for self-reflection. This might promote confidence, which ultimately optimizes motivation to engage in whole class discussions." (Lesson 7, Teacher Guide)
- Lesson 9, Explore Section, Step 2 Broadening Access Callout: "Supporting emergent multilinguals: Take time to break down some of the new words arising in this lesson, especially if you have emergent multilingual learners in your class. Ask students, Where have you seen the word "solar" before? "Still"? If possible, ask students to translate these words into other languages they might speak, and look for cognates. You can support all students, particularly emerging multilingual students, in forming a deeper understanding of newly encountered vocabulary by representing the term in multiple ways. For example, students can (1) write the term, (2) draw a representation of the term, (3) use their own words and experiences to write an explanation for what the term means, and (4) use the new term in a sentence." (Lesson 9, Teacher Guide)

Learners with special needs (visual impairments, tactile engagement, etc.)

- Lesson 2, Explore Section, Step 3, Broadening Access: "To make this investigation accessible to students with visual impairments, offer vision heightening options as ways to support students make and record observations of water samples. Options could include magnifying glasses combined with a light source to shine on water samples, detailed verbal/written descriptions of investigation and sample properties to focus on, and ensuring samples are labeled with large print. If available, use accessible technology such as video magnifiers to project magnified images of specimens onto a screen which allow students to see details with their remaining vision. Allow extra time for students if possible and a helpful partner to compare the properties of sample observations with. Work closely with the student's accommodations for the visually impaired to understand their specific needs and develop appropriate accommodations." (Lesson 2, Teacher Guide)

- Lesson 12, Synthesize Section, Step 5, Broadening Access: "The Healthy/Unhealthy Water chart is a great resource for students to reference as they make sense of the final health of their water samples, but the class copy may be difficult to read from far away. Consider creating a digital version of the completed Healthy/Unhealthy Water Chart so that students can have a printed or digital copy of the chart to access as they work in their pairs." (Lesson 12, Teacher Guide)

Learners reading below grade level

- Lesson 5, Explore Section, Step 2: "Use structures that work well with your students to read a passage together (taking turns reading paragraphs, re-reading the text, etc.). Some students may benefit from additional support as they engage in reading the article with their partner. Please see the Supporting Literacy for all Students section of the Teacher Handbook for ways to scaffold literacy tasks for students based on their individual needs." (Lesson 5, Teacher Guide)
- Lesson 8, Connect Section, Step 5 Broadening Access Callout: "Students can read this article in small groups or in partners as they answer questions. Some students may benefit from additional support as they engage in this reading task. Please see the Supporting Literacy for all Students section of the Teacher Handbook for ways to scaffold literacy tasks for students based on their individual needs." (Lesson 8, Teacher Guide)

ii. Extra support (e.g., phenomena, representations, tasks) for students who are struggling to meet the targeted expectations.

- Evidence from the materials where the criterion was met,
- Lesson 7, Lesson Assessment Guidance: "If a student needs additional scaffolds to apply the science ideas about identifying materials using their properties, review the My Growing Ideas chart, the Healthy/Unhealthy Water Chart, or any of the charts or materials that students used to identify materials based on their properties in Lessons 2 and 6 of this unit. You may also consider reviewing the properties chart and the properties of the red algae and the rain water on Student Assessment with individual students as needed." (Lesson 7, Teacher Guide)
- Lesson 11, Lesson Assessment Guidance: "If you notice that students need additional support in understanding that a new substance is formed when the properties change, consider giving students more time to digest the changes in smaller groups by creating a Venn diagram of the original sample, the substance and the results. It is important that students focus on how the measurable properties of chlorine and acidity prove that a new substance has formed. " (Lesson 11, Teacher Guide)

iii. 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.

- Lesson 3, Explore Section, Step 6: "Extension opportunity: If you do wish to build from students' previous experiences in 3rd and 4th grade measuring and estimating liquid volumes, have students use the graduated cylinders as a tool to measure the volume of their samples before and after filtering. The beakers included in the kit can provide an approximate measure of volume; if you have graduated cylinders they would enable students to more accurately measure the volume. (MP5 and MP6)." (Lesson 3, Teacher Guide) While this may be considered an extension, it does not help students deepen their understanding of the targeted practices, disciplinary core ideas, or crosscutting concepts.
- Lesson 5, Synthesize Section, Step 4: "Extension Opportunity: If time and interest allow, invite students to create a model that explains why one of the other types of water they read about was healthy for a living thing to swim in and/or drink." (Lesson 5, Teacher Guide).

- Lesson 10, Explore Section, Step 3: "Extension Opportunity: There are many scientists and engineers that are currently doing exciting work identifying microorganisms that can help remove pollution like microplastics from water. Consider searching or supporting your students in searching online for news articles and/or videos about these advances in making water healthier." (Lesson 10, Teacher Guide).

Criterion-Based Suggestions for Improvement

- Consider providing extension opportunities for students with high interest or who have already met the performance expectations in ways that involve applying learning in new contexts (e.g., transfer phenomena) or through the lenses of different CCC elements or could include extending to learning from the next grade level, such as the next level SEP element in a learning progression.

II.F. Teacher Support for Unit Coherence

EXTENSIVE

Supports teachers in facilitating coherent student learning experiences over time by:

i. Providing strategies for linking student engagement across lessons (e.g. cultivating new student questions at the end of a lesson in a way that leads to future lessons, helping students connect related problems and phenomena across lessons, etc.).

ii. Providing strategies for ensuring student sense-making and/or problem-solving is linked to learning in all three dimensions.

The reviewers found **extensive** evidence of teacher support for unit coherence. The materials support teachers in facilitating coherent learning experiences over time by providing guidance to help students see how lessons fit together. Guidance and support are provided for how to recognize what students figure out in a lesson, what questions are left unanswered, and what new questions could be answered in the next investigation. Navigation routines are used to make connections between lessons explicit to students. Throughout the unit, lesson assessment guidance and strategies are provided to ensure that students view their learning in all three dimensions as coherently linked to the progress they make toward explaining the water quality phenomenon.

i. Providing strategies for linking student engagement across lessons (e.g. cultivating new student questions at the end of a lesson in a way that leads to future lessons, helping students connect related problems and phenomena across lessons, etc.).

Each lesson begins with a Navigate Section that prompts students to share ideas about where they left off in the previous lesson and what they want to figure out in the next lesson. Each lesson ends with a Navigate Section that allows students to share their ideas about what they have figured out in the previous lesson and begin thinking about what that means for the next lesson.

- Lesson 1, Synthesize Section, Step 6: "Distribute one sticky note to each student (or two if you have extra time or a small class). Direct students to look back at the work we've done thinking about healthy and unhealthy water. Ask, "What questions do we need to answer to decide if the samples are healthy or unhealthy?" Ask students to use a marker to write one question on their sticky note." (Lesson 1, Teacher Guide)

- Lesson 4, Navigate Section, Step 6: "After giving time for students to reflect, ask students what more information we could collect to know if we removed everything from the water. What could be left that is giving off an order or causing the properties not to change? What other evidence do we need to collect? Give students time to revisit the ideas for the investigation chart and decide if there is an investigation that we listed we can do to gather more information, or if there is an idea we can add to figure out if our water sample is healthy or not and explore more about what is in the water samples." (Lesson 4, Teacher Guide)
- Lesson 7, Slide A: "Turn and tell a partner: What questions are we trying to answer in this unit? Where can we look to remind ourselves of what we have figured out so far? What investigations did we complete to figure out the answers to our questions?" (Lesson 7, 5.2 Lesson 7 Slides).

ii. Providing strategies for ensuring student sense-making and/or problem-solving is linked to learning in all three dimensions.

- Lesson 2, Synthesize Section, Step 7: "Teaching Tip: These moments for self-reflection are important for students to synthesize information in ways that make sense to them, while also practicing how to communicate that information, even if it is for their own use. We suggest that if you choose to review students' Growing Ideas charts, you only use them to see where your students are in their learning, rather than using them as a graded assessment." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 4 Asking Questions and Defining Problems callout: "In this lesson students define a specific problem of needing to remove visible materials from their water samples. Students may struggle with the distinction between criteria and constraints, especially if this is their first experience with them. Leverage Engineers Solve Problems and Design Solutions as well as students' stated goals from the beginning of the lesson to help students understand criteria. Constraints can also be returned to in the next few steps of the lesson as students plan their filter designs." (Lesson 3, Teacher Guide).
- Lesson 8, Lesson Assessment Guidance: "If students are challenged by explaining this process, or the differences between the two different results, have them talk to each other to explain their ideas. Circulate to hear what kinds of ideas they are sharing, and build on those to collaboratively work through the process. This can be challenging for students to explain since they can not directly observe the particles. Consider providing manipulatives to help envision the particles and what happens as the samples boiled, using previous models from this unit as examples." (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize Section, Step 5 Broadening Access Callout: "Support multiple means of representation by emphasizing to students that the [sic] model for the solar still handout is intended to support their thinking and explanatory process. If the manipulatives and cups help students to verbally and physically explain how the solar still works, they don't need to fully fill out every part of the handout." (Lesson 9, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

II.G. Scaffolded differentiation over time

ADEQUATE

Provides supports to help students engage in the practices as needed and gradually adjusts supports over time so that students are increasingly responsible for making sense of phenomena and/or designing solutions to problems.

The reviewers found **adequate** evidence that supports are provided to help students engage in the practices as needed and for teachers to gradually adjust supports over time so that students are increasingly responsible for making sense of phenomena and/or designing solutions to problems for some of the intentionally developed SEP elements. Scaffolding generally occurs at the level of the SEP and not at the level of the element. Several targeted elements occur in only one lesson and can, therefore, not have scaffolded differentiation over time in this unit.

AQDP: Asking Questions and Defining Problems

Claimed Element: AQDP-E3: Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.

Claimed in Lesson 1. Evidence was found in lesson 1. Examples include:

- Lesson 1, Synthesize Section, Step 6: "Direct students to look back at the work we've done thinking about healthy and unhealthy water. Ask, "What questions do we need to answer to decide if the samples are healthy or unhealthy?") (Lesson 1, Teacher Guide) This element is identified in Lesson 1. However, as this is the only time the element is used in the unit, there is not sufficient development over time to meet the criteria of II.G.

Claimed Element: AQDP-E5: Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.

Claimed in Lessons 3, 13, and 15. Evidence was found in all claimed lessons. Examples include:

- Lesson 3, Connect Section, Step 2: "Review the list and elicit students' ideas about which we should try out first with our water samples, narrowing in on the direction to physically separate, or filter, materials from the mixture of water and other materials...Show Slide C and introduce the available materials. Ask students which materials they think might be helpful in filtering our water samples, keeping in mind the water sample that they will be filtering." (Lesson 3, Teacher Guide)
- Lesson 3, Explore Section, Step 4: "Use the prompts below and on Slides H-I to review the terms "criteria" and "constraints" and add these to the word wall. Then elicit students' ideas for criteria and constraints for designing filters, and record them on a class Filter Criteria and Constraints chart." (Lesson 3, Teacher Guide)
- Lesson 13, Lesson 13 Slides, Slide E: "What criteria and constraints do we need to consider? How will you know if your design solutions work?" (Lesson 13, Slides)

INV: Planning and Carrying Out Investigations

Claimed Element: INV-E1: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

Claimed in Lessons 3, 4, and 11. Evidence was found in all claimed lessons. Examples include:

- Lesson 3, Explore Section, Step 5: "Introduce a new challenge. Use Slide K to introduce the idea that each group working on the same sample type needs to have a different filter design: when we are engineering, the more design ideas we have to test out, the more we can figure out from our first designs!" (Lesson 5, Teacher Guide)
- Lesson 4, Explore Section, Step 2: "Decide on changes to filter design. Distribute the Optimize, test, and reflect on our filter handout to each student. As on Slide D, provide about ten minutes for groups to determine which changes they want to make to their filter, based on their data on Filter Design and Testing)." (Lesson 4, Teacher Guide)
- Lesson 4, Explore Section, Step 2: "Note with students that in line with controlling variables, they will only make one change at a time. Direct them to choose the top two changes that they want to make to their original filter design and predict the new effects that those changes will cause." (Lesson 4, Teacher Guide)
- Lesson 11, Lesson 11 Slides, Slides F-K: Students are working collaboratively to plan criteria and constraints for the investigation. Then procedures are followed to carry out the investigation of adding a substance to the water samples. (Lesson 11, Slides)

Claimed Element: INV-E3: Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

Claimed in Lessons 2 and 6. Evidence was found in all claimed lessons. Examples include:

- Lesson 2, Explore Section, Step 3: "Work through the procedure for observing the samples and recording the data for drinking water. Referring to the Water Observations, show students that we are going to collect data about each water sample by observing the same properties about each sample. Tell students that we are going to do the drinking water observations together to get an idea of the procedure and then we will do the rest of the samples in small groups. Demonstrate how to make observations for each of the properties using the drinking water sample." (Lesson 2, Teacher Guide)
- Lesson 6, Explore Section, Step 3: "Tell students that now that we have collected this data we can verify with evidence more of the matter that is in the water samples. Display slide G and facilitate a discussion about the types of matter that we now have evidence to prove are in the water samples." (Lesson 6, Teacher Guide) While students are using this element in two lessons, there is no evidence that scaffolds are deliberately removed, allowing them to use the element more independently as the unit progresses.

Claimed Element: INV-E4: Make predictions about what would happen if a variable changes.

Claimed in Lesson 4. Evidence was found in lesson 4. Examples include:

- Lesson 4, Student Materials, Handout 1 Optimize, test, and: "Choose two parts of your filter that you want to change to solve the problem of getting stuff that we can see out of the water. In the box below, write or draw your prediction of what that change will do (cause) to get stuff out of the water (effect)." (Lesson 4, 5.2 Lesson 4 Handout 1 Optimize, test, and) This element is identified in Lesson 4. However, as this is the only time the element is used in the unit, there is not sufficient development over time to meet the criteria of II.G.

Claimed Element: INV-E5: Test two different models of the same proposed object, tool, or process to determine which better meets criteria for success.

Claimed in Lessons 4 and 14. Evidence was found in all claimed lessons. Examples include:

- Lesson 4, Explore Section, Step 2: "Build and test the new filter. As groups decide what they will change, allow them to access the supplies to build and test their new design" (Lesson 4, Teacher Guide)
- Lesson 4, Lesson 4 Slides, G: "Build and test your optimized filter. To control variables, make only one change at a time. Record data for each change you make in Part B." (Lesson 4, 5.2 Lesson 4 Slides)
- Lesson 14, Synthesize Section, Step 3: "Provide peer review and feedback. Display slide F and ensure students the Community Water Problems: Criteria and Constraints chart is still visible to students. Distribute the Revision Ideas handout. Pair students up with someone from a group that has been working on a different community water problem. Remind students that they will need to first provide some background information about the problem using Engineering Design: Community Water Problem from Lesson 13 before explaining their solution to their partner. Encourage students to record revision ideas in words, symbols or pictures as their peers provide feedback on Revision Ideas. Ensure that students have Giving and Receiving Feedback out to help guide their feedback discussions." (Lesson 14, Teacher Guide). As students move through the unit, they use this element in concrete examples early in the unit, and then use it to test a large community solution in lesson 14. This testing is done by applying criteria and constraints to solutions that are not concrete and testable in the classroom.

CEDS: Constructing Explanations and Designing Solutions

Claimed Element: CEDS-E2: Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.

Claimed in Lesson 15. Evidence was found in lesson 15. Examples include:

- Lesson 15, Student Materials, Student Assessment 1: "For each part of your explanation, include at least one piece of evidence (measurements, observations, patterns) to support your idea. The evidence you share should also explain a cause and effect relationship." (Lesson 15, 5.2 Lesson 15 Student Assessment Emily_s Turtle Tank) This element is identified in Lesson 15. However, as this is the only time the element is used in the unit, there is not sufficient development over time to meet the criteria of II.G.

Claimed Element: CEDS-E4: Apply scientific ideas to solve design problems.

Claimed in Lesson 13 and 14. Evidence was found in lesson 13 and 14. Examples include:

- Lesson 13, Student Materials, Handout 2: "Explain how you think your design solution may change the properties of the water to be more healthy. For each part of your explanations, use evidence from our investigations throughout the unit to support your idea." (Lesson 13, 5.2 Lesson 13 Handout 2 Engineering Design Community)
- Lesson 14, Synthesize Section, Step 4: "Reflect on the design process. Display slide I. Students fill out Engineering Reflection, a reflection answering the following questions to demonstrate what they have individually learned through the process of designing this solution:" (Lesson 14, Teacher Guide). While students are using this element in two lessons, there is no evidence that scaffolds are deliberately removed, allowing students to use the element more independently as the unit progresses.

Claimed Element: CEDS-E5: Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

Claimed in Lesson 14. Evidence was found in lesson 14. Examples include:

- Lesson 14, Synthesize Section, Step 3: "Provide peer review and feedback. Display slide F and ensure students the Community Water Problems: Criteria and Constraints chart is still visible to students. Distribute the Revision Ideas handout. Pair students up with someone from a group that has been working on a different community water problem. Remind students that they will need to first provide some background information about the problem using Engineering Design: Community Water Problem from Lesson 13 before explaining their solution to their partner. Encourage students to record revision ideas in words, symbols or pictures as their peers provide feedback on Revision Ideas. Ensure that students have Giving and Receiving Feedback out to help guide their feedback discussions." (Lesson 14, Teacher Guide) This element is identified in Lesson 14. However, as this is the only time the element is used in the unit, there is not sufficient development over time to meet the criteria of II.G.

Criterion-Based Suggestions for Improvement

- Consider either providing support for the development of the identified elements (AQDP-E3, INV-E3, INV-E4, CEDS-E2, CEDS-E4, and CEDS-E5) and reducing scaffolding over time for them or removing these elements from the Unit Front Matter and the 5 5.2 Matter Properties SEP-DCI-CCC-ELA-Math-Matrix.

CATEGORY III
Monitoring NGSS Student Progress

III.A. Monitoring 3D Student Performance

EXTENSIVE

Elicits direct, observable evidence of three-dimensional learning; students are using practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions.

The reviewers found **extensive** evidence that materials elicit direct, observable evidence of three-dimensional learning and that students are using practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions. In Lessons 7 and 15, teachers are prompted to assess student performance in summative assessments, and informal, formative assessment occurs in every lesson throughout the unit. Additionally, students produce artifacts across the unit that demonstrate their integration of the three dimensions for sensemaking and problem solving.

Formal tasks in the materials are driven by well-crafted phenomena- and problem-based scenarios that can elicit rich student performances.

- Lesson 7, Connect Section, Step 3: "Read a personal account. Display Slide D and tell students that you have a personal account from a person named Jarret, who explains an experience he had with unhealthy water. Jarret could use our help in figuring out what happened to him." (Lesson 7, Teacher Guide)
- Lesson 7, Student Assessment Handout: Students are provided a realistic scenario and data to analyze and interpret. They are tasked with using the data to identify the matter in the water sample and use evidence to support their claim. (Lesson 7, Student Assessment)
- Lesson 15, Synthesize Section, Step 3: "Construct an explanation Display Slide D. Give students 20-30 minutes to complete *Emily's Turtle Tank* to help Emily identify what she needs to do to solve the problem with the water in Mikey's tank. (Lesson 15, Teacher Guide)
- Lesson 15, Student Assessment Handout: Students are provided a realistic scenario, data to analyze and interpret, and an opportunity to justify a solution for improving the water quality in a pet turtle's tank. This task effectively requires students to apply what they have learned throughout the unit to explain why they chose one of the design solutions.

Student performances produce artifacts of integrating the three dimensions in service of sense-making or problem-solving.

- Lesson 1, Synthesize Section, Step 3: "Ask students to decide which water sample they think is the most healthy and which is the least healthy. Distribute the Initial Model handout to each student and use slide G to walk through the different prompts that support student's modeling. Point out the zoom-in bubble on Initial Model and tell students that if they think there is anything really small that they would like to represent in their model, to do that in the zoom-in bubble so it is large enough for people to view clearly." **MOD-E2: Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.**, **CE-E1: Cause and effect relationships are routinely identified, tested, and used to explain change**, **5-PS1.A.1 PS1.A Structure and Properties of Matter: Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.** (5-PS1-1) (Lesson 1, 5.2 Lesson 1 Teacher Guide)
- Lesson 3, 5.2 Lesson 3 Handout 3 Filter Design and: "Record visual observations in detail. Draw your filter after filtering. It should include the materials that were left in the filter after you poured your water sample through the filter. Consider how the properties of the materials you are trying to remove from the water relate to this part of the

filter. Be specific about what you think the cause and effect relationship will be." **MOD-E5: Develop a diagram or simple physical prototype to convey a proposed object, tool, or process. ETS1.A.1 ETS1.A Defining Engineering Problems: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (ETS1.A-E1). CE-E1: Cause and effect relationships are routinely identified, tested, and used to explain change.** (Lesson 3, 5.2 Lesson 3 Handout Filter Design and)

- Lesson 7, Connect Section, Step 3: Students are asked to support their thinking with evidence. For example on question 3 on the student assessment: "3. Using the above information and Table 1, what type of matter do you think was filtered out of the water? (*circle one*) Green algae, Red algae, Iron, Rainwater; Identify all of the evidence that you have to support your answer." (Lesson 7, Teacher Guide/Student Assessment) **Analyze and interpret data** related to the **properties** of types of matter that can be found in water, including **weight**, in order to **identify what type of matter they are**. **DATA-E2: Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation. PS1.A-E3: Measurements of a variety of properties can be used to identify materials. SPQ-E2: Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.**

Students routinely produce artifacts with evidence of using the grade-appropriate elements of SEPs, CCCs, and DCIs that are targeted as learning objectives.

- Lesson 3, Handout: Filter Design and Testing: students produce an artifact as evidence of targeted learning objective 3.A: "3.A Identify criteria, constraints, and predicted cause and effect relationships to design an engineered solution that changes the properties of our water samples to be more healthy by removing materials from the mixture." (Lesson 3, 5.2 Lesson 3 Handout Filter Design and Testing).
- Lesson 4, Handout 1: Optimize, test, and reflect on our filter, students optimize their filter design using elements of the three dimensions INV-E1, CE-E1, and ETS1.A-E1.
- Lesson 8, Handout 2: Analyze and interpret boiling data: "What caused the changes that you observed in the sample? Use the box and lines below to draw or write your explanation of what happened to the matter and particles in the water sample as it boiled." (Lesson 8, 5.2 Lesson 8 Handout 2 Analyze and interpret).

Criterion-Based Suggestions for Improvement: N/A

III.B. Formative

EXTENSIVE

Embeds formative assessment processes throughout that evaluate student learning to inform instruction.

The reviewers found **extensive** evidence that formative assessment processes are embedded into instruction. Students can use a range of modalities to demonstrate their thinking. Formative assessment opportunities are included for assessing students' thinking in each of the three dimensions—separately and together. Students are given the opportunity to revise their models, their growing ideas chart, and the DQB throughout the unit. The formative assessments take varied forms and are frequently built directly into instructional sequences rather than existing as a separate "assessment." Students are offered choices of modalities to demonstrate their thinking, ensuring that all learners have the opportunity to demonstrate their knowledge. Teachers are supported in adjusting instruction based on individual student difficulties with all three dimensions and their use together. Guidance for teachers is provided in each lesson so that the teacher can modify instruction based on formative assessment results.

Materials include explicit, frequent, and varied supports for formative assessment processes.

- 5.2 Matter Properties Assessment System Overview: "Assessment opportunities are embedded and called out directly in the lesson plans. Please look for the yellow "Assessment Opportunity" support in each lesson plan to identify suggested assessments." (5.2 Matter Properties Assessment System Overview)
- In each lesson's Lesson Assessment Guidance, the materials provide the three dimensional learning target, information to look/listen for color-coded to each dimension, and suggestions for how to use the assessment information.
- Lesson 3, Lesson Assessment Guidance: "Use the student handout, as well as student discussions during their planning and investigation, to formatively assess students' investigation plan. Provide feedback and time to revise their investigation plans as needed before they test their filters. Feedback may take the form of recommending students be more specific in their investigation plans by including measurement units or naming tools or parts used to build and test the filter. Feedback on Part C may include encouraging students to use correct units or add labels to their models to clarify their observations." (Lesson 3, Teacher Guide)

Formative assessment processes routinely provide varied support for student thinking across all three dimensions.

- Lesson 6, Explore Section, Step 2: "Formative assessment: Collecting data from the test strips and magnets on Testing the Water Samples provides an opportunity to gather evidence about Learning Goal 6, with the purpose of providing feedback and supporting students in producing data to serve as evidence to prove that certain types of matter exist in the water samples even when they cannot be seen. Use the following suggestions to provide feedback and determine next steps before moving on to the discussion of the data." (Lesson 6, Teacher Guide)
- Lesson 8, Teacher Guide, Synthesize 4: Participate in a discussion, Developing and Using Models callout: "Students are using this practice as they represent their ideas in the class consensus model. Look for students to include what happened to the water at the particle level." (Lesson 8, 5.2 Lesson 8 Teacher Guide).
- Lesson 11, Explore Section, Step 3: "Assessment Opportunity: On Part C of Add a Substance Investigation you have an individual opportunity to formatively assess learning goal 11.A. Look for students accurately using their investigative data to support the claim that a new substance was formed, based on the change in properties. Spend time as needed during the Building Understandings Discussion that follows in the Synthesize to ensure students' understanding of this idea based on their investigative findings." (Lesson 11, Teacher Guide)

Formative assessment processes routinely attend to multiple aspects of student equity.

- Lesson 11, Assessment Guidance: "Evidence of students' ideas may be expressed in words, drawings, written or spoken descriptions, movement, and/or gestures." (Lesson 11, Teacher Guide)
- Lesson 15, Explore Section, Step 2, Broadening Access: "Some students may benefit from additional support as they engage in reading the assessment. Please see the Supporting Literacy for all Students section of the Teacher Handbook for ways to scaffold literacy tasks for students based on their individual needs." (Lesson 15, Teacher Guide)
- Lesson 15, Synthesize Section, Step 3, Broadening Access: "Provide opportunities, as needed, for students to communicate their ideas through words, pictures, diagrams, data tables, verbally, or using gestures. This allows for multiple means of *action or expression*. Another option is to encourage students to use their My Growing Ideas chart to support their thinking as they respond to the assessment questions. Provide opportunities for students to access materials and resources they may have from the unit's lessons such as past data, handouts or My Growing Ideas chart to support their thinking as they respond to the assessment questions. Allow students to communicate their ideas through words, pictures, verbally, or using gestures. This allows for multiple means of *action or expression which will support students in more fully expressing their sensemaking*." (Lesson 15, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

III.C. Scoring Guidance

EXTENSIVE

Includes aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers in (a) planning instruction and (b) providing ongoing feedback to students.

The reviewers found **extensive** evidence for this because the materials include explicit guidance on levels of student understanding and proficiency for all three dimensions and their use together. Scoring rubrics help teachers determine the level of understanding that students have achieved in using each of the three dimensions for sensemaking. Scoring guidance is provided for major formative assessments and summative assessments. Both teachers and students are supported in interpreting student progress over time.

Every lesson contains Lesson Assessment Guidance that indicates where to use the assessment within the lesson, what to look and listen for, and detailed guidance on how to use the information. Every lesson contains at least one Assessment Opportunity embedded in the lesson that provides guidance on what to look and listen for and how to use the information. Key formative assessment opportunities include an Instructional Guidance document that provides possible responses to help interpret student responses. The Instructional Guidance documents provide planning for instruction in response to student performances to move the learning forward. Scoring guidance for summative assessments does not provide teachers with suggestions for providing targeted feedback.

Support for planning instruction

- Lesson 7, Synthesize Section, Step 4, Assessment Opportunity: "Summative assessment: Students analysis and interpretation of data on Student Assessment provides an opportunity to gather evidence about learning goal 7, with the purpose of summatively assessing students' analysis of data related to various properties of different types of matter to identify which type of matter was in a water sample. Use Beach assessment scoring guide and to provide feedback to students." (Lesson 7, Teacher Guide) The scoring guide is organized by dimension and provides suggestions for student responses to each question across three performance levels. Suggestions for planning instruction with respect to student responses are not provided.

- Lesson 11, Explore Section, Step 3, Assessment Opportunity: "On Part C of Add a Substance Investigation you have an individual opportunity to formatively assess learning goal 11.A. Look for students accurately using their investigative data to support the claim that a new substance was formed, based on the change in properties. Spend time as needed during the Building Understandings Discussion that follows in the Synthesize to ensure students' understanding of this idea based on their investigative findings." (Lesson 11, Teacher Guide)
- Lesson 15, Synthesize Section, Step 3, Assessment Opportunity: "Use students' responses on *Emily's Turtle Tank* as a summative assessment for learning goal 15. Look for evidence that students can identify and explain cause and effect relationships between adding a substance and resulting mixtures, using changes in properties and matter as evidence to support their explanation. See Scoring Guide for details." The scoring guide is organized by dimension and provides suggestions for student responses to each question across three performance levels. (Lesson 15, Teacher Guide)

Support for ongoing feedback

- Lesson 8, Lesson Assessment Guidance: "This assessment is a formal opportunity to gather summative information about students' progress. See guidance for interpreting student responses provided in the Beach assessment scoring guide tool." (Lesson 8, Teacher Guide) Suggestions for modifying instruction or providing ongoing, targeted feedback to individual students based on the scoring criteria are not provided.
- Lesson 11, Lesson Assessment Guidance: "Use the information you gather to guide follow-up questions during the discussion in the Synthesize as the class discusses the results of the investigation. If you notice that students need additional support in understanding that a new substance is formed when the properties change, consider giving students more time to digest the changes in smaller groups by creating a Venn diagram of the original sample, the substance and the results. It is important that students focus on how the measurable properties of chlorine and acidity prove that a new substance has formed." (Lesson 11, Teacher Guide)
- Lesson 15, Synthesize Section, Step 3, Assessment Opportunity: "Use students' responses on *Emily's Turtle Tank* as a summative assessment for learning goal 15. Look for evidence that students can identify and explain cause and relationships between adding a substance and resulting mixtures, using changes in properties and matter as evidence to support their explanation. See Scoring Guide for details." (Lesson 15, Teacher Guide) Suggestions for modifying instruction or providing ongoing, targeted feedback to individual students based on the scoring criteria in subsequent units are not provided.

Criterion-Based Suggestions for Improvement

- Consider including suggestions for providing ongoing, targeted feedback to individual students based on the scoring criteria for the summative assessment opportunities.

III.D. Unbiased Tasks/Items

EXTENSIVE

Assesses student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students.

The reviewers found **extensive** evidence that tasks/items assess student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students. The teacher guidance for the summative assessments in Lessons 7 and 15 provide structures for ensuring that all students can access the new phenomena before they are asked to demonstrate sensemaking and/or problem solving related to the phenomena.

Multiple modes of communication

- Lesson 7, Student Assessment: The student assessment task contains pictures, tables, and options for students to select, communicating expectations using a variety of modes. The vocabulary and text volume are grade-level appropriate. Since the task involves a beach scenario, the materials provide prompts for the teacher to use to reach students who have not experienced a beach. Students are prompted to use the information available on the task as evidence in their responses.
- Lesson 12, Synthesize Section, Step 3 Broadening Access Callout: "Students benefit from having various options to perceive ideas from other students. Have students share their diagrams with others multimodality to support access to different entry points of sensemaking through processing written text, verbal explanations, and drawings. To support physical action explanations, students could also model the diagram with materials such as cuisenaire rods, unifix cubes, and/or tape diagrams." (Lesson 12, Teacher Guide)
- Lesson 15, Student Assessment Emily's Turtle Tank: The student assessment task contains pictures, tables, and options for students to select. Students communicate expectations using a variety of modes. The vocabulary and text volume are grade-level appropriate. Students are asked to provide their explanations using text and drawings.

Supports success for all students

- Lesson 1, Connect Section, Step 5: "Share related phenomena. Display slide L and a chart paper labeled "Related Phenomena" and ask students to share any phenomena they noticed in their home or community or discuss with family or friends. Record related phenomena on the chart paper." (Lesson 5, Teacher Guide)
- Lesson 3, Connect Section, Step 2: "Brainstorm with a partner. Have students pair up to discuss the question on Slide B with a partner. After one minute, have two pairs join together to share ideas. Encourage students to pay attention to where their ideas align or differ. After one more minute, call students back together. Ask for volunteers to share what they discussed." (Lesson 3, Teacher Guide)
- Lesson 9, Explore Section, Step 2: "Broadening Access: Supporting emergent multilinguals: Take time to break down some of the new words arising in this lesson, especially if you have emergent multilingual learners in your class. Ask students, Where have you seen the word "solar" before? "Still"? If possible, ask students to translate these words into other languages they might speak, and look for cognates. You can support all students, particularly emerging multilingual students, in forming a deeper understanding of newly encountered vocabulary by representing the term in multiple ways. For example, students can (1) write the term, (2) draw a representation of the term, (3) use their own words to write an explanation for what the term means, and (4) use the new term in a sentence." (Lesson 9, Teacher Guide)

Multiple modalities and student choice

- Lesson 2, Teacher Reference Agreements, Student's Linguistic and Multimodal Resources for Meaning-Making: "The table below includes examples of linguistic and multimodal resources that students might draw upon as they engage in scientific sensemaking. These examples reflect the forms that language can take (i.e., the noun), and the modes through which meaning-making resources might be employed (e.g., writing, reading, listening, speaking, graphing, charting, drawing). These resources are all essential for making meaning and communicating ideas. They should not be viewed as scaffolds or supplemental to one another. Avoid privileging any one resource over others (e.g., favoring writing in English over gestures)." (Lesson 2, 5.2 Lesson 2 Teacher Reference Agreements Lesson 2)
- Lesson 7, Connect Section, Step 5: "Create a warning poster. Display Slide G. Water can be healthy and unhealthy for many reasons. We have figured out a lot about what makes water healthy and unhealthy and what properties of the water can help us decide if it is healthy or unhealthy. Allow students time to complete *Create a Warning Poster* and use their knowledge of properties to create an informative warning poster that can advise someone if the water is healthy to swim in. " (Lesson 7, Teacher Guide)
- Lesson 9, Teacher Guide, Synthesize 5: Develop a model: "Direct students to use the manipulatives as they talk with their partner to explain their thinking about how the solar still works, for about 5 minutes." (Lesson 9, Teacher Guide).
- Lesson 11, Teacher Guide, Lesson Assessment Guidance: "Evidence of students' ideas may be expressed in words, drawings, written or spoken descriptions, movement, and/or gestures." (Lesson 11, 5.2 Lesson 11 Teacher Guide).
- Lesson 13, Connect Section, Step 3: "Distribute a copy of Solving Water Problems to each group and a copy of Identifying Water Problems to each student. Explain that in this book there are water problems that affect two different communities. Each group will get to pick which community's water problem they would like to read about and design a solution for that problem. Encourage groups to pause and answer questions together on *Identifying Water Problems* together as they read." (Lesson 13, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

III.E. Coherent Assessment System

EXTENSIVE

Includes pre-, formative, summative, and self-assessment measures that assess three-dimensional learning.

The reviewers found **extensive** evidence that the materials include pre-, formative, summative, and self-assessment measures that assess three-dimensional learning. There is an assessment system that supports teachers in understanding how students' three-dimensional performances in each assessment fit together to reflect student learning related to the assessment statements across the unit. Each lesson in the unit contains formative assessments with assessment guidance; Lesson 1 contains a pre-assessment; and Lessons 7 and 15 contain summative assessments. Self-assessment is embedded in the unit as well. These assessments function cohesively to support student learning across the three dimensions and across the unit.

Matches three-dimensional learning objectives

- 5.2 Matter Properties Assessment System Overview, Lesson-by-Lesson Assessment Opportunities: "OpenSciEd lessons include one or two three-dimensional learning goals...The table below lists assessment opportunities for the three-dimensional learning goals in each lesson." (5.2 Matter Properties Assessment System Overview)
- Lesson 2, the three-dimensional learning objective is **Make observations of properties in water samples to identify the materials which cause those properties.**
  - Lesson 2, Explore Section, Step 3: "Work through the procedure for observing the samples and recording the data for drinking water. Referring to the *Water Observations*, show students that we are going to collect data about each water sample by observing the same properties about each sample. Tell students that we are going to do the drinking water observations together to get an idea of the procedure and then we will do the rest of the samples in small groups. Demonstrate how to make observations for each of the properties using the drinking water sample." (Lesson 2, Teacher Guide)
- Lesson 8, the three-dimensional objective is **Analyze and interpret data to make sense of** how **measurements of weight** and **matter properties** in our boiled water samples changed.
  - Lesson 8, Explore Section, Step 3, Assessment Opportunity: "As students analyze and interpret data on the Analyze and interpret boiling data, you have an opportunity to formatively assess learning goal 8.A. Look and listen for using the evidence from their data to identify whether the material that made the water unhealthy is still in the sample after boiling." (Lesson 8, Teacher Guide)
- Lesson 8, the three-dimensional objective is **Develop a model to describe how the matter in the water samples is made of particles**, which may **change form but do not vanish as they boil**.
  - Lesson 8, Synthesize Section, Step 4, Assessment Opportunity: "During this Building Understandings Discussion, you have a collective opportunity to formatively assess learning goal 8.B. Look/listen for students describing what happened to the water and material particles as they boiled: water heated from the stove and changed to gas (evaporated, but students do not need to use this term); water left the pot as steam but did not vanish; some of the particles of materials in our water samples (baking soda, iron, vinegar) have properties that kept them from leaving the pot with the water, while chlorine is a material that also changed to gas and left the pot with the water (but did not vanish)." (Lesson 8, Teacher Guide)

Pre-, formative, summative, and self-assessment

Pre-Assessment

- Lesson 1, Teacher Guide, Synthesize 3: Develop a model, assessment callout: "Pre-assessment: Students' initial models provide an opportunity to gather evidence around Learning Goal 1 with the purpose of determining support students may need in upcoming lessons around the practice of modeling and ideas around cause and effect and matter. Encourage students to be specific in their representations of what makes water unhealthy, as this will help them further develop the practice of modeling and will also help generate more questions. Provide feedback to students as they complete their models by asking them how their models are or are not representing the answers to questions." (Lesson 1, 5.2 Lesson 1 Teacher Guide).

Formative Assessment

- Formative assessment opportunities and support are provided for each lesson-level three-dimensional learning goal. This is found both in the Lesson Assessment Guidance at the beginning of the lesson and in Assessment Opportunity callouts within the lesson.

- Lesson 4, Lesson Assessment Guidance: "This is the only opportunity that students will have during this unit to use all three phases of the Engineering Design Process. Be sure students can connect how their investigative data and cause-effect relationships inform the optimization process. If needed, review a group's data as a class to clarify the process of investigating to inform the design, which they will be repeating during the optimizing process." (Lesson 4, Teacher Guide)
- 5.2 Matter Properties Assessment Overview, Lesson 5, Where to check for understanding: "In the Synthesize 2, when students review each others' models on Modeling Unseen Matter and provide feedback for each other and when students use that feedback to improve their models. (slide G-H) In the Synthesize 2 when students develop a model of the unseen unhealthy matter in the water as a class (slide I)" (5.2 Matter Properties Assessment Overview)
- 5.2 Matter Properties Assessment Overview, Lesson 10, Where to check for understanding: "During the Explore when students complete the Andrea Naranjo-Soledad & Jessica Ray handout and the class discussion during the Synthesize, and during the Navigate [2] after students have read over the infographic." (5.2 Matter Properties Assessment Overview)

Summative Assessment

- Lesson 7, Synthesize Section, Step 4, Assessment Opportunity: "Summative assessment: Students analysis and interpretation of data on Student Assessment provides an opportunity to gather evidence about learning goal 7, with the purpose of summatively assessing students' analysis of data related to various properties of different types of matter to identify which type of matter was in a water sample. Use Beach assessment scoring guide and to provide feedback to students." (Lesson 7, Teacher Guide)
- Lesson 15, Synthesize Section, Step 3, Assessment Opportunity: "Use students' responses on *Emily's Turtle Tank* as a summative assessment for learning goal 15. Look for evidence that students can identify and explain cause and relationships between adding a substance and resulting mixtures, using changes in properties and matter as evidence to support their explanation. See Scoring Guide for details." (Lesson 15, Teacher Guide)

Self Assessment

- Lesson 4, Synthesize Section, Step 5: "Give students time to update their own chart. Display slide L. Show how this version of the chart is different from the last time they updated during Lesson 3, by asking students to reflect on what they figured out about the Engineering Design Process and their water samples (noting that they will dive deeper into the water samples in Lesson 5)." (Lesson 4, Teacher Guide)
- Lesson 8, Synthesize Section, Slide P: "What did we figure out about boiling water at a particle level? how boiling changed our water samples? why we boil water to make it more healthy?" (Lesson 8, Slides)
- Lesson 11, Explore Section, Step 3 Assessment Callout: "Self reflection: Students use Part D on My Growing Ideas to use data that they collected from their investigation to reflect on how their thinking about what happens when you add a new substance to their water sample has changed." (Lesson 11, Teacher Guide).

A coherent three-dimensional assessment system rationale is clearly described.

- Unit 2, Assessment System Overview: "Each OpenSciEd unit includes an assessment system that offers many opportunities for different types of assessments throughout the lessons. These opportunities include: pre-assessment, formative assessment, summative assessment, peer assessment (called peer feedback with students), and/or self assessment (called self reflection with students). Grades K-2 units may only include peer or self assessment, not always both. Assessment opportunities are embedded and called out directly in the lesson plans. Please look for the yellow "Assessment Opportunity" support in each lesson plan to identify suggested assessments.

In addition, there are two tables below that outline where each type of assessment can be found in the unit. The first table, Unit Assessment Plan by Assessment Type, lists the purpose, placement, and tools for each assessment type. The second table, Lesson-by-Lesson Assessment Opportunities, chronologically lists the assessment guidance for each lesson. For more information about the OpenSciEd approach to assessment, visit the OpenSciEd Elementary Teacher Handbook." (Unit 2, 4 5.2 Matter Properties Assessment System Overview).

Criterion-Based Suggestions for Improvement: N/A

III.F. Opportunity to Learn

EXTENSIVE

Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback

The reviewers found **extensive** evidence that the materials provide multiple opportunities for students to demonstrate the performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback. There is evidence of multiple opportunities for students to demonstrate performances of targeted learning objectives 7 and 15 (found in Lessons 7 and 15, respectively). Across the unit, opportunities are provided for students to develop the competencies and elements of the three dimensions needed to achieve the unit's learning goals. They then have the opportunity to receive and grow from feedback prior to the summative assessment.

Multiple, interconnected opportunities over time

Lesson 7, Learning Goal: " **Analyze and interpret data** related to the **properties** of types of matter that can be found in water, including **weight**, in order to **identify what type of matter they are**." Lesson 7, Synthesize Section, Step 4, Assessment Opportunity: "Summative assessment: Students analysis and interpretation of data on Student Assessment provides an opportunity to gather evidence about learning goal 7, with the purpose of summatively assessing students' analysis of data related to various properties of different types of matter to identify which type of matter was in a water sample. Use Beach assessment scoring guide and to provide feedback to students." (Lesson 7, Teacher Guide) Working backwards:

- Lesson 6, Explore Section, Step 3: "Discuss the data from the investigation as a class. Continue to have the Healthy/Unhealthy Water Chart visible to students and make sure they have *Testing the Water Samples* available. Tell students that now that we have collected this data we can verify with evidence more of the matter that is in the water samples. Display slide G and facilitate a discussion about the types of matter that we now have evidence to prove are in the water samples." (Lesson 6, Teacher Guide)
- Lesson 6, Synthesize Section, Step 4: "Class discuss the health of the water samples. Gather students in a Scientists' Circle and ask them to bring their copy of *Testing the Water Samples*. Have the Healthy/Unhealthy Water Chart visible and accessible and a marker ready to write student ideas onto the chart. Present slide K and tell them that we are going to work together to connect our ideas from the articles we read in Lesson 5 and the data we collected in this lesson to determine which of our samples have matter that could be unhealthy in them, even if that matter cannot be seen. Tell students that we are going to discuss our data and what it means together. Facilitate a Building Understandings discussion with students." (Lesson 6, Teacher Guide)

- Lesson 4, Explore Section, Step 2, Assessment Opportunity: "As students discuss results during the explore, and as they complete Optimize, test, and reflect on our filter, you have an individual and collective opportunity to formatively assess learning goal 4.A. On the handout, look for how students connect their investigative data and cause-effect relationships to the optimization process. This is the only opportunity that students will have during this unit to complete all three phases of the Engineering Design Process, so focus on these connections before moving on to Lesson 6." (Lesson 4, Teacher Guide)
- Lesson 3, Explore Section, Step 7, Assessment Opportunity: "Formative assessment: Part C of the Filter Design and Testing handout provides an opportunity to formatively assess learning goal 3.B with the purpose of providing feedback on conducting an investigation and collecting data. As students investigate and as they complete Part C of Filter Design and Testing, attend to how students are recording data on what happens with the water sample before, during, and after filtering, identifying the cause and effect relationships of different parts of the filter, and making sense of these ideas as they determine how to improve their filter design. Be sure they are clear on the connections between these points before moving on to the optimization process that follows in the next lesson." (Lesson 3, Teacher Guide)
- Lesson 2, Explore Section, Step 3: "Work through the procedure for observing the samples and recording the data for drinking water. Referring to the *Water Observations*, show students that we are going to collect data about each water sample by observing the same properties about each sample. Tell students that we are going to do the drinking water observations together to get an idea of the procedure and then we will do the rest of the samples in small groups. Demonstrate how to make observations for each of the properties using the drinking water sample." (Lesson 2, Teacher Guide)
- Lesson 2, Explore Section, Step 5: "Make sense of data. Display slide F. Distribute the *Properties and Materials Key* handout to each group and ask students to begin to identify materials they think are in the water samples as best as they can by matching their observations recorded on Water Observations with the properties listed on the *Properties and Materials Key* handout. If students struggle to identify which material goes with which property, have them give it their best guess based on the information they currently have available. Students should record their ideas in Column C of Water Observations. Display slide G." (Lesson 2, Teacher Guide)
- Lesson 2, Synthesize Section, Step 6: "Gather in a Scientists Circle for a Building Understandings Discussion. Display slide H. Form a scientist circle around the class data table that was created during Synthesize[1]. Students should bring [material: MP.L2.HO1] to the circle. They will fill out Column C during the discussion. Ask students to think about the properties that we noticed while observing our water samples. Ask students based on the properties that were observed, do we feel like we can identify any of the materials in our water samples? You will create a new class chart called "Healthy/Unhealthy Water Chart" to keep track of the materials that we figure out in the water samples. Make sure to probe students about what evidence they have about different materials. Display the chart "Water Sample Observations" chart. Students can use this as a source of evidence when identifying possible materials along with [material: MP.L2.HO3]. [slide: OP.MP.L2.slides, 9]" (Lesson 2, Teacher Guide)
- Lesson 2, Synthesize Section, Step 6, Assessment Opportunity: "Formative assessment: Use what students share during this discussion as well as their responses on the Water Observations handout to informally assess if students need more support in identifying and classifying materials based on properties. Students will have another chance to identify materials based on their properties in Lesson 5." (Lesson 2, Teacher Guide)
- Lesson 1, Explore Section, Step 2: "Observe water samples. Tell students that you actually have water samples from each of the bodies of water from the photos to further observe. Invite students to closely observe the five pitchers with water samples (that you prepared before class; see *Water Sample Preparation (L1)*). Display slide E for students to first discuss the health of the water samples in small groups." (Lesson 1, Teacher Guide)

Lesson 15, Learning Goal: "**Define a problem** happening in a turtle habitat and **construct an explanation** for how **adding a substance** to the water in the habitat **causes a change in properties** that **solves the problem.**" Lesson 15, Synthesize Section, Step 3, Assessment Opportunity: "Use students' responses on *Emily's Turtle Tank* as a summative assessment for learning goal 15. Look for evidence that students can identify and explain cause and relationships between adding a substance and resulting mixtures, using changes in properties and matter as evidence to support their explanation. See Scoring Guide for details." (Lesson 15, Teacher Guide) Working backwards:

- Lesson 15, Explore Section, Step 2: "Introduce students to Emily's turtle. Tell students that we have one final water problem to help solve. Display Slide B and tell students that we are going to read a story about a kid who had a problem with the water in her turtle's tank and we are going to figure out what the problem is and how to help her solve it. To help students connect with and find value in this story and task, consider asking students to share personal accounts of solving pet related problems particularly around the health of their pet's water needs." (Lesson 15, Teacher Guide)
- Lesson 15, Explore Section, Step 2, Broadening Access: "Consider capturing some of these ideas on the board or a poster if possible/needed - ideas can include drawings, words, or descriptions of gestures that students make during this discussion so that students can then reference them later when completing the task." (Lesson 15, Teacher Guide)
- Lesson 14, Explore Section, Step 2: "Introduce the peer-review task. Display slide C. Say something like, "We are going to present and workshop our design solutions to another group today. You all will have two really important jobs. One job is to explain the problem you are solving and the solutions you have designed. The other important job is that you will listen to another group present their design and you will ask questions and provide feedback to help them improve their design. The point of this is to get and give peer feedback. Scientists and engineers do this all of the time, they present a 'working draft' that they have to get ideas on how they might revise their plans to optimize it." (Lesson 14, Teacher Guide)
- Lesson 14, Explore Section, Step 2: "Work through an example of giving feedback. Display slide D and tell students that we are going to practice giving and receiving feedback as a group before we try it in our small groups. Ask one group to volunteer so you may demonstrate how this might go when they are in partner-groups. Remind this group that they will first give us context, or explain the problem they researched. Then they will explain their design solution to the class. The class's job is to use the Community Water Problems: Criteria and Constraints chart to ask thoughtful questions or provide ideas for revision. They can use the sentence frames on slide D or *Giving and Receiving Feedback* to help them generate their questions and ideas. Use this whole group example as an opportunity for student practice and teacher demonstrating how to pose questions and provide ideas. Be sure to highlight thoughtful questions and suggestions from the group." (Lesson 14, Teacher Guide)
- Lesson 14, Synthesize Section, Step 4:" Provide peer review and feedback. Display slide F and ensure students the Community Water Problems: Criteria and Constraints chart is still visible to students. Distribute the Revision Ideas handout. Pair students up with someone from a group that has been working on a different community water problem. Remind students that they will need to first provide some background information about the problem using *Engineering Design: Community Water Problem* from Lesson 13 before explaining their solution to their partner. Encourage students to record revision ideas in words, symbols or pictures as their peers provide feedback on *Revision Ideas*. Ensure that students have *Giving and Receiving Feedback* out to help guide their feedback discussions." (Lesson 14, Teacher Guide)
- Lesson 14, Synthesize Section, Step 4: "Reflect on the design process. Display slide I. Students fill out Engineering Reflection, a reflection answering the following questions to demonstrate what they have individually learned through the process of designing this solution: Define: Explain the water problem. Design: Explain how your design solution solved the water problem and made the water healthier. Optimize: How did peer feedback/reading about other design solutions help you optimize your design solution?

- Lesson 13, Connect Section, Step 3: “Tell students that they are going to read about community water problems. Their job is to collect as much information as they can to help identify what problems are happening in this community so they can start thinking of solutions that can make the water healthier.” (Lesson 13, Teacher Guide)
- Lesson 13, Synthesize Section, Step 4, Literacy Supports: “Encourage students to use direct quotes from the book as well as images from the book to summarize the information they read aloud. This supports RI.5.1 and SL.5.2 as students work toward coherently summarizing and quoting information written in a text.” (Lesson 13, Teacher Guide)
- Lesson 13, Synthesize Section, Step 6, Constructing Explanations and Designing Solutions: “Students are engaging with this science practice when they brainstorm and develop solutions for their Community Water Problem. Students will apply what they know about removing matter from classroom water samples to a larger body of water in order to develop their solution.” (Lesson 13, Teacher Guide)
- Lesson 13, Synthesize Section, Step 6, Assessment Opportunity: “Formative Assessment: There is an individual and collective opportunity to formatively assess learning goal 13 as students identify their community water problem and begin to design solutions using Identifying Water Problems, Engineering Design: Community Water Problem. Look for and listen to how students are connecting the criteria and constraints to their specific problem and how they are thinking about how different materials, tools, processes, or systems change to enact their solutions. If you notice students are struggling, ask questions to support student thinking around how the design and/or materials they’re including in their solutions will help eliminate the unhealthy matter from their specific Community Water Problem.” (Lesson 13, Teacher Guide)
- Lesson 12, Explore Section, Step 2, Assessment Opportunity: “Formative assessment: Small group discussions and Making sense of our investigation data provide an opportunity to gather evidence about Learning Goal 12, with the purpose of providing feedback and supporting students in using weight data to explain that even though a change in some properties occurred when substances were mixed together, there was not a change in the total weight of the mixture. Use the following suggestions to provide feedback and determine next steps before moving on to updating the My Growing Ideas chart in Synthesize[2]. If a student enters the weight in the incorrect place on the diagram, encourage them to match the language from the table in part 1 with the language on the section of the diagram that they are completing. If a student is struggling to make sense of the idea that the total weight of the mixture is equal to its parts, consider using physical objects like unifix cubes to further visualize the idea of part plus part equals whole. Consider using some of the ideas and observations that you gathered while circulating the room during this small group activity to inform the direction of the class discussion in the next step.
- Lesson 12, Synthesize Section, Step 3: “Discuss the weight data. Tell students that now that we have made sense of the weight data from our water samples, we are going to discuss the data as a class. Explain that this way we can compare data from different groups to see if the other water samples had similar results. Make sure students still have their copy of My Growing Ideas. Present slide D and facilitate a discussion about the data using the prompts below.” (Lesson 12, Teacher Guide)
- Lesson 12, Synthesize Section, Step 3, Analyzing and Interpreting Data: “In this lesson, students first analyze and interpret the weight data that they collected during their investigation in Lesson 11 with their small group. They make sense of the data collected from one water sample. They then share their small group analysis with the class to collectively interpret and generalize the data to come to the conclusion that even when a change in properties occurs the total weight of the mixture stays the same.” (Lesson 12, Teacher Guide)

- Lesson 12, Synthesize Section, Step 5: "Determine if our water samples meet our design goal. Note that students have successfully removed unhealthy unseen matter from their water samples by adding another substance to the water. Remind them that they have been working toward making the water samples healthier throughout the whole unit. Tell them that now, we are going to get a chance to look back on the journey of our water samples. We will work in pairs to decide if our water samples now meet our design goal for making the water samples healthier. Present slide F and distribute one copy of Final health of our water samples to each pair of students. Tell students that they can choose one of the water samples to reflect on and determine if it now meets the design goal. Encourage students to use the Healthy/Unhealthy Water chart and any other resources from the unit to help recall the journey of their water sample. Consider having the final water samples accessible to students so they can use the physical samples as a reference too. Give students time to complete Final health of our water samples while circulating the room and offering support where needed." (Lesson 12, Teacher Guide)
- Lesson 11, Explore Section, Step 3: "Make sense of data in small groups. Display Slide L. Give students time in small groups to complete Parts C and D on *Add a Substance Investigation* handout. While students are discussing measurable properties, get them to focus on the chlorine or acidity level." (Lesson 11, Teacher Guide)
- Lesson 11, Explore Section, Step 3, Assessment Opportunity: "On Part C of Add a Substance Investigation you have an individual opportunity to formatively assess learning goal 11.A. Look for students accurately using their investigative data to support the claim that a new substance was formed, based on the change in properties. Spend time as needed during the Building Understandings Discussion that follows in the Synthesize to ensure students' understanding of this idea based on their investigative findings." (Lesson 11, Teacher Guide)
- Lesson 11, Synthesize Section, Step 4: "Lead a Building Understandings Discussion. Then use the sequence of prompts on Slide M and below to lead the Building Understandings Discussion, focused on using their findings as evidence to answer the question: How did adding a substance change our water samples? Say something like, "Remember that our investigation was trying to answer the question: How did adding a substance change our water samples. Let's share our investigation results to work to answer this question together." (Lesson 11, Teacher Guide)

Multi-modal feedback loops

- Lesson 4, Handout: Optimize, test, and reflect on our filter: students gather visual data, odor, and weight data to determine the effectiveness of their filter and the redesigns (Lesson 4, 5.2 Lesson 4 Handout Optimize, test, and).
- Lesson 8, Teacher Guide, Lesson Assessment Guidance: "If students are challenged by explaining this process, or the differences between the two different results, have them talk to each other to explain their ideas. Circulate to hear what kinds of ideas they are sharing, and build on those to collaboratively work through the process. This can be challenging for students to explain since they can not directly observe the particles. Consider providing manipulatives to help envision the particles and what happens as the samples boiled, using previous models from this unit as examples." (Lesson 8, 5.2 Lesson 8 Teacher Guide).
- Lesson 14, Teacher Guide, Lesson Assessment Guidance: "This is a formative assessment to determine how well your students developed ideas toward the ETS Performance Expectations in this unit. Allow students to revisit investigations and texts from previous lessons to provide additional evidence for their ideas. Ask questions like: How does that data/evidence support your choice for design revision? How are the tests fair, which variables are controlled, and the number of trials considered for your design solution? Why is this solution better than the other options? How could a combination of solutions work? How did peer feedback help improve your thinking?" (Lesson 14, 5.2 Lesson 14 Teacher Guide).

- Lesson 14, Teacher Guide, Synthesize 3: Compare solutions: “Provide peer review and feedback. Display slide F and ensure students the Community Water Problems: Criteria and Constraints chart is still visible to students. Distribute the Revision Ideas handout. Pair students up with someone from a group that has been working on a different community water problem. Remind students that they will need to first provide some background information about the problem using Engineering Design: Community Water Problem from Lesson 13 before explaining their solution to their partner. Encourage students to record revision ideas in words, symbols or pictures as their peers provide feedback on Revision Ideas. Ensure that students have Giving and Receiving Feedback out to help guide their feedback discussions.” (Lesson 14, 5.2 Lesson 14 Teacher Guide).

Criterion-Based Suggestions for Improvement: N/A

Category Ratings

CATEGORY I	**NGSS 3D Design**	0 1 2 (3)
CATEGORY II	**NGSS Instructional Supports**	0 1 2 (3)
CATEGORY III	**Monitoring NGSS Student Progress**	0 1 2 (3)
TOTAL SCORE		**9**

Overall Ratings

Overall ratings: The score total is an approximate guide for the rating. Reviewers should use the evidence of quality across categories to guide the final rating. In other words, the rating could differ from the total score recommendations if the reviewer has evidence to support this variation.	**E: Example of high quality NGSS design—** High quality design for the NGSS across all three categories of the rubric; a lesson or unit with this rating will still need adjustments for a specific classroom, but the support is there to make this possible; exemplifies most criteria across Categories I, II, & III of the rubric. (total score ~8–9) **E/I: Example of high quality NGSS design if Improved—**Adequate design for the NGSS, but would benefit from some improvement in one or more categories; most criteria have at least adequate evidence (total score ~6–7) **R: Revision needed—**Partially designed for the NGSS, but needs significant revision in one or more categories (total ~3–5) **N: Not ready to review—**Not designed for the NGSS; does not meet criteria (total 0–2)	**Overall rating below:** **E**