EQuIP Rubric for Science

How can we design a new toy?

Curriculum Developer: OpenSciEd

GRADE 2 | FEBRUARY 2025

nsta
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	EXTENSIVE

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	EXTENSIVE	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:

- **Designing Solutions:** The focus of the unit is to support students in designing solutions. While engaging in the engineering process, students develop Disciplinary Core Ideas from physical science.
- **Integrating the Three Dimensions:** Grade-appropriate elements of the three dimensions are used together (integrated) in nearly every lesson, and the integration of the elements is part of designing a solution.
- **Unit Coherence:** Each lesson's focus is defined using student questions and ideas related to their progress in designing solutions.
- **Relevance and Authenticity:** Students experience designing solutions directly by designing toys for their classroom and for another classroom in their school.
- **Differentiated Instruction:** Supportive ways to access instruction are suggested for multilingual learners and students with disabilities.
- **Teacher Support for Unit Coherence:** The materials provide tools and strategies to support teachers in linking student engagement across lessons.
- **Coherence Assessment System:** The unit provides pre-assessment, formative assessment, summative assessment, and self-assessment opportunities that measure the targeted elements of the three dimensions.

The unit was reviewed to "provide constructive criterion-based feedback and suggestions for improvement to developers" (EQuIP Rubric for Lessons & Units: Science (Version 3.1). Reviewers recommend focusing on the following criteria during revisions:

- For each lesson, ensure students understand how what they figure out helps them design a better solution.
- Ensure students require the use of patterns thinking to complete a task in which elements of the CCCs are claimed.
- Ensure lessons help students develop toward proficiency for all claimed targeted performance expectations.
- Consider describing support teachers can provide for students who read below grade level when independent reading is required. Ensure summative assessment tasks require student reasoning with new information to construct a new understanding of the problem presented.

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 **5**

I.B. Three Dimensions **12**

I.C. Integrating the Three Dimensions **26**

I.D. Unit Coherence **29**

I.E. Multiple Science Domains **33**

I.F. Math and ELA **36**

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 designing solutions to a problem drives student learning. Most of the materials are organized so that students are solving the central problem: making toys from a set of classroom materials. In some lessons, students develop science ideas and practices, but that learning does not help students design a better solution. Student questions and prior experiences related to the problem consistently motivate sensemaking and/or problem solving. When engineering is a learning focus, it is integrated with developing Disciplinary Core Ideas from physical science.

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

There is a student-centered focus on phenomena or problems.

- Unit Front Matter: "The anchoring phenomenon for this unit is investigating how a toy can be made out of a set of classroom materials...The anchoring phenomenon lesson was piloted with 2nd grade classrooms in different locations around the country to determine students' engagement, interest, and connections with the phenomenon. The building toys anchoring phenomenon anchor produced many noticings and wonders aligned to the science and engineering ideas to be developed in the unit. Teachers reported high levels of engagement from students with the phenomenon." (Unit Front Matter) In the unit, students design solutions to the problem of making toys from a set of classroom materials. The lessons are anchored in a central problem. However, the problem is incorrectly identified as a phenomenon in the front matter.
- Lesson 1, Navigate Section, Step 1: "Introduce the idea of building toys for our classroom. Ask students if they think they could use their experiences to create new toys out of objects that are in our classroom...Discuss with students what they would want to know about toys in order to help them think about creating new toys for our classroom. Support students in considering learning about many different types of toys as a way to learn about creating new ones." (Lesson 1, Teacher Guide)
- Lesson 1, Explore Section, Step 4: "Point out to students that we have defined a problem; we want to see if we can build toys from a set of objects in our classroom and we made a plan to build our toys, our design sketch." (Lesson 1, Teacher Guide)
- Lesson 2, Connect Section, Step 5: "After students have read about the different properties, pause and refer back to the Other Objects For Toy Building chart from lesson 1. Ask students to share if considering these additional properties would be important for toys that our classmates are working on. In an effort to hear from all voices, ask students who have not yet had a chance to share to voice their ideas to the whole class. Example prompts and responses are below." (Lesson 2, Teacher Guide)

- Lesson 3, Synthesis Section, Step 5: "Prompts to use...What did we figure out today about the properties of materials? How can we use those to make choices for our toys?...Ideas to look and listen for..."Properties help us pick materials that will help our toy do what we want it to or look the way we want." (Lesson 3, Teacher Guide)
- Lesson 4, Navigate Section, Step 1: "Suggest that our focus today should be how objects and materials can be changed to help us better use them to do a specific thing. Work with students to develop a question like, How can we change objects and materials so we can better use them to build our toys? However, feel free to use terms and phrasing that reflect your class's ideas." (Lesson 4, Teacher Guide).
- Lesson 4, Synthesize Section, Step 4: "Display slide F Ask students to consider their toy designs and share how they or a partner assembled something or disassembled something. Have students refer back to Material Changes to share what they learned from talking with others in their group. As students share examples, record them on a blank chart with an assemble column and a disassemble column." (Lesson 4, Teacher Guide)
- Lesson 4, Synthesize Section, Step 6: "Prompt: How can changing objects help us design a new toy? Ideas to look for: We can disassemble objects and put them together in different ways in our toy design solution. We can bend, cut, and fold objects to be used in different ways in our toy design solutions. Prompt: We have limited objects that are available to use. Why is it important to think about how we can change these objects to use in our toy design solutions? Ideas to look for: We will have more options if we change the objects rather than using them as they are." (Lesson 4, Teacher Guide)
- Lesson 5, Navigate Section, Step 1: "Display the Notice and Wonder chart (refer to slide B) and circle the questions related to how materials can change when heated or cooled. Highlight that we are unsure if all materials change like we saw in the book last time. Work with the class to craft a lesson question similar to "What happens to materials when they are heated or cooled? Write the classes' Lesson 5 question on the next row of Our Growing ideas chart. Display slide C with our lesson question." (Lesson 5, Teacher Guide)
- Lesson 5, Synthesize Section, Step 4: "Point out that we looked at a few examples of reversible and irreversible changes in our books and saw some in class. Ask students to consider if the materials we are using to build toys might go through reversible or irreversible changes when heated. Ask students how we might find out more. Look for students to suggest we look at more materials." (Lesson 5, Teacher Guide)
- Lesson 5, Navigate Section, Step 8: "Now that we have learned how objects can change when heated and cooled, which objects do you think you might change for your toy design solution?..Ideas to look and listen for...Responses can vary. Students may provide specific examples of objects that can be cut, folded, bent, or disassembled to be used in their toy design solutions." (Lesson 5, Teacher Guide) Students did not have the option to heat and cool the materials they used to build their toys in Lesson 1 and 3. How the knowledge of changes caused by heating and cooling will help students design better toys should be more explicit in this lesson.
- Lesson 6, Synthesize Section, Step 5: Students use properties to construct an argument about which materials to use in their toy design. (Lesson 6, Teacher Guide)
- Lesson 7, Navigate Section, Step 1: "Display slide A and remind students that the kindergarteners heard we were building toys and were wondering if we could build new toys for their classroom. Use the following discussion prompts to support students in interviewing kindergarten students to learn more about what toys they like. Encourage students to think back to Lesson 1 when they discussed toys they enjoyed and how that helped them design their toy." (Lesson 7, Teacher Guide)
- Lesson 8, Navigate Section, Step 1: "Support students in remembering that they were ready to build their toys using their design sketches. Suggest that our work today should center around figuring out how they can use their design sketches to build their toys. Work with students to develop a question like, 'How can we use our design sketches to build a toy?'" (Lesson 8, Teacher Guide)

- Lesson 9, Explore Section, Step 3: "Have partners use their Feedback Tracker handout to review the feedback they received from their peers and then agree on one or two small changes to improve their toys... Encourage students to put a star next to one or two changes that they will complete first. " (Lesson 9, Teacher Guide)
- Lesson 10, Explore Section, Step 3: Students present their toy designs to Kindergarteners. (Lesson 10, Teacher Guide)

There is consistent student-driven learning over time.

- Lesson 1, Synthesize Section, Step 5: "Display slide I. Celebrate the work that students have done up to this point and remind them that there will be more time to work on our toys soon. Have students first respond to the prompts on the slide with a partner. Prompts to use: What do we need to figure out to get our toys to work the way we want?"; 'What questions might you have about other objects we can use in our designs?' Possible follow-up responses: 'What else are others wondering about?", 'Why do you think ___ would help us make toys?', 'How is _____ different from the supplies we used today?" (Lesson 1, Teacher Guide).
- Lesson 3, Navigate Section, Step 1: "Prompts to use...After testing materials during our last lesson, what do we still need to figure out about materials so we can decide which ones to use in our designs?...Ideas to look and listen for... Responses may vary...Which materials are the most flexible?...Which materials are the strongest?...Which materials have the properties we need for our designs?..." Work with students to develop a question like, "How can we use the properties of materials to decide what we need for our toys?...Prompts to use...How will sharing our material properties data help us decide what we need for our toys?...Ideas to look and listen for...Then we will be able to see all the choices. We can see all the things that are blue/strong, etc. We can see all the things that are really strong. It can help us decide what materials will make our toy work how we want it to....Craft the lesson question. Validate students' questions and statements about what still needs to be figured out about material properties by circling or staring a few relevant questions to revisit as we learn more. Recall that we ended last class with ideas that we may want to pick materials based on their properties. Work with students to develop a question like, 'How can we use the properties of materials to decide what we need for our toys?' However, feel free to use terms and phrasing that reflect your class's ideas." (Lesson 3, Teacher Guide)
- Lesson 4, Navigate Section, Step 7: "Have students do a think-pair-share about engineering their toys. Add new questions or ideas to the Notice and Wonder chart. Prompts to use: 'In our book we saw how some objects can change when heated, do you think all materials change when heated?' 'It sounds like we have different ideas about what might happen, how could we find out more?' 'What new questions do you have about how properties of materials can change?' Suggest that next class period we investigate what happens to some of our materials when they are heated in order to help us better decide how to use and change materials for our toy designs." (Lesson 4, Teacher Guide).
- Lesson 5, Navigate Section, Step 1: "Display the Notice and Wonder chart (refer to slide B) and circle the questions related to how materials can change when heated or cooled. Highlight that we are unsure if all materials change like we saw in the book last time. Work with the class to craft a lesson question similar to "What happens to materials when they are heated or cooled? Write the classes' Lesson 5 question on the next row of Our Growing Ideas chart." (Lesson 5, Teacher Guide).
- Lesson 6, Navigate Section, Step 1: "Ask students to recall why we were exploring the different ways in which objects and materials can change. Guide students to remember that they were figuring out how we can change objects and materials so they can be used when we design our toys... Guide students to agree that our focus today should be how we can update the materials that we will use in our designs. Work with the class to craft a lesson question similar to, "How can we choose which materials to use for our toys? Write your class's version of our Lesson 6 question on the next row of Our Growing Ideas chart" (Lesson 6, Teacher Guide)

- Lesson 6, Explore Section, Step 2: "Connect how the glue could be useful for our toys. Facilitate a brief discussion about how this type glue could be useful for our designs using the sample prompts. Prompt: What were some of the properties you saw before the glue was heated? Ideas to look for: It was strong. It was a little flexible. It was white. It was smooth. Prompt: What about after it cooled? Ideas to look for: It was a different shape. It was strong. It was white. It was smooth. Prompt: How could this be helpful for our designs? Ideas to look for: When it cools its strong, it can hold things together. It can take on the shape of our toys and hold them together. When it cools, the parts of the toy will be in the strong glue. (Lesson 6, Teacher Guide)
- Lesson 9, Navigate Section, Step 1: "Prompts to use…Now the toys are built, what do we think we should do next?… Ideas to look and listen for…See if the toys work. Test out the toys. Play with the toys to try them out. Give the kindergartners directions for how to play with the toys…Suggest that our work today should center around figuring out how we can make sure that the toys are ready to share with the kindergarteners. Work with students to develop a question like, "How can we finalize our toy designs?" (Lesson 9, Teacher Guide)
- Lesson 10, Navigate Section, Step 1: "Point out any questions that relate to presenting or sharing the designs with kindergartners. Remind students that at the end of Lesson 9, they suggested we give the toys to kindergarteners. Suggest that our focus today be, 'How can we share our toy designs with the kindergartners?'." (Lesson 10, Teacher Guide)

The additional phenomenon of materials changing shape when heated and cooled is used in the unit. The materials introduce this phenomenon when students are considering how they changed the objects they are using to build their toys.

- Lesson 4, Synthesize Section, Step 4: "Transition to reading a book. Suggest that we read a book to find out more about other ways that we could change materials in order to assemble our toys in the best way possible." (Lesson 4, Teacher Guide)
- Lesson 4, Connect Section, Step 5: the teacher read a book to the class that describes plastic being heated and cooled to make toys, metal being heated and cooled to make toy cars, and recycled plastic being used to make toys. (Lesson 4, Changing Materials in Our Communities)
- Lesson 4, Navigate Section, Step 7: "Suggest that next class period we investigate what happens to some of our materials when they are heated in order to help us better decide how to use and change materials for our toy designs." (Lesson 7, Teacher Guide)
- Lesson 5, Navigate Section, Step 1: "Highlight that we are unsure if all materials change like we saw in the book last time. Work with the class to craft a lesson question similar to "What happens to materials when they are heated or cooled? Write the classes' Lesson 5 question on the next row of Our Growing ideas chart." (Lesson 5, Teacher Guide)
- Lesson 5, Explore Section, Step 2: "Observe a melted crayon. Direct the students' attention to the heat source with the melted crayon. Tilt the tray with the crayon so that students can see that the crayon has melted. Remove the crayon and tray from the heat source. Tell students to watch to see if there are any changes as the crayon cools. Students will observe the crayon harden again. Ask students if this reminds them of anything they have observed before. Have students draw a picture of these changes on their Changing Materials handout." (Lesson 5, Teacher Guide)
- Lesson 5, Explore Section, Step 2: "Now that students have observed a melting crayon, ask students to consider what might happen to the piece of paper if it was heated. Accept all responses. Pass around paper and allow students to record the properties of the paper on Changing Materials handout. Ask students to predict what might happen when the paper is heated. Display slide E. Explain that we will watch a video of this material being heated. Pause the video at the end and allow students time to record their observations." (Lesson 5, 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 phenomena/problems and the student learning objectives throughout the materials.

Lesson 1, **Ask questions** about ways to **use different materials to design a** new toy **that has specific functions.**

- Lesson 1, Synthesize Section, Step 5: "Prompts to use...What questions might you have about other objects we can use in our designs?...Ideas to look and listen for...Can we get more plastic? Can we get something like this but bigger (holds up craft sticks) Can we use glue?" (Lesson 1, Teacher Guide)

Lesson 2, **Use observations from an investigation** to **describe and identify patterns** of **observable properties of materials.**

- Lesson 2, Synthesize Section, Step 4: "Use the following prompts to have students think, pair, and share with another partner group to compare objects and the materials they are made out of to discover similarities and differences in materials. After 2-3 minutes bring students back together and have them share out. As students share, listen for ideas that materials that are different AND materials that are the same can have similar and different properties. Records the similarities and differences on the Materials Patterns Chart. Recognize the patterns students point out as patterns *are something that happens over and over again.*" (Lesson 2, Teacher Guide)
- Lesson 2, Synthesize Section, Step 6: "Prompts to use...How can we use what we learned about material properties to help us design a new toy?...Ideas to look and listen for...I can use some of those! (points to strong materials). We have new ideas on materials we can use. Some materials work better for some designs than others because the materials are stronger, more flexible, etc." (Lesson 2, Teacher Guide)

Lesson 3, **Analyze and interpret data** to identify **patterns** in the **properties of different materials** and use the **patterns** to **determine materials to use in a toy design**.

- Lesson 3, Explore Section, Step 3: "Identify patterns in the data. Engage students in identifying the properties of different materials to explore how materials can be used based on the purpose of the properties and connect to the students' toy design needs. The following prompts can be used to engage students in analyzing the properties of the materials tested. As students notice patterns in the materials, move cards around to group materials together." (Lesson 3, Teacher Guide)

Lesson 4, **Observe how objects can break into smaller pieces and be put together into larger pieces** allowing for **many different objects to be built from the same materials.**

- Lesson 4, Explore Section, Step 3: "Prompts to use...Think about the objects we have been exploring for our toys (ie, straws, cups/lids, cardboard). How can we change some of these objects to use in our toy design solutions?...Ideas to look and listen for...Answers will vary. Cups and lids can be used together or separately for different purposes (ie, lids could be used as wheels on a car.) Straws, cardboard, and other objects can be cut into different shapes and sizes to use for different purposes." (Lesson 4, Teacher Guide)

Lesson 5, **Construct an argument using observations as evidence** that **heating a material** can **sometimes cause** a **reversible change** and **sometimes cause an irreversible change.**

- Lesson 5, Explore Section, Step 5: "Explain that they will work with a partner to sort the cards into two categories, a reversible change or an irreversible change. Tell students that as they look at each card and decide where it goes they should record it on Reversible or Irreversible Change. Ask students to consider what we might do if we disagree on where a card goes. Use the prompts below to support students in developing strategies for how to work through

disagreements. Prompts to use…How would we know where to put a card in the first place? What evidence have we seen so far?…If something was a reversible change what might we see?…If something was an irreversible change what might we see?…What if you and your partner do not agree on where to put a card?" (Lesson 5, Teacher Edition)

Lesson 6, **Use observations as evidence to construct an argument** about how **heating a material can cause a reversible change**.

- Lesson 6, Explore Section, Step 2: Students make observations of a hot glue gun and make a claim about whether the changes they observe are reversible or irreversible. (Lesson 2, Teacher Guide)

Lesson 6, **Construct an argument** using **patterns in the properties of materials** as **evidence** to **support** the **claim** that a **specific material will be a good choice to use for the toy.**

- Lesson 6, Synthesize Section, Step 5: "Choose one material you would like to use in your toy design solution and write an argument to answer the question: Why is this material a good choice to use for your toy?" (Lesson 6, Student Assessment Written Argument)

Lesson 7, **Design a sketch of a toy (model)** that includes specific **properties and shapes (structures)** that support the proposed **purpose (function) of the toy**.

- Lesson 7, Explore Section, Step 3: "Brainstorm and decide on a toy design. Display slide I and distribute Toy Design Sketch handout to each pair of students. Remind students that they had time to discuss ideas in small groups and receive peer feedback. Now, they will work with their partner to decide which toy design they want. Have the students turn and talk with their partner about which toy design idea was their favorite and why. Then, they will need to agree upon one toy to design and build. Encourage students to use their Kindergarten Interview handout as evidence to support why that idea is the best based on the kindergartners' interests. Allow a couple of minutes for students to discuss and prompt them when the time is running out, and a decision needs to be made for their final decision for their toy design. Sketch a model. Remind students when they sketched their toy designs for themselves in an earlier lesson, they drew a model for their design. They will also use the engineering process to sketch their design ideas and communicate how their toy may look." (Lesson 7, Teacher Guide)

Lesson 8, **Use a design sketch (model) to support the building of a toy with materials that have specific properties and shapes that allow the toy to function as planned.**

- Lesson 8, Explore Section, Step 2: Students use their sketches of their toy designs to build toys for Kindergarteners. (Lesson 8, Teacher Guide)

Lesson 9, **Analyze data** from **testing** a **toy to determine** if the **properties** and **structure cause it to work as intended.**

- Lesson 9, Explore Section, Step 3: "Have partners use their Feedback Tracker handout to review the feedback they received from their peers and then agree on one or two small changes to improve their toys… Encourage students to put a star next to one or two changes that they will complete first. " (Lesson 9, Teacher Guide)

Lesson 10, **Communicate how** the **design and parts of the toy (i.e., shapes and properties) help it to function in the way it was intended.**

- Lesson 10, Explore Section, Step 2: Students plan their presentation of their toy designs to Kindergartners by responding to the prompt "We used (object) to make (shape/structure) because it is made out of (material), which is (property), so it can (function)." (Lesson 10, Student Assessment Toy Presentation)

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.

- Lesson 4, Navigate Section, Step 1: "Why are the properties of an object important when we are designing our toys? What is the connection between the property of the material and the purpose of the toy we want to build? Answers will vary based on the toys they are making. Different properties would have different purposes. If we want something to bend, we would need something that flexible." (Lesson 4, Teacher Guide)
- In Lesson 6, Synthesize Section, Step 4: "Tell students that they will be choosing one material for their toy design solution and they will be writing an argument to support their choice. Use the prompts to lead a discussion. Prompts to use include: ' What are we trying to figure out?', 'What information can we use from previous lessons that will help us figure this out?', 'For my design, I want something that is strong and is not flexible. How can I find a material like this?', Follow-up: 'Are there any other materials that fit into those categories?'; 'If there are many materials listed in those categories, how can you choose which one to use?', 'What evidence can we use to support our ideas of which materials to use in our designs?' Following up, 'Where do we get information about the properties?' (Lesson 6, Teacher Guide).
- Lesson 7, Explore Section, Step 3: "Have students use their Kindergarten Interview handout to discuss the following prompts. Encourage students to think about which ideas are their favorites and why and discuss them with their partner later. Point out the Material Properties Charts to support students with making decisions about the best material to use based on its properties" (Lesson 7, Teacher Guide).
- In Lesson 9, Explore Section, Step 2: "Remind students to use their engineering notebooks (or handouts) to explain the design and to use them as evidence for their choices. Have Pair A and Pair B each take two minutes to demonstrate and share the following: 'Explain the design, what properties the objects have for the structure to be stable (keep the shape), and to do what it needs to.' 'Share one challenge/struggle the pair had with the design they want help with.' Have pairs exchange toys and play with the other group's toy for two minutes to gather information and brainstorm ideas for improvement.

Criterion-Based Suggestions for Improvement

- Consider referring to second-grade and kindergarten students' need for toys in their classrooms as a "problem" rather than an "anchor phenomenon."
- Ensure that students designing their toys is *the reason,* from the students' perspective, for students to learn about reversible and irreversible changes and assembling and disassembling objects.

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 the anchoring or lesson-level phenomenon. The unit centers on students designing toys using targeted elements of all three dimensions that are clearly identified and addressed throughout the unit.

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:

- **MOD: P4—Develop a simple model based on evidence to represent a proposed object or tool.**
- **DATA: P3—Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) to answer scientific questions and solve problems.**
- **DATA: P5—Analyze data from tests of an object or tool to determine if it works as intended.**
- **CEDS: P1—Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.**
- **ARG: P6—Construct an argument with evidence to support a claim.**
- **ARG: P7—Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence.**

There is a close match between the claimed SEP elements and evidence of their development and use in unit materials. Students use the claimed SEP elements in service of designing their toys.

MOD: Developing and Using Models

Claimed Element: MOD: P4 Develop a simple model based on evidence to represent a proposed object or tool. Claimed as intentionally developed in Lessons 6, 7, and 8. Evidence was found in all claimed lessons, and an additional opportunity to claim the element in Lesson 3, examples include:

- Lesson 3, Explore Section, Step 3: "Update our design sketch from lesson 1. Display slide E. Help students to recall that during lesson 1 we drew our design before building our toys. Suggest that we return to our engineering notebooks and update our sketches with our new ideas for materials we want to include. Encourage students to write across any languages they prefer. Pass out a copy of Updated Design Sketch. Ask students to draw and update their designs and circulate while they are drawing. As you circulate, ask students to share reasons for the material choices they are making. Look for students to base their choices on the properties of the materials." (Lesson 3, Teacher Guide) The "Alignment with the Three-Dimensions of NGSS" document claims MOD-2.P2 in Lesson 3. (Compare models to identify common features and differences.) In this lesson, however, students are using MOD 2.P4 (Develop a simple model based on evidence to represent a proposed object or tool.) This is correctly labeled as 2.P4 in the Matrix.
- Lesson 6, Synthesize Section, Step 5: " Instruct students to use Written Argument to draw their final design sketch and then construct an argument about a material they want to include in their toy. Point out that we now have a new tool, so if they want to include hot glue in their design they should show that on their design sketch. Continue to display the example of the argument so that students can use it as a model. As students are writing, circulate the room to observe their progress. Remind students that they should include their observations of the properties of the materials in their evidence. Encourage them to refer to Partner Bag Set-Up and the class chart of materials from previous lessons to help determine the properties as well as the feedback Updated Design Sketch from the last time they updated their design sketches." (Lesson 6, Teacher Guide)
- Lesson 6, Synthesize Section, Step 5: "Sketch your updated design idea using the box below." (Lesson 6, Assessment Written Argument)
- Lesson 7, Explore Section, Step 3: "Display slide I and distribute Toy Design Sketch handout to each pair of students. Remind students that they had time to discuss ideas in small groups and receive peer feedback. Now, they will work with their partner to decide which toy design they want. Have the students turn and talk with their partner about which toy design idea was their favorite and why. Then, they will need to agree upon one toy to design and build. Encourage students to use their Kindergarten Interview handout as evidence to support why that idea is the best based on the kindergartners' interests." (Lesson 7, Teacher Guide).
- Lesson 7, Explore Section, Step 3: "Prompts to use...What would you like your toy to do? Write your ideas in the function box. What part/structure of the structure will allow your toy to do that? Draw a line to that part of the structure. What shape is that part/structure? Trace that shape with your colored pencil. What properties will the materials need to make and hold that shape of the structure? Write your idea(s) in the properties box and draw a line from that part to the idea(s)." (Lesson 7, Teacher Guide)
- Lesson 8, Explore Section, Step 2: "Gather objects. Have students gather their engineering notebooks or their Material Investigation and Toy Design Sketch handouts. Display slide C and remind students we are ready to build toys!" (Lesson 8, Teacher Guide).
- Lesson 8, Explore Section, Step 2: "Build the toys. Display slide E and have students start building their toys using the objects. Explain to students that while it is important to build the best toy possible, they don't have much time. They will need to value their time and choose objects fairly quickly. As students are building, point out the amount of time they have and the amount of time they have left. Circulate the room to ensure each partner contributes to the toy's construction and provide guidance using the following prompts." (Lesson 8, Teacher Guide)

DATA: Analyzing and Interpreting Data

Claimed Element: DATA: P3 Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.
Claimed as intentionally developed in Lessons 2 and 3. Evidence was found in all claimed lessons, examples include:

- Lesson 2, Synthesize Section, Step 4: " Use the following prompts to have students think, pair, and share with another partner group to compare objects and the materials they are made out of to discover similarities and differences in materials. After 2-3 minutes bring students back together and have them share out. As students share, listen for ideas that materials that are different AND materials that are the same can have similar and different properties. Records the similarities and differences on the Materials Patterns Chart. Recognize the patterns students point out as patterns are something that happens over and over again....Prompts to use...What do you notice about objects made of the same materials?...Ideas to look and listen for...Wood objects are smooth, strong, and do not bend. Metal objects are smooth, strong, and somewhat bend. Paper objects are smooth or rough, bend, and are either strong or weak. Fabric objects are fluffy or rough, bend, and are weak. Plastic objects are smooth, bend, and can be strong or weak. The glass object is smooth, does not bend, and is strong. They are all different colors." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 2: "After students have visited all of the charts, invite them to form a scientist circle on the rug. Use the example prompts below to help guide students toward looking for patterns in their observations of properties....Prompts to use...(Hold up a craft stick) What is this craft stick made of? What are some properties we noticed about it?...Is that true of the other objects made of wood? What other objects are made of wood that you have experienced before?...It sounds like there might be some patterns in our materials, but we are not sure. How could we find out more?" (Lesson 3, Teacher Guide)
- Lesson 3, Explore Section, Step 3: "Engage students in identifying the properties of different materials to explore how materials can be used based on the purpose of the properties and connect to the students' toy design needs. The following prompts can be used to engage students in analyzing the properties of the materials tested. As students notice patterns in the materials, move cards around to group materials together." (Lesson 3, Teacher Guide).
- Lesson 3, Explore Section, Step 3: "Suggest considering a backup material. Bring students back together and point out that we are sharing the same materials as we all make our different toys. Ask students to consider what they could do if we run out of a certain material. Accept all responses. Tell students that we may not be able to get more materials and ask students to consider picking a second material that could work for at least one part of their toy in case their first choice is not available. Point out that we discovered that many materials have some properties in common." (Lesson 3, Teacher Guide)

Claimed Element: DATA: P5 Analyze data from tests of an object or tool to determine if it works as intended.
Claimed as intentionally developed in Lessons 3, 6, and 9. Evidence was also found in Lessons 4 and 9, examples include:

- Lesson 3, Explore Section, Step 3: "Update our design sketch from lesson 1. Display slide E. Help students to recall that during lesson 1 we drew our design before building our toys. Suggest that we return to our engineering notebooks and update our sketches with our new ideas for materials we want to include. Encourage students to write across any languages they prefer. Pass out a copy of Updated Design Sketch. Ask students to draw and update their designs and circulate while they are drawing. As you circulate, ask students to share reasons for the material choices they are making. Look for students to base their choices on the properties of the materials." (Lesson 3, Teacher Guide)
- Lesson 6, Synthesize Section, Step 4: "Prompts to use...For my design, I want something that is strong and is not flexible. How can I find a material like this?...Ideas to look and listen for...Look at the chart with the properties of materials. Look in the "strength" category for materials that are strong. Look in the "flexible" category for materials that do not bend. See if any materials are listed in both categories. Wood is listed in both categories." (Lesson 6, Teacher Guide)

- Lesson 9, Explore Section, Step 3: "Have partners use their Feedback Tracker handout to review the feedback they received from their peers and then agree on one or two small changes to improve their toys... Encourage students to put a star next to one or two changes that they will complete first. " (Lesson 9, Teacher Guide)
- Lesson 9, Explore Section, Step 3: "Students engage in this science practice when reflecting on their peer feedback and their Feedback Tracker handout, they are analyzing revisions that may need to be necessary and/or revisions that will improve their toy design to function as intended to complete their final design. Students previously analyzed data from testsw and here they build on that use by reflecting on the data and determining the revisions." (Lesson 9, Teacher Guide)

CEDS: Constructing Explanations and Designing Solutions

Claimed Element: **CEDS: P1 Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.** Claimed as intentionally developed in Lesson 3, 4, 5. Evidence was found in all claimed lessons, examples include

- Lesson 3, Synthesis Section, Step 5: "Prompts to use...How are we able to make so many different toys with our set of materials?....Ideas to look and listen for...We can put them together in different ways. We can change objects and then put them on our toys. We all have different ideas on how to put them together." (Lesson 3, Teacher Guide)
- In Lesson 4, Explore Section, Step 3: students meet with peers and observe how similar materials were used to make a different toy. Students will use these observations as evidence to describe that objects can be assembled in different ways to make a variety of toys. Prompts to use and Ideas to look and listen for: "It looks like you all used ___ material, did you change it for your toy? How? [Answers will vary. Some students might say they cut, bent, formed, folded, or changed the material in another way.] (Lesson 4, Teacher Guide).
- Lesson 4, Synthesize Section. Step 4 " Display slide F Ask students to consider their toy designs and share how they or a partner assembled something or disassembled something. Have students refer back to Material Changes to share what they learned from talking with others in their group. As students share examples, record them on a blank chart with an assemble column and a disassemble column. Discussion Questions: What did you disassemble to build your toy? How did you assemble objects or materials to build your toy?" (Lesson 4, Teacher Guide)
- In Lesson 5, Explore Section, Step 2: students use observations to determine how heating or cooling changes a material. They use observations from a crayon melting, a video of paper being heated (Explore Section, Step 2), examples in a book (Connect Section, Step 3), and several images (Synthesize Section, Step 4:) to determine if the heating or cooling of a material caused a reversible or irreversible change. (Lesson 5, Teacher Guide).
- Lesson 5, Explore Section, Step 5: "As students work, circulate the room and ask students to share their thinking for placing a card in a particular category. Use the sample prompts below to support students in using evidence to support their claims. Can you tell me/show me why you put _____ in the category for a reversible change? Can you tell me/show me why you put _____ in the category for a reversible change?" (Lesson 5, Teacher Guide)

ARG: Engaging in Argument From Evidence

Claimed Element: **ARG: P6 Construct an argument with evidence to support a claim.** Claimed as intentionally developed in Lesson 2, 3, 5, and 6. Evidence was found in all claimed lessons, examples include:

- Lesson 2, Synthesize Section, Step 6: "As students share answers, explain that a claim is an idea that answers a scientific question. Listen for ideas that a material can have the same and different properties...Use evidence to

support claims. Explain to students that in science we always want to support our claims with evidence from what we did or observed. Evidence is the observations, data, and information that helps answer a scientific question. Ask students what they did that helps them know that. Listen for observations from their investigation that support the claim. Add the evidence to the "How did we figure it out?" column." (Lesson 2, Teacher Guide)

- Lesson 3, Explore Section, Step 3: "Begin a whole class discussion to analyze the material properties data on their Material Properties Charts to uncover where consensus on image placement is needed. If more than one partner group tested the same object and disagrees about where image is on a Material Properties Charts, engage the pairs in a discussion, inviting the students to agree/disagree or share their thinking. Probe students to use evidence from their Material Investigation handouts to support their arguments for the properties of the materials." (Lesson 3, Teacher Guide)
- Lesson 5, Explore Section, Step 5: "Share data and come to a consensus on the type of change. Display The Changes in Materials Chart (refer to slide I) and ask one partner group to share an example of a change that they thought was reversible. Ask them to come up and tape the card to the chart and to provide evidence for their decision. Use the sample prompts below to support students in determining where to put each example of a change. After the student places the card and provides their evidence, have the class give a thumbs up or down to share if they agree or disagree with the type of change. If there are any students who disagree, ask them to provide their evidence for why they disagree. Support students in using evidence to support their claims." (Lesson 5, Teacher Guide)
- Lesson 6, Explore Section, Step 2: Students draw a picture of glue before it is heated, while it is heated and after it is heated. They respond to the prompt "I think this was a ____ change because _____" (Lesson 6, Handout Changing Glue)
- Lesson 6, Connect Section, Step 3: "Engineers use argumentation to explain their claims with evidence. Evidence includes observations, data, and information that supports a claim and helps to solve engineering problems." (Lesson 3, Book Engineers Make Arguments)
- Lesson 6, Synthesize Section, Step 5: "Demonstrate how to use this information to answer the questions for the "claim" of the argument on Written Argument. Ask students, When I was trying to choose a material, which properties did I look for on the Materials Investigation chart? (i.e., strong, not flexible) How will these properties help my design? (i.e., The wood can support the roof of the house. It will not bend when used for building.) Demonstrate how to use this information to answer the questions for the "evidence" of the argument on Written Argument." (Lesson 6, Teacher Guide)
- Lesson 6, Synthesize Section, Step 5: "Choose one material you would like to use in your toy design solution and write an argument to answer the question: Why is this material a good choice to use for your toy?...List two properties that make this material a good choice for your design." (Lesson 6, Assessment Written Argument)

Claimed Element: ARG: P7 Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence. Claimed as intentionally developed in Lesson 8, 9. Evidence was found in all claimed lessons, examples include:

- Lesson 8, Explore Section, Step 2: "Prompts to use...I see that you chose ____ to use. Why did you choose that?..Ideas to look and listen for...We used the pipe cleaners because it is flexible. *gestures bending with hands* We used the marble because it rolls (students roll the marble)." (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 2: Students evaluate the toy designs of their classmates and answer the questions "What works well?, What can be improved? How can it be improved?" (Lesson 9, 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. There is a close match between the claimed DCI elements and evidence of their development and use in unit materials. Students have multiple opportunities to build the following science ideas:

Claimed Element:

- **2-PS1.A.1 PS1.A—Structure and Properties of Matter. ~~Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature.~~ Matter can be described and classified by its observable properties. (2-PS1-1)**
- **2-PS1.A.2—Different properties are suited to different purposes. (2-PS1-2), (2-PS1-3)**
- **2-PS1.A.3—A great variety of objects can be built up from a small set of pieces.**
- **2-PS1.B.1—Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.**
- **K-2-ETS1.A.1—A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1) Such problems may have many acceptable solutions. (secondary to K-PS2-2)**
- **K-2-ETS1.A.2—Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1), (secondary to K-ESS3-2)**
- **K-2-ETS1.B.1—Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.**

PS1.A: Structure and Properties of Matter

Claimed Element: 2-PS1.A.1 PS1.A Structure and Properties of Matter: ~~Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature.~~ Matter can be described and classified by its observable properties. (2-PS1-1) Claimed in Lessons 1, 2, 6. Evidence was found in all claimed lessons. Examples include:

- Lesson 1, Explore Section, Step 3: " Prompts to use ...What did you notice about the toys? How were the toys similar or different? Would you change anything about the toys?...Ideas to look and listen for...Accept all ideas. The toys were made out of different materials. The toys were different shapes/sizes."
- Lesson 2, Synthesize Section, Step 4: " Use the following prompts to have students think, pair, and share with another partner group to compare objects and the materials they are made out of to discover similarities and differences in materials. After 2-3 minutes bring students back together and have them share out. As students share, listen for ideas that materials that are different AND materials that are the same can have similar and different properties. Records the similarities and differences on the Materials Patterns Chart. Recognize the patterns students point out as patterns are something that happens over and over again....Prompts to use...What do you notice about objects made of the same materials?...Ideas to look and listen for...Wood objects are smooth, strong, and do not bend. Metal objects are smooth, strong, and somewhat bend. Paper objects are smooth or rough, bend, and are either strong or weak. Fabric objects are fluffy or rough, bend, and are weak. Plastic objects are smooth, bend, and can be strong or weak. The glass object is smooth, does not bend, and is strong. They are all different colors." (Lesson 2, Teacher Guide)

- Lesson 6, Explore Section, Step 2: "Display slide D to review the words "reversible" and "irreversible" changes. Have students recall some examples of reversible and irreversible changes that were discussed last lesson including the crayon and the paper. Ask students what we should do to determine if the glue is a reversible or irreversible change. Look for them to suggest that we observe the properties before, during, and after the glue is heated. Pass out a copy of Changing Glue to each student." (Lesson 6, Teacher Guide)
- Lesson 6, Explore Section, Step 2: "Observe properties of a glue before it is heated. Display slide F. Pass around the low-heat glue sticks and allow each student to observe the properties of the glue stick by looking at it and feeling it. Have students draw a picture of the glue stick on Changing Glue handout. Direct the students' attention to the hot glue gun and squeeze out some glue onto a piece of paper. Tell students to watch to see if there are any changes as the glue cools." (Lesson 6, Teacher Guide)

PS1.A: Structure and Properties of Matter

Claimed Element: **2-PS1.A.2: Different properties are suited to different purposes.** **(2-PS1-2), (2-PS1-3)** Claimed in Lessons: 3, 6, 7, 8, 9, 10. Evidence was found in all claimed lessons, examples include

- Lesson 3, Explore Section, Step 3: "Identify patterns in the data. Engage students in identifying the properties of different materials to explore how materials can be used based on the purpose of the properties and connect to the students' toy design needs. The following prompts can be used to engage students in analyzing the properties of the materials tested. As students notice patterns in the materials, move cards around to group materials together... Prompts to use...What patterns do you notice about the types of materials that are flexible?...Ideas to look and listen for...Why might we want flexible materials in our toy design solution? How have flexible materials been helpful to you before?..." (Lesson 3, Teacher Guide)
- Lesson 6, Synthesize Section, Step 5: "Choose one material you would like to use in your toy design solution and write an argument to answer the question: Why is this material a good choice to use for your toy?...List two properties that make this material a good choice for your design." (Lesson 6, Assessment Written Argument)
- Lesson 7, Explore Section, Step 3: "What properties will the materials need to make and hold that shape of the structure? Write your idea(s) in the properties box and draw a line from that part to the idea(s). Flexible, Strong, Soft, Sticky, You want that part to _____. What property will help do that? Is there more than one property you need for that part of the structure?" (Lesson 7, Teacher Guide)
- Lesson 7, Explore Section, Step 3: "Prompts to use...What would you like your toy to do? Write your ideas in the function box. What part/structure of the structure will allow your toy to do that? Draw a line to that part of the structure. What shape is that part/structure? Trace that shape with your colored pencil. What properties will the materials need to make and hold that shape of the structure? Write your idea(s) in the properties box and draw a line from that part to the idea(s)." (Lesson 7, Teacher Guide)
- Lesson 8, Explore Section, Step 3: "If a property is not on the Material Investigation handout or on the Material Properties Charts what can we do? Choose an object we think has that property and test it. Try an object out. Pick an object and see if it works. If there are many objects with the same property, how can you decide which object to use? Choose the one we think is best. Choose the object that has multiple properties we need. Choose one and test it and see if it works, if it doesn't we can choose a different one." (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 2: "Prompts to use...What are important ideas you need to share about your toys and design sketches?...Ideas to look and listen for...What the toy is supposed to do. How the toy works. How the toy is supposed to look. How the toy is supposed to feel. Why we used the objects we did in our design. What wasn't working when we tested our design." (Lesson 9, Teacher Guide)

- Lesson 10, Explore Section, Step 2: Students plan their presentation of their toy designs to Kindergartners by responding to the prompt "We used (object) to make (shape/structure) because it is made out of (material), which is (property), so it can (function)." (Lesson 10, Student Assessment Toy Presentation)

PS1.A: Structure and Properties of Matter

Claimed Element: **2-PS1.A.3: A great variety of objects can be built up from a small set of pieces.** Claimed in Lessons: 3, 4, and 8. Evidence was found in all the claimed lessons,

- Lesson 3, Connect Section, Step 5: "Prompts to use...The toys at the toy show came in sets of materials, how is that similar to what we are doing? How is it different?...Ideas to look and listen for...We are using a set of materials to build our toys. We are putting materials together in different ways. We can all make different things from the materials. We are using different materials. We are making different toys." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize Section, Step 4: "Explain to students that when engineers put things together and take things apart, they use the words "assemble" and "disassemble." Disassemble is to take apart into smaller pieces. Point out that when we took apart the box and cut it into smaller pieces we disassembled it. Explain that Assemble is to put pieces together. Point out that when we took those pieces and added them to our toys we assembled them. Add the words "assemble" and "disassemble" to the Word Wall." (Lesson 4, Teacher Guide)
- Lesson 4, Connect Section, Step 5: "Materials can change! Plastic materials can become soft to build toys, and then plastic can become hard again. The properties of materials can change to build toys in different shapes and sizes." (Lesson 4, Changing Materials in our Communities)
- Lesson 8, Explore Section, Step 2: "Prompts to use...Why might you need more than one object?...Ideas to look and listen for...We can put things together to make one thing. We need more than one thing to make one new toy. It is just the object if it is by itself. When we add something to it we make something new!" (Lesson 8, Teacher Guide)
- Lesson 8, Synthesize Section, Step 3: "Prompts to use...About how many different objects did you use to make your toy? Why was it important to use more than one object?...Ideas to look and listen for...We put together these things (points to objects) so it would (shows what the toy does). We needed it to be a different shape and have multiple properties to do this (shows a movement on the toy)." (Lesson 8, Teacher Guide)

PS1.B: Chemical Reactions

Claimed Element: **2-PS1.B.1: Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.** Claimed in Lessons: 4, 5, 6, and 8. Evidence was found in all claimed lessons, examples include:

- Lesson 4, Connect Section, Step 5: "Some materials can change when heated or cooled. When materials change, their properties change too. Metal and plastic are hard at first, but once they are heated, they melt and become soft. But when metal and plastic cool down, they become hard again." (Lesson 4, Changing Materials in Our Communities)
- Lesson 5, Explore Section, Step 2: "Observe a melted crayon. Direct the students' attention to the heat source with the melted crayon. Tilt the tray with the crayon so that students can see that the crayon has melted. Remove the crayon and tray from the heat source. Tell students to watch to see if there are any changes as the crayon cools. Students will observe the crayon harden again. Ask students if this reminds them of anything they have observed before. Have students draw a picture of these changes on their Changing Materials handout." (Lesson 5, Teacher Guide)

- Lesson 5, Synthesize Section, Step 4: "Prompts to use...What were the properties of the clay and fabric before they were heated?...What were the properties of the clay and fabric after it cooled?...What about the crayon? What did you notice about its properties?...Point out that it seems there are two different kinds of changes we are seeing. Explain that we can describe a change as Reversible or Irreversible. Reversible is when something can go back to the way it was. Irreversible is when something cannot go back to the way it was. " (Lesson 5, Teacher Guide)
- Lesson 5, Explore Section, Step 5: "Explain that they will work with a partner to sort the cards into two categories, a reversible change or an irreversible change. Tell students that as they look at each card and decide where it goes they should record it on Reversible or Irreversible Change. Ask students to consider what we might do if we disagree on where a card goes. Use the prompts below to support students in developing strategies for how to work through disagreements. Prompts to use...How would we know where to put a card in the first place? What evidence have we seen so far?...If something was a reversible change what might we see?...If something was an irreversible change what might we see?...What if you and your partner do not agree on where to put a card?" (Lesson 5, Teacher Edition)
- Lesson 5, Synthesize Section, Step 6: "Display The Changes in Materials Chart (refer to slide I) and ask one partner group to share an example of a change that they thought was reversible. Ask them to come up and tape the card to the chart and to provide evidence for their decision. Use the sample prompts below to support students in determining where to put each example of a change. After the student places the card and provides their evidence, have the class give a thumbs up or down to share if they agree or disagree with the type of change. If there are any students who disagree, ask them to provide their evidence for why they disagree. Support students in using evidence to support their claims." (Lesson 5, Teacher Guide)
- Lesson 6, Explore Section, Step 2: "Observe properties of a glue before it is heated. Display slide F. Pass around the low-heat glue sticks and allow each student to observe the properties of the glue stick by looking at it and feeling it. Have students draw a picture of the glue stick on Changing Glue handout. Direct the students' attention to the hot glue gun and squeeze out some glue onto a piece of paper. Tell students to watch to see if there are any changes as the glue cools. Students will observe the glue harden again. Have students draw a picture of these changes on Changing Glue handout." (Lesson 6, Teacher Guide)
- Lesson 8, Explore Section, Step 2: "How did you change the shape of objects to use in your design? If students used hot glue: Was it a reversible or irreversible change? heated the glue for it to hold pieces together...The hot glue was reversible because it was still the original material after it cooled down, just a different shape." (Lesson 8, Teacher Guide)

ETS1.A: Defining Engineering Problems

Claimed Element: **K-2-ETS1.A.1: A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1) Such problems may have many acceptable solutions. (secondary to K-PS2-2)** Claimed in Lessons: 1, 4, and 6. Evidence was found in all claimed lessons. Examples include:

- Lesson 1, Explore Section, Step 4: "Connect to engineering. Point out to students that we have defined a problem; we want to see if we can build toys from a set of objects in our classroom and we made a plan to build our toys, our design sketch. Explain to students that these are some of the things that engineers do. Explain to students that an engineer is someone who plans, builds, and tests things in the world around us." (Lesson 1, Teacher Guide)
- Lesson 4, Explore Section, Step 3: "Display slide E and point out that as you walked around the room you saw many different ways students were changing materials for their toys. Explain that engineers learn from one another and ask students if they think it could be helpful to find out the different ways each pair thought to change and/or combine the materials for our toys to get ideas or ask questions to other students. Ask if someone thinks it might be helpful to meet with other students who used similar materials in their designs." (Lesson 4, Teacher Guide)

- Lesson 6, Synthesize Section, Step 5: "Instruct students to use Written Argument to draw their final design sketch and then construct an argument about a material they want to include in their toy. Point out that we now have a new tool, so if they want to include hot glue in their design they should show that on their design sketch. Continue to display the example of the argument so that students can use it as a model. As students are writing, circulate the room to observe their progress. Remind students that they should include their observations of the properties of the materials in their evidence. Encourage them to refer to *Partner Bag Set-Up* and the class chart of materials from previous lessons to help determine the properties as well as the feedback Updated Design Sketch from the last time they updated their design sketches." (Lesson 6, Teacher Guide)

ETS1.A: Defining Engineering Problems

Claimed Element: **K-2-ETS1.A.2: Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1), (secondary to K-ESS3-2)** Claimed in Lessons: 4, 6, and 7. Evidence was found in all claimed lessons, examples include

- Lesson 4, Explore Section, Step 3: "Explain that engineers learn from one another and ask students if they think it could be helpful to find out the different ways each pair thought to change and/or combine the materials for our toys to get ideas or ask questions to other students. Ask if someone thinks it might be helpful to meet with other students who used similar materials in their designs." (Lesson 4, Teacher Guide)
- Lesson 6, Navigate Section, Step 7: "Refer to slide N Have students do a think-pair-share about engineering a toy for someone else. Add questions or ideas to the Notice and Wonder chart. Do you have questions about how we can build toys for another class? How might we find out more about these questions?...Explain that next class period we will consider how we can find out more about what the kindergartners may want." (Lesson 6, Teacher Guide)
- Lesson 7, Navigate Section, Step 1: "Brainstorm interview questions. Display slide C and have a discussion about questions the students can ask when interviewing them. Use the following prompts to generate student ideas for interview questions...We are designing a toy for the kindergartners in their classroom. What question(s) can we ask to figure out what they would like to have? What toy would you like to play with in the classroom? What toy would you play with at school? What toy do you want for the classroom?" (Lesson 7, Teacher Guide)
- Lesson 7, Explore Section, Step 3: "Ask students why it was important to interview kindergartners and how we can use their answers for the toy design solutions. Listen for ideas that we needed to learn more about what they liked to get ideas to design a new toy." (Lesson 7, Teacher Guide)

Claimed Element: **K-2-ETS1.B.1: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.** Claimed in Lessons: 7, 8, 9, and 10. Evidence was found in all claimed lessons, examples include:

- Lesson 7, Explore Section, Step 3: "Remind students when they sketched their toy designs for themselves in an earlier lesson, they drew a model for their design. They will also use the engineering process to sketch their design ideas and communicate how their toy may look. Display slide J and have students draw their design ideas on their handouts. Allow students to draw their designs and then have a quick discussion with them to motivate the need to add more details to their sketches. Ask students for ideas they may need and/or want to add to their sketches. Listen for ideas of objects to build with, materials of the objects, what the toy will do (function of the toy/pieces of the toy), shapes of the toy, etc...For each function, have students use a different colored pencil to connect the function to its structure and the properties for stability of the structure. Have students add as many functions as needed for their toys." (Lesson 7, Teacher Guide)

- Lesson 8, Synthesize Section, Step 3: "Prompts to use…Let's look back at our question, How can we use our design sketches to build a toy? What did we figure out about that? How did we figure that out?…Ideas to look and listen for…We chose our objects to build with ideas from our design sketches. We built the toy like the sketch we drew. We looked at the shapes we drew and made the objects like the shapes. We tested the toys as we were building to check if our plans worked." (Lesson 8, Teacher Guide)
- Lesson 8, Connect Section, Step 4: "Toy designers, like Cas, use their observations of kids playing to help draw new designs. Cas can draw, write, or sketch all of her ideas on paper or on the computer. After that, Cas uses all of her ideas to start building a toy.…Once toy designers have a plan, they take their sketches, ideas, and materials and use that to build their design. First, they build a prototype of their design. A prototype is the first model that a toy designer creates. " (Lesson 8, Meet the Toy Designers)
- Lesson 9, Explore Section, Step 2: "Have student pairs partner up with their toy and engineering notebooks or the following handouts: Material Investigation and Toy Design Sketch handout. Have each group of pairs choose a Pair A and Pair B to present their toy design solutions to each other. Pass out a Peer Feedback Discussion Prompts table tent to each set of pairs and read through the discussion prompts for both giving feedback and receiving feedback. Show how pairs can use the Peer Feedback Discussion Prompts table tent to help them with sentence starters to use when sharing their feedback with the other pair…Have pairs exchange toys and play with the other group's toy for two minutes to gather information and brainstorm ideas for improvement." (Lesson 9, 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. In most cases, there is a close match between the CCC elements claimed and evidence of their development and use in the unit materials.

Students have multiple opportunities to build the following Crosscutting Concepts:

Claimed Elements:

- **PAT: P.1—Patterns in the natural and human-designed world can be observed, used to describe phenomena, and used as evidence.**
- **CE: P1—Events have causes that generate observable patterns.**
- **CE: P2—Simple tests can be designed to gather evidence to support or refute student ideas about causes.**
- **EM: P1—Objects may break into smaller pieces and be put together into larger pieces, or change shapes.**
- **SF: P1—The shape and stability of structures of natural and designed objects are related to their function(s).**

PAT: Patterns

Claimed Element: **PAT: P.1: Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.** Claimed in Lessons 2, 3, 6 and 8. Evidence was found in lessons 2 and 8. Examples include:

- Lesson 2, Synthesize Section, Step 4: "Compare testing results. Display slide G. Use the following prompts to have students think, pair, and share with another partner group to compare objects and the materials they are made out of to discover similarities and differences in materials. After 2-3 minutes bring students back together and have them share out. As students share, listen for ideas that materials that are different AND materials that are the same can have similar and different properties. Records the similarities and differences on the Materials Patterns Chart. Recognize the patterns students point out as patterns are something that happens over and over again." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 3: "Identify patterns in the data. Engage students in identifying the properties of different materials to explore how materials can be used based on the purpose of the properties and connect to the students' toy design needs. The following prompts can be used to engage students in analyzing the properties of the materials tested. As students notice patterns in the materials, move cards around to group materials together." (Lesson 3, Teacher Guide)
- Lesson 6, Synthesize Section, Step 5: "Choose one material you would like to use in your toy design solution and write an argument to answer the question: Why is this material a good choice to use for your toy?...List two properties that make this material a good choice for your design." (Lesson 6, Assessment Written Argument) Students are prompted to use observations of properties of materials. Students do not need to use patterns as evidence to support their argument. Instead, they use the observations of the properties of the materials.
- Lesson 8, Explore Section, Step 2: "Students use patterns from their investigation during Lesson 2 to choose the objects and/or materials they will use to build their toys. Students previously investigated objects by testing properties to identify the patterns of properties of materials, and here they build on that use by using those patterns to decide on the object to use based on the testing of the properties of materials." (Lesson 8, Teacher Guide) Students will most likely use observations of properties of materials rather than patterns to select their materials.

CE: Cause and Effect

Claimed Element: **CD: P1: Events have causes that generate observable patterns.** Claimed in Lessons 5 and 6. Evidence was found in all claimed lessons. Examples include:

- In Lesson 5, Explore Section, Step 2: and Synthesize Section, Step 4: students observe materials that go through changes that are irreversible as well as reversible. They witness a crayon melting in person and observe paper being heated in a video (Explore Section, Step 2). They also observe several pictures of objects before and after they were heated or cooled. They use the observations of these events to determine that heating causes some materials to undergo reversible changes and others to undergo irreversible changes (Synthesize Section, Step 4:). (Lesson 5, Teacher Guide).
- In Lesson 6, Explore Section, Step 2: students observe glue being heated and individually argue from evidence that the change was a reversible change using the patterns from the previous lessons. (Lesson 6, Teacher Guide).
- Lesson 6, Explore Section, Step 2:Students draw a picture of glue before it is heated, while it is heated and after it is heated. They respond to the prompt "I think this was a ____ change because _____" (Lesson 6, Handout Changing Glue)

Claimed Element: **CE.P2: Simple tests can be designed to gather evidence to support or refute student ideas about causes.** Claimed in Lessons 8 and 9. Evidence was found in all claimed lessons. Examples include:

- Lesson 8, Explore Section, Step 2: "Explain to students that when they decide and/or want to test an object to use, they should have one student go to the supplies area to retrieve the object and take it back to their work area. If they are testing the material and decide not to use it, one student can return it. Point out that our ideas can change and grow, so there may be more than one trip needed to get objects. Encourage students to take turns gathering/returning an object." (Lesson 8, Teacher Guide)
- In Lesson 9, Explore Section, Step 2: students test the toys to gather evidence of how the shapes and properties (cause) of materials in the toys do or do not fulfill the intentions (effect) of the design and provide feedback on any improvements to change the toy so that it functions as intended. (Lesson 9, Teacher Edition).
- Lesson 9, Explore Section, Step 2: "Have pairs exchange toys and play with the other group's toy for two minutes to gather information and brainstorm ideas for improvement." (Lesson 9, Teacher Guide)

EM: Energy and Matter

Claimed Element: **EM: P1: Objects may break into smaller pieces and be put together into larger pieces, or change shapes.** Claimed in Lessons 3 and 4. Evidence was found in all claimed lessons. Examples include:

- Lesson 3, Explore Section, Step 3: "It sounds like we have determined a few ways that we can use our materials. Can someone share two materials that could work for part of their toy? Why? It seems like we have different ways of using these materials to build our different toys. Have you ever played with or seen a toy or a set of toys that you can make a lot of different things out of?" (Lesson 3, Teacher Guide)
- Lesson 3, Connect Section, Step 5: "Prompts to use...The toys at the toy show came in sets of materials, how is that similar to what we are doing? How is it different?...Ideas to look and listen for...We are using a set of materials to build our toys. We are putting materials together in different ways. We can all make different things from the materials. We are using different materials. We are making different toys." (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 2: "Remind students that they determined two different materials that they could use to build certain parts of their toys. Encourage them to consider the different ways they can use and change the materials today as they update their toys...Prompts to use...I notice you using _____ material, did you have to change it for your toy? In what way? When time is up, have students clean up leftover supplies and suggest to students that we share how we made changes to materials so we can learn from each other." (Lesson 4, Teacher Guide)
- Lesson 4, Synthesize Section, Step 4: "Prompts to use...What might we have to do to this cardboard box to use it for our toys? How have you changed cardboard before?...Ideas to look and listen for...Go like this. (demonstrates ripping the box) Take it apart. Cut pieces off of it...Prompts to use...It sounds like we can take apart some objects. What did you do with the pieces once the cardboard was a part?...Ideas to look and listen for...I put them on my toy. I taped them together. I put them here and here (holds up toy)." (Lesson 4, Teacher Guide)
- In Lesson 4, Synthesize Section, Step 4: "Display slide F Ask students to consider their toy designs and share how they or a partner assembled something or disassembled something. Have students refer back to Material Changes to share what they learned from talking with others in their group. As students share examples, record them on a blank chart with an assemble column and a disassemble column." (Lesson 4, Teacher Guide).

SF: Structure and Function

Claimed Element: **SF: P1: The shape and stability of structures of natural and designed objects are related to their function(s).**Claimed in Lessons 1, 7, 8, 9 and 10. Evidence was found in all claimed lessons. Examples include:

- Lesson 1, Synthesize Section, Step 5: "Prompts to use...I see a lot of different shapes when I look at your toys, can you tell me more about why you chose that shape to make your toy?...Ideas to look and listen for...It has to be this square to hold up the roof for the house. I needed these (points to circles) so that it could roll like this (shows toys rolling). I made this smaller than this so that it can fit in here." (Lesson 1, Teacher Guide)
- Lesson 7, Explore Section, Step 3: "Prompts to use...What would you like your toy to do? Write your ideas in the function box. What part/structure of the structure will allow your toy to do that? Draw a line to that part of the structure. What shape is that part/structure? Trace that shape with your colored pencil. What properties will the materials need to make and hold that shape of the structure? Write your idea(s) in the properties box and draw a line from that part to the idea(s)." (Lesson 7, Teacher Guide)
- Lesson 8, Explore Section, Step 2:Students build their toys for Kindergarteners. As they do the teacher is guided to use the following prompts, "This part of your toy needs to _____. What shape(s) objects is needed to do that? How can you change the shape of this object to it will ____. Can you add objects to make the shape/structure you need? Test the stability of the structure. How can it keep that shape? Using your hands and bodies can you tell me about how you took many objects to make your toy?" (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 2: "Have student pairs partner up with their toy and engineering notebooks or the following handouts: Material Investigation and Toy Design Sketch handout. Have each group of pairs choose a Pair A and Pair B to present their toy design solutions to each other. Pass out a Peer Feedback Discussion Prompts table tent to each set of pairs and read through the discussion prompts for both giving feedback and receiving feedback. Show how pairs can use the Peer Feedback Discussion Prompts table tent to help them with sentence starters to use when sharing their feedback with the other pair...Have pairs exchange toys and play with the other group's toy for two minutes to gather information and brainstorm ideas for improvement." (Lesson 9, Teacher Guide)
- Lesson 10, Explore Section, Step 2: "Students engage in this crosscutting concept by reflecting on the engineering process when building their toy and highlight how it can function as they intended based on the use of specific objects, properties, and shapes they chose for the structure. Those shapes create a stable structure that serves the function they intended. The structure and function details are presented to kindergartners when they use the toy and the handouts that support the students to create a final design." (Lesson 10, Teacher Guide)
- Lesson 10, Explore Section, Step 2: "Students plan their presentation of their toy designs to Kindergartners by responding to the prompt "We used (object) to make (shape/structure) because it is made out of (material), which is (property), so it can (function)." (Lesson 10, Student Assessment Toy Presentation)

Criterion-Based Suggestions for Improvement

- Ensure the claimed CCC element of Patterns P1 is required for students to complete the associated task.

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 students designing solutions requires student performances that integrate elements of the SEPs, CCCs, and DCIs. In almost all lessons in the unit, students are expected to design toys, which requires them to use grade-appropriate elements of the three dimensions simultaneously. The three dimensions are not used in isolation, rarely appear in isolation, and are generally learned in tandem, with each dimension supporting understanding of the others. Students have opportunities to experience this kind of three-dimensional learning in almost every lesson and with all learning objectives. 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 throughout the unit, students engage in three-dimensional tasks to help explain phenomena. Examples include:

- Lesson 1 Lesson Learning Goal: **Ask questions** about ways to **use different materials to design a** new toy **that has specific functions.**
  - Lesson 1, Explore Section, Step 3: Students share notices and wonderings about different toys they read about in the one dimension **AQDP 1.P1 Ask questions based on observations to find more information about the natural and/or designed world(s).** There is no evidence that students will use structure and function or describing and classifying matter by its properties in their question as is described by the Lesson Learning Goal.
  - Lesson 1, Explore Section, Step 3: "What do we need to figure out to get our toys to work the way we want?" and "Display slide E. Display the Notice and Wonder chart. Use the prompts below to ask students to first share what they noticed about the toys, then move into asking what wonders they had. As students share, record these noticings and wonderings in the Notice and Wonder columns. Prompts to use: 'Why were we reading about the toys?', 'Using your words or bodies, how are the toys used, or how might you use the toys?', 'What did you notice about the toys?', 'How were the toys similar or different? Would you change anything about the toys?', 'What were the toys made of?' (Lesson 1, Teacher Guide). While teachers are guided to ask the students questions that will lead to deeper thinking, there is no explicit evidence here indicating students are "**asking questions** about ways to **use different materials to design a** new toy **that has specific functions,"** as described by the Lesson Learning Goal. (Lesson 1, Teacher Guide).
  - Lesson 1, Synthesize Section, Step 5: "After 1-2 minutes bring the students back together and use the prompts below to support students in sharing their experiences with building a toy. As students share noticings and wonderings, update the Notice and wonder chart. Prompts to use: 'What do we need to figure out to get our toys to work the way we want?', 'What questions might you have about other objects we can use in our designs?...Ideas to look and listen for...Can we get more plastic? Can we get something like this but bigger (holds up craft sticks) Can we use glue?:'" Students ask questions about materials they use, but there is no evidence that students will develop or use the understanding that matter can be described and classified by its observable properties as stated in 2-PS1.A.1 PS1.A Structure and Properties of Matter (**Structure and Properties of Matter: Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties**)

- Lesson 2, Synthesize Section, Step 4: students integrate the use of the elements when they analyze the class's data collected during an investigation and identify patterns in properties of objects in the three dimensions CCC 1.P1 Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence, **DCI 2-PS1.A.1 PS1.A Structure and Properties of Matter: Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.** (2-PS1-1) and **DATA 4.P3 Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.**
- Lesson 3, Explore Section, Step 3: students integrate the use of the elements when they analyze the class's data to identify patterns in the properties of materials and use those patterns to consider how the materials could be useful in their toy design in the three dimensions CCC 6.P1 Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence, **DATA 4.P3 Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems, 2-PS1.A.2: Different properties are suited to different purposes.** (2-PS1-2), (2-PS1-3)
- Lesson 4, Synthesize Section, Step 4: students integrate the elements when they compare how toys were designed by taking apart objects and using the materials in the three dimensions **EM: 5.P1: Objects may break into smaller pieces and be put together into larger pieces, or change shapes. 2-PS1.A.3: A great variety of objects can be built up from a small set of pieces. CEDS 6.P3 Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.) is claimed in this task but students are not explaining a phenomenon.**
- Lesson 5, Explore Section, Step 6: students integrate the elements when they engage in argument to determine if heating causes materials to undergo reversible or irreversible changes in the three dimension **CD: 2.P1: Events have causes that generate observable patterns 2-PS1.B.1: Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. ARG: 7.P6 Construct an argument with evidence to support a claim.**
- Lesson 6, Explore Section, Step 2: students use observations of glue as evidence to construct an argument that the change in heating the glue is a reversible change in the three dimensions **ARG: 7.P6 Construct an argument with evidence to support a claim 2-PS1.B.1: Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. CE: 2.P1: Events have causes that generate observable patterns.**
- Lesson 7, Explore Section, Step 3: students draw sketches of their proposed toy, including the materials they plan to use, structures the toys will include, and functions in the three dimensions **MOD: 2.P4 Develop a simple model based on evidence to represent a proposed object or tool. 2-PS1.A.2: Different properties are suited to different purposes.** (2-PS1-2), (2-PS1-3) **SF: 6.P1: The shape and stability of structures of natural and designed objects are related to their function(s).**
- Lesson 8, Explore Section 2: students build toy designs while considering the shape and function provided by different materials in the three dimensions **MOD: 2.P4 Develop a simple model based on evidence to represent a proposed object or tool. 2-PS1.A.2: Different properties are suited to different purposes.** (2-PS1-2), (2-PS1-3) **SF: 6.P1: The shape and stability of structures of natural and designed objects are related to their function(s).**
- Lesson 9, Explore Section 3: students analyze feedback data from their classmates about the materials used and structure and function of their toy designs in the three dimensions **DATA: 4.P5 Analyze data from tests of an**

object or tool to determine if it works as intended, 2-PS1.A.2: Different properties are suited to different purpose, SF: 6.P1: The shape and stability of structures of natural and designed objects are related to their function(s).

- Lesson 10, Explore Section, Step 2: students prepare to present their toy designs to Kindergarteners in the dimensions **INFO: 8.P4 Communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, and/or design ideas, 2-PS1.A.2: Different properties are suited to different purposes, SF: 6.P1: The shape and stability of structures of natural and designed objects are related to their function(s).**

There is Integration to support student sense-making over time.

- Lesson 2, Synthesize Section, Step 4: "As students share, listen for ideas that materials that are different AND materials that are the same can have similar and different properties. Records the similarities and differences on the Materials Patterns Chart. Recognize the patterns students point out as patterns *are something that happens over and over again*." Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 3: "Identify patterns in the data. Engage students in identifying the properties of different materials to explore how materials can be used based on the purpose of the properties and connect to the students' toy design needs. The following prompts can be used to engage students in analyzing the properties of the materials tested. As students notice patterns in the materials, move cards around to group materials together." (Lesson 3, Teacher Guide)
- Lesson 7, Explore Section, Step 3: "Remind students when they sketched their toy designs for themselves in an earlier lesson, they drew a model for their design. They will also use the engineering process to sketch their design ideas and communicate how their toy may look. Display slide J and have students draw their design ideas on their handouts. Allow students to draw their designs and then have a quick discussion with them to motivate the need to add more details to their sketches. Ask students for ideas they may need and/or want to add to their sketches. Listen for ideas of objects to build with, materials of the objects, what the toy will do (function of the toy/pieces of the toy), shapes of the toy, etc...For each function, have students use a different colored pencil to connect the function to its structure and the properties for stability of the structure. Have students add as many functions as needed for their toys." (Lesson 7, Teacher Guide)
- Lesson 10, Explore Section, Step 2:Students plan their presentation of their toy designs to Kindergartners by responding to the prompt "We used (object) to make (shape/structure) because it is made out of (material), which is (property), so it can (function)." (Lesson 10, Student Assessment Toy Presentation)

Criterion-Based Suggestions for Improvement

- Ensure that in Lesson 1, students' use of the claimed DCI and CCC is required when students are asking questions as described in the three-dimensional lesson objective.

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 because each lesson directly builds on prior lessons, and the links between lessons are made explicit to students. The unit encourages students to revisit their questions and prior learning, guiding them through a progression of problem solving and sensemaking that strengthens their understanding of material properties and engineering.

The lessons help students develop toward proficiency in the following targeted performance expectations:

- 2-PS1-1—Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- 2-PS1-2—Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
- 2-PS1-3—Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
- 2-PS1-4—Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.
- K-2-ETS1-1—Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2—Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

The lessons do not help students develop toward proficiency in the following performance expectations, despite being claimed in the materials:

- K-2-ETS1-3—Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

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.

Most lessons end with a Navigate Section, where students are given opportunities for students to ask new questions and a class discussion on what to figure out next.

- Lesson 2, Navigate Section, Step 7: "Ask students how we could use what we learned about the properties of materials for our design and apply it to our toy engineering. Listen for ideas that relate to the properties of materials and how those properties could help a toy to function in a specific way. Ask a few students to briefly share a material they may

want to add to their design. Accept all responses. Ask students if the reason that they are choosing something related to the properties. Say something like, "Let's see a show of hands, how many are choosing something related to color? To texture? Point out that we are starting to think about how the properties are driving our thinking about what materials to use to build out toys. Ask students how we could find out more about what other groups found out about properties. Look for students to suggest we share data during our next class." (Lesson 2, Teacher Guide)

- Lesson 3, Navigate Section, Step 6: "Decide where to go next. Celebrate the work we have done to update our design ideas using the observations from our investigation. Ask students to consider what we should do next class. Look for them to suggest that we update our toys with some of the materials we investigated." (Lesson 3, Teacher Guide)

Most lessons begin with a class discussion in the Navigate Section. In this section, students reflect on what they wanted to figure out at the end of the previous lesson and develop a focus for the current lesson.

- Lesson 6, Navigate Section, Step 1: "Display Our Growing Ideas chart (refer to slide A), and prompt students to recall that in Lesson 5 we figured out that materials can change when they are heated or cooled. Ask students to recall why we were exploring the different ways in which objects and materials can change. Guide students to remember that they were figuring out how we can change objects and materials so they can be used when we design our toys." (Lesson 6, Teacher Guide).

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

The lessons help students develop toward proficiency in most of the targeted performance expectations. The target Performance Expectations are:

2-PS1-1: Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

- Lesson 2, Synthesize Section, Step 4 " Use the following prompts to have students think, pair, and share with another partner group to compare objects and the materials they are made out of to discover similarities and differences in materials. After 2-3 minutes bring students back together and have them share out. As students share, listen for ideas that materials that are different AND materials that are the same can have similar and different properties. Records the similarities and differences on the Materials Patterns Chart. Recognize the patterns students point out as patterns are something that happens over and over again....Prompts to use...What do you notice about objects made of the same materials?...Ideas to look and listen for...Wood objects are smooth, strong, and do not bend. Metal objects are smooth, strong, and somewhat bend. Paper objects are smooth or rough, bend, and are either strong or weak. Fabric objects are fluffy or rough, bend, and are weak. Plastic objects are smooth, bend, and can be strong or weak. The glass object is smooth, does not bend, and is strong. They are all different colors." (Lesson 2, Teacher Guide)
- Lesson 6, Explore Section, Step 2: "Display slide D to review the words "reversible" and "irreversible" changes. Have students recall some examples of reversible and irreversible changes that were discussed last lesson including the crayon and the paper. Ask students what we should do to determine if the glue is a reversible or irreversible change. Look for them to suggest that we observe the properties before, during, and after the glue is heated. Pass out a copy of Changing Glue to each student." (Lesson 6, Teacher Guide)

2-PS1-2: Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

- Lesson 3, Explore Section, Step 3: "Identify patterns in the data. Engage students in identifying the properties of different materials to explore how materials can be used based on the purpose of the properties and connect to the students' toy design needs. The following prompts can be used to engage students in analyzing the properties of the materials tested. As students notice patterns in the materials, move cards around to group materials together...

Prompts to use...What patterns do you notice about the types of materials that are flexible?...Ideas to look and listen for...Why might we want flexible materials in our toy design solution? How have flexible materials been helpful to you before?..." (Lesson 3, Teacher Guide)

- Lesson 6, Synthesize Section, Step 5: "Choose one material you would like to use in your toy design solution and write an argument to answer the question: Why is this material a good choice to use for your toy?...List two properties that make this material a good choice for your design." (Lesson 6, Assessment Written Argument)
- Lesson 9, Explore Section, Step 2: "Have Pair A and Pair B each take two minutes to demonstrate and share the following: Explain the design, what properties the objects have for the structure to be stable (keep the shape), and to do what it needs to. Share one challenge/struggle the pair had with the design they want help with." (Lesson 9, Teacher Guide)

2-PS1-3: Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

- Lesson 3, Connect Section, Step 5: "Prompts to use...The toys at the toy show came in sets of materials, how is that similar to what we are doing? How is it different?...Ideas to look and listen for...We are using a set of materials to build our toys. We are putting materials together in different ways. We can all make different things from the materials. We are using different materials. We are making different toys." (Lesson 3, Teacher Guide)
- Lesson 8, Explore Section, Step 2: "Prompts to use...Why might you need more than one object?...Ideas to look and listen for...We can put things together to make one thing. We need more than one thing to make one new toy. It is just the object if it is by itself. When we add something to it we make something new!" (Lesson 8, Teacher Guide)
- Lesson 8, Synthesize Section, Step 3: "Prompts to use...About how many different objects did you use to make your toy? Why was it important to use more than one object?...Ideas to look and listen for...We put together these things (points to objects) so it would (shows what the toy does). We needed it to be a different shape and have multiple properties to do this (shows a movement on the toy)." (Lesson 8, Teacher Guide)

2-PS1-4: Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

- Lesson 4, Connect Section, Step 5: "Some materials can change when heated or cooled. When materials change, their properties change too. Metal and plastic are hard at first, but once they are heated, they melt and become soft. But when metal and plastic cool down, they become hard again." (Lesson 4, Changing Materials in Our Communities)
- Lesson 5, Synthesize Section, Step 4: "Prompts to use...What were the properties of the clay and fabric before they were heated?...What were the properties of the clay and fabric after it cooled?...What about the crayon? What did you notice about its properties?...Point out that it seems there are two different kinds of changes we are seeing. Explain that we can describe a change as Reversible or Irreversible. Reversible is when something can go back to the way it was. Irreversible is when something cannot go back to the way it was. " (Lesson 5, Teacher Guide)
- Lesson 6, Explore Section, Step 2: "Observe properties of a glue before it is heated. Display slide F. Pass around the low-heat glue sticks and allow each student to observe the properties of the glue stick by looking at it and feeling it. Have students draw a picture of the glue stick on Changing Glue handout. Direct the students' attention to the hot glue gun and squeeze out some glue onto a piece of paper. Tell students to watch to see if there are any changes as the glue cools. Students will observe the glue harden again. Have students draw a picture of these changes on Changing Glue handout." (Lesson 6, Teacher Guide)
  - Lesson 6, Explore Section, Step 2:Students draw a picture of glue before it is heated, while it is heated and after it is heated. They respond to the prompt "I think this was a ____ change because _____" (Lesson 6, Handout Changing Glue)

K-2-ETS1-1: Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

- Lesson 4, Explore Section, Step 3: "Explain that engineers learn from one another and ask students if they think it could be helpful to find out the different ways each pair thought to change and/or combine the materials for our toys to get ideas or ask questions to other students. Ask if someone thinks it might be helpful to meet with other students who used similar materials in their designs." (Lesson 4, Teacher Guide)
- Lesson 7, Navigate Section, Step 1: "Brainstorm interview questions. Display slide C and have a discussion about questions the students can ask when interviewing them. Use the following prompts to generate student ideas for interview questions…We are designing a toy for the kindergartners in their classroom. What question(s) can we ask to figure out what they would like to have? What toy would you like to play with in the classroom? What toy would you play with at school? What toy do you want for the classroom?" (Lesson 7, Teacher Guide)
- Lesson 7, Explore Section, Step 3: "Ask students why it was important to interview kindergartners and how we can use their answers for the toy design solutions. Listen for ideas that we needed to learn more about what they liked to get ideas to design a new toy." (Lesson 7, Teacher Guide)

K-2-ETS1-2: Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

- Lesson 7, Explore Section, Step 3: "Remind students when they sketched their toy designs for themselves in an earlier lesson, they drew a model for their design. They will also use the engineering process to sketch their design ideas and communicate how their toy may look. Display slide J and have students draw their design ideas on their handouts. Allow students to draw their designs and then have a quick discussion with them to motivate the need to add more details to their sketches. Ask students for ideas they may need and/or want to add to their sketches. Listen for ideas of objects to build with, materials of the objects, what the toy will do (function of the toy/pieces of the toy), shapes of the toy, etc…For each function, have students use a different colored pencil to connect the function to its structure and the properties for stability of the structure. Have students add as many functions as needed for their toys." (Lesson 7, Teacher Guide)
- Lesson 8, Connect Section, Step 4: "Toy designers, like Cas, use their observations of kids playing to help draw new designs. Cas can draw, write, or sketch all of her ideas on paper or on the computer. After that, Cas uses all of her ideas to start building a toy.…Once toy designers have a plan, they take their sketches, ideas, and materials and use that to build their design. First, they build a prototype of their design. A prototype is the first model that a toy designer creates. " (Lesson 8, Meet the Toy Designers)
- Lesson 9, Explore Section, Step 2: "Have student pairs partner up with their toy and engineering notebooks or the following handouts: Material Investigation and Toy Design Sketch handout. Have each group of pairs choose a Pair A and Pair B to present their toy design solutions to each other. Pass out a Peer Feedback Discussion Prompts table tent to each set of pairs and read through the discussion prompts for both giving feedback and receiving feedback. Show how pairs can use the Peer Feedback Discussion Prompts table tent to help them with sentence starters to use when sharing their feedback with the other pair…Have pairs exchange toys and play with the other group's toy for two minutes to gather information and brainstorm ideas for improvement." (Lesson 9, Teacher Guide)

K-2-ETS1-3: Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

- Lesson 9, Explore Section, Step 3: "Have partners use their Feedback Tracker handout to review the feedback they received from their peers and then agree on one or two small changes to improve their toys… Encourage students to put a star next to one or two changes that they will complete first. " (Lesson 9, Teacher Guide) In the unit students collect and analyze data on the strengths and weaknesses of a toy but they do not compare two objects/toys designed to solve the same problem as stated by the PE.
- Lesson 9, Explore Section, Step 3: "Students engage in this science practice when reflecting on their peer feedback and their Feedback Tracker handout, they are analyzing revisions that may need to be necessary and/or revisions that will improve their toy design to function as intended to complete their final design. Students previously analyzed data from tests and here they build on that use by reflecting on the data and determining the revisions." (Lesson 9, Teacher Guide) In the unit, students collect and analyze data on the strengths and weaknesses of a toy, but they do not compare two objects/toys designed to solve the same problem, as stated by the PE.

Criterion-Based Suggestions for Improvement

- Ensure that students build toward proficiency in all claimed performance expectations.

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 the unit allows students to design a solution only using the physical science domain. As mentioned in I.B, there is a close match among all claimed DCI elements found in the unit.

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

Students can design toys for their classroom and for Kindergartners using the Physical Science and Engineering, Technology, and Application of Science domains. DCIs from life science and earth/space science are not necessary for designing toys.

2-PS1.A.1 PS1.A Structure and Properties of Matter: ~~Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature.~~ Matter can be described and classified by its observable properties.

- Lesson 2, Synthesize Section, Step 4: " Use the following prompts to have students think, pair, and share with another partner group to compare objects and the materials they are made out of to discover similarities and differences in materials. After 2-3 minutes bring students back together and have them share out. As students share, listen for ideas that materials that are different AND materials that are the same can have similar and different properties. Records the similarities and differences on the Materials Patterns Chart. Recognize the patterns students point out as patterns are something that happens over and over again….Prompts to use…What do you notice about objects made

of the same materials?...Ideas to look and listen for...Wood objects are smooth, strong, and do not bend. Metal objects are smooth, strong, and somewhat bend. Paper objects are smooth or rough, bend, and are either strong or weak. Fabric objects are fluffy or rough, bend, and are weak. Plastic objects are smooth, bend, and can be strong or weak. The glass object is smooth, does not bend, and is strong. They are all different colors." (Lesson 2, Teacher Guide)

2-PS1.A.2: Different properties are suited to different purposes.

- Lesson 3, Explore Section, Step 3: "Identify patterns in the data. Engage students in identifying the properties of different materials to explore how materials can be used based on the purpose of the properties and connect to the students' toy design needs. The following prompts can be used to engage students in analyzing the properties of the materials tested. As students notice patterns in the materials, move cards around to group materials together... Prompts to use...What patterns do you notice about the types of materials that are flexible?...Ideas to look and listen for...Why might we want flexible materials in our toy design solution? How have flexible materials been helpful to you before?..." (Lesson 3, Teacher Guide)
- Lesson 6, Synthesize Section, Step 5: "Choose one material you would like to use in your toy design solution and write an argument to answer the question: Why is this material a good choice to use for your toy?...List two properties that make this material a good choice for your design." (Lesson 6, Assessment Written Argument)
- Lesson 7, Explore Section, Step 3: "What properties will the materials need to make and hold that shape of the structure? Write your idea(s) in the properties box and draw a line from that part to the idea(s). Flexible, Strong, Soft, Sticky, You want that part to _____. What property will help do that? Is there more than one property you need for that part of the structure?" (Lesson 7, Teacher Guide)
- Lesson 10, Explore Section, Step 2:Students plan their presentation of their toy designs to Kindergartners by responding to the prompt "We used (object) to make (shape/structure) because it is made out of (material), which is (property), so it can (function)." (Lesson 10, Student Assessment Toy Presentation)

2-PS1.A.3: A great variety of objects can be built up from a small set of pieces.

- Lesson 4, Explore Section, Step 3: "Organize students into small groups so that each person in the group used at least one similar material. Have students use the Material Changes handout to find out how other students changed the materials. Circulate around the room and support students in their discussion by using the following prompts: Which objects or materials did you use? Did you have to change the objects or materials to use them? How did you change the objects or materials? Why did you have to change the objects or materials?" (Lesson 4, Teacher Guide)
- Lesson 8, Synthesize Section, Step 3: "Prompts to use...About how many different objects did you use to make your toy? Why was it important to use more than one object?...Ideas to look and listen for...We put together these things (points to objects) so it would (shows what the toy does). We needed it to be a different shape and have multiple properties to do this (shows a movement on the toy)." (Lesson 8, Teacher Guide)

2-PS1.B.1: Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not.

- Lesson 6, Explore Section, Step 2: "Observe properties of a glue before it is heated. Display slide F. Pass around the low-heat glue sticks and allow each student to observe the properties of the glue stick by looking at it and feeling it. Have students draw a picture of the glue stick on Changing Glue handout. Direct the students' attention to the hot glue gun and squeeze out some glue onto a piece of paper. Tell students to watch to see if there are any changes as the glue cools. Students will observe the glue harden again. Have students draw a picture of these changes on Changing Glue handout." (Lesson 6, Teacher Guide)

K-2-ETS1.A.1: A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1) Such problems may have many acceptable solutions.

- Lesson 1, Explore Section, Step 4: "Connect to engineering. Point out to students that we have defined a problem; we want to see if we can build toys from a set of objects in our classroom and we made a plan to build our toys, our design sketch. Explain to students that these are some of the things that engineers do. Explain to students that an engineer is someone who plans, builds, and tests things in the world around us." (Lesson 1, Teacher Guide)
- Lesson 4, Explore Section, Step 3: " Display slide E and point out that as you walked around the room you saw many different ways students were changing materials for their toys. Explain that engineers learn from one another and ask students if they think it could be helpful to find out the different ways each pair thought to change and/or combine the materials for our toys to get ideas or ask questions to other students. Ask if someone thinks it might be helpful to meet with other students who used similar materials in their designs." (Lesson 4, Teacher Guide)

K-2-ETS1.A.2: Asking questions, making observations, and gathering information are helpful in thinking about problems.

- Lesson 4, Explore Section, Step 3: "Explain that engineers learn from one another and ask students if they think it could be helpful to find out the different ways each pair thought to change and/or combine the materials for our toys to get ideas or ask questions to other students. Ask if someone thinks it might be helpful to meet with other students who used similar materials in their designs." (Lesson 4, Teacher Guide)
- Lesson 7, Navigate Section, Step 1: "Brainstorm interview questions. Display slide C and have a discussion about questions the students can ask when interviewing them. Use the following prompts to generate student ideas for interview questions...We are designing a toy for the kindergartners in their classroom. What question(s) can we ask to figure out what they would like to have? What toy would you like to play with in the classroom? What toy would you play with at school? What toy do you want for the classroom?" (Lesson 7, Teacher Guide)

K-2-ETS1.B.1: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

- Lesson 7, Explore Section, Step 3: "Remind students when they sketched their toy designs for themselves in an earlier lesson, they drew a model for their design. They will also use the engineering process to sketch their design ideas and communicate how their toy may look. Display slide J and have students draw their design ideas on their handouts. Allow students to draw their designs and then have a quick discussion with them to motivate the need to add more details to their sketches. Ask students for ideas they may need and/or want to add to their sketches. Listen for ideas of objects to build with, materials of the objects, what the toy will do (function of the toy/pieces of the toy), shapes of the toy, etc...For each function, have students use a different colored pencil to connect the function to its structure and the properties for stability of the structure. Have students add as many functions as needed for their toys." (Lesson 7, Teacher Guide)
- Lesson 8, Synthesize Section, Step 3: "Prompts to use...Let's look back at our question, How can we use our design sketches to build a toy? What did we figure out about that? How did we figure that out?...Ideas to look and listen for...We chose our objects to build with ideas from our design sketches. We built the toy like the sketch we drew. We looked at the shapes we drew and made the objects like the shapes. We tested the toys as we were building to check if our plans worked." (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 2: "Have student pairs partner up with their toy and engineering notebooks or the following handouts: Material Investigation and Toy Design Sketch handout. Have each group of pairs choose a Pair A and Pair B to present their toy design solutions to each other. Pass out a Peer Feedback Discussion Prompts table

tent to each set of pairs and read through the discussion prompts for both giving feedback and receiving feedback. Show how pairs can use the Peer Feedback Discussion Prompts table tent to help them with sentence starters to use when sharing their feedback with the other pair...Have pairs exchange toys and play with the other group's toy for two minutes to gather information and brainstorm ideas for improvement." (Lesson 9, Teacher Guide)

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

- Designing toys for kindergarten students only requires content ideas related to physical science. This problem did not require the crosscutting concepts developed in the unit to be used across science domains.

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/or English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects because the materials explicitly state the mathematics and ELA standards used in the unit and support students to see the connections between content areas.

ELA: Reading: Informational Text

CCSS.ELA-LITERACY.RI.2.2 Identify the main topic of a multi-paragraph text as well as the focus of specific paragraphs within the text. Claimed as supported in Lessons 3. Evidence was found in all claimed lessons. Examples include:

- In lesson 3, connect Section, Step 4: "Literacy Supports; Reading the newspaper article offers students an opportunity to identify the main topic of the entire text, in addition to the focus of individual paragraphs within the text. Remind students as they ask and answer questions while reading that this work supports their sensemaking and their reading skills (RI.2.2, RI.2.6)." (Lesson 3, Teacher Guide).

CCSS-ELA-LITERACY.RI.2.6 Identify the main purpose of a text, including what the author wants to answer, explain, or describe. Claimed as supported in Lessons 1 and 3. Evidence was found in all claimed lessons. Examples include:

- Lesson 1, Explore Section, Step 3: "As students answer teacher prompts about the text, they also identify the main purpose of the text and identify key details that the author describes. This work supports RI.2.6 and helps prepare students for applying concepts in the book to their own toy building experiences." (Lesson 3, Teacher Guide)
- Lesson 3, Connect Section, Step 4: "Reading the newspaper article offers students an opportunity to identify the main topic of the entire text, in addition to the focus of individual paragraphs within the text. Remind students as they ask and answer questions while reading that this work supports their sensemaking and their reading skills. "(Lesson 3, Teacher Guide)

CCSS-ELA-LITERACY.RI.2.7 Explain how specific images (e.g., a diagram showing how a machine works) contribute to and clarify a text. Claimed as supported in Lessons 4 and 5. Evidence was found in all claimed lessons. Examples include:

- Lesson 4, Connect Section, Step 5:"As students read, encourage them to use the images and words in the text to support their comprehension of reversible changes. For example, students can use images in the text to explain how reversible changes happen in the book and apply that knowledge to reversible changes they experience within the unit" (Lesson 5, Teacher Guide)
- Lesson 5, Connect Section, Step 3: "Students can use specific images in the text to support their understanding of reversible and irreversible changes" (Lesson 5, Teacher Guide)

CCSS-ELA-LITERACY.RI.2.9 Compare and contrast the most important points presented by two texts on the same topic. Claimed as supported in Lessons 5. Evidence was found in all claimed lessons. Examples include:

- In Lesson 5, Synthesize Section, Step 6: "Students use information obtained from the Changing Materials in Our Communities book and the card sort to identify reversible and irreversible changes. They compare and contrast images and words in both texts to figure out which changes are reversible and which ones are irreversible. This work supports RI.2.9." (Lesson 5, Teacher Guide).

ELA: Speaking and Listening

CCSS-ELA-LITERACY.SL.2.1A Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion). Claimed as supported in Lessons 1, 7, and 10. Evidence was found in all claimed lessons. Examples include:

- In Lesson 1, Synthesize Section, Step 5: "Gather in a Scientists Circle. Gather students for an Initial Ideas Discussion about their experiences building their toy so far. Review the Classroom Agreements chart and suggest the class focus on the agreement, "we look, listen, and respond to each other's ideas". Explain to students it is important to gather many different ideas to help us improve our toys in the future." (Lesson 1, Teacher Guide).
- Lesson 7, Explore Section, Step 3: "Before beginning group discussions, it is important to look back at your Classroom Agreements. Ask students to point out important agreements when listening and giving ideas to their peers. Emphasize the agreements for the expectations of peer feedback: Supporting a student who is unsure about sharing. Looking at the person speaking. Allowing our ideas to grow and change. Use and build on others' ideas." (Lesson 7, Teacher Guide)
- In Lesson 10, Navigate Section, Step 1: "Support students in understanding the class expectations for listening and sharing during their presentations of their toy designs. Remind students that good listeners follow agreed-upon rules for discussion like taking turns and raising their hands to ask questions. While presenting, students can speak loudly with a confident voice to clearly communicate their ideas." (Lesson 10, Teacher Guide).

CCSS-ELA-LITERACY.SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings Claimed as supported in Lessons 7. Evidence was found in all claimed lessons. Examples include:

- Lesson 7, Explore Section, Step 3: "Sketch a model. Remind students when they sketched their toy designs for themselves in an earlier lesson, they drew a model for their design. They will also use the engineering process to sketch their design ideas and communicate how their toy may look. Display slide J and have students draw their design ideas on their handouts. Allow students to draw their designs and then have a quick discussion with them to

motivate the need to add more details to their sketches. Ask students for ideas they may need and/or want to add to their sketches. Listen for ideas of objects to build with, materials of the objects, what the toy will do (function of the toy/pieces of the toy), shapes of the toy, etc." (Lesson 7, Teacher Guide)

CCSS-ELA-LITERACY.SL.2.6 Produce complete sentences when appropriate to task and situation in order to provide requested detail or clarification. Claimed as supported in Lessons 10. Evidence was found in all claimed lessons. Examples include:

- In lesson 10, Explore Section, Step 2: "Encourage students to practice sharing their toy design alongside their written work on the Toy Presentation assessment. Students can use their written work to prompt communicating in expanded and complete sentences. For example, students can say, "You can play with my design by ____" or "My design is built out of _____." This supports SL.2.6 so that students gain practice speaking loudly and coherently in complete sentences." (Lesson 10, Teacher Guide).

ELA: Language

CCSS-ELA-LITERACY.L.2.4B Determine the meaning of the new word formed when a known prefix is added to a known word (e.g., happy/unhappy, tell/retell). Claimed as supported in Lessons 4 and 5. Evidence was found in all claimed lessons. Examples include:

- Lesson 4, Synthesize Section, Step 4: "Introducing the words "assemble" and "disassemble" is a good opportunity to reiterate how students can use root words and prefixes to figure out what a word means. Consider looking at both words simultaneously to point out that the root of both words is the same, but the prefix dis- is what differs between them. The prefix dis- means not or the opposite of something. The meaning of this prefix can help students distinguish between the meanings of these two words and be applied to other words that use the prefix dis-" (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize Section, Step 4: "Introducing the words "reversible" and "irreversible" is an opportunity to reiterate how students can use root words and prefixes to figure out what a word means. Consider looking at both words simultaneously to point out that the root of both words is the same, but the prefix ir- is what differs between them. The prefix ir- means not or the opposite of something. The meaning of this prefix can help students distinguish between the meanings of these two words and be applied to other words that use the prefix ir-" (Lesson 5, Teacher Guide)

CCSS-ELA-LITERACY.L.2.5B Distinguish shades of meaning among closely related verbs (e.g., toss, throw, hurl) and closely related adjectives (e.g., thin, slender, skinny, scrawny). Claimed as supported in Lessons 2. Evidence was found in all claimed lessons. Examples include:

- Lesson 2, Explore Section, Step 2: "Students will apply their oral language skills as they discuss different objects in preparation for their investigation. Encourage students to notice how many different kinds of adjectives can be used to describe these objects (e.g., smooth, rough, strong). Then, invite students to distinguish between the meanings of these adjectives and apply that knowledge to the tests that they can do during their investigation ." (Lesson 2, Teacher Guide)

Mathematics

CCSS-MATH-Practice.MP2 Reason abstractly and quantitatively. Claimed in Lesson 2. Evidence was found in the claimed lessons. Examples include:

- In Lesson 2, Explore Section, Step 2: "Students engage in quantitative reasoning as they share and justify their reasoning for the differences between not strong, a little strong, and very strong based on the number of items each object can hold. (MP2)" (Lesson 2, Teacher Guide).

CCSS-MATH-Practice.MP5 Use appropriate tools strategically. Claimed in Lesson 8. Evidence was found in the claimed lessons. Examples include:

- Lesson 8, Explore Section, Step 2: "Have students gather their engineering notebooks or their Material Investigation and Toy Design Sketch handouts. Display slide C and remind students we are ready to build toys! Point to the designated area with all the objects students can build with. Point to the designated area and the process for students if they need something hot glued by an adult. Remind students the hot glue is only to be used by adults." (Lesson 8, Teacher Guide)

CCSS-MATH-Practice.MP7 Look for and make use of structure. Claimed in Lesson 8. Evidence was found in the claimed lessons. Examples include:

- Lesson 8, Explore Section, Step 2: "The object shape is used as a tool to strategically choose the materials for their toys. Have students explain why the shape of the object(s) is important for that part of the toy and how that influenced what materials they selected." (Lesson 8, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

CATEGORY II

NGSS Instructional Supports

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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 practice of science and engineering as experienced in the real world. The materials help students connect designing a solution to experiences in their own lives. Students will authentically be motivated to design toys for their classroom. Students experience designing the solutions as directly as possible because they design toys for their own classroom and other classrooms in their school. The materials offer suggestions for connecting instruction to students' lives by drawing on their experiences playing with toys. They encourage students to design toys that can be used in classrooms and provide ideas for how students can apply the science practices developed in the unit when students are outside of the classroom.

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

- Lesson 1, Navigate Section, Step 1: "Ask students to turn to a neighbor and share their experiences with playing with a non-electric toy (not video games). After a minute or two, return to the whole group and invite a few students to share with the class. You can use the prompts below as students share. You may want to use hand signals to allow students to participate even if they do not have a chance to share with the whole class. Display slide A. Ask students, What types of toys do you like to play with? How do you play with these toys?...Introduce the problem and elicit ideas about toy creation. Introduce the idea of building toys for our classroom. Ask students if they think they could use their experiences to create new toys out of objects that are in our classroom. " (Lesson 1, Teacher Guide)
- Lesson 2, Explore Section, Step 2: "To empower learners to take charge of their own learning and support student access, make connections to the toys that students want to make or certain aspects of the toy they want to improve to optimize value and authenticity. Look for ways to bring up specific needs or issues that arose when students were building toys to make a more personal relevant connection to the investigation. Referring back to these specific moments will support student's ongoing investment, reflection and interest in the investigation and the improvement of their toy." (Lesson 2, Teacher Guide)
- Lesson 3, Connect Section, Step 4: "Have you had experiences with toys that come in sets? What were they? Have you had experiences playing with building blocks? What are some things that could be built with blocks? Have you had any experiences with toys that have tracks? What were they? Have any of you made layers of materials or objects for your toys? Why did you do that?" (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 2: "Update our toys with additional materials. Slide D Show students where in the classroom they will be able to get materials. Hold up each material or object as you show them where they are located. Explain to students that we will work for 15 minutes on updating our toys and tell them that you do not expect them to finish the toy today. Pass out a roll of tape to each group and have students retrieve the toys they built

in lesson 1. Remind students that they determined two different materials that they could use to build certain parts of their toys. Encourage them to consider the different ways they can use and change the materials today as they update their toys. Invite 1-2 groups up at a time to get a material or object to get started with. Remind students that there is a limit to our materials and ask them to consider how we can make sure we do not waste our materials. Accept all responses. As students update their toys, circulate around the room and provide guidance using the following prompts." (Lesson 4, Teacher Guide)

- Lesson 5, Explore Section, Step 2: "Now that students have observed a melting crayon, ask students to consider what might happen to the piece of paper if it was heated. Accept all responses. Pass around paper and allow students to record the properties of the paper on Changing Materials handout. Ask students to predict what might happen when the paper is heated. Display slide E. Explain that we will watch a video of this material being heated. Pause the video at the end and allow students time to record their observations." (Lesson 5, Teacher Guide).
- Lesson 7, Explore Section, Step 3: "Point out that each pair makes one toy for the kindergarten class, so their toy can include ideas from multiple students. Encourage students to review the interview answers and brainstorm ideas for a toy they can design and make. Use the following prompts for students to think about when brainstorming with their partners: Are there any similar favorite types of toys? Can you think of any ideas for toys similar to their favorite toys? Can you think of any toy ideas that have a similar way of playing with their favorite toys?" (Lesson 7, Teacher Guide)

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

- Lesson 1, Explore Section, Step 1: "Introduce the idea of building toys for our classroom. Ask students if they think they could use their experiences to create new toys out of objects that are in our classroom." (Lesson 1, Teacher Guide).
- Lesson 1, Connect Section, Step 2: "Prompts to use...Page 1: What is your favorite way to play? Page 3: Have you ever played with a toy like this? Does this remind you of another toy? Page 6: What does the shape of the diablo remind you of? Do you have any personal stories with a similar toy?" (Lesson 1, Teacher Guide)
- Lesson 6, Connect Section, Step 3: "Community Connections As students discuss argumentation, they may think about how other toys or objects require different materials to be built. They can relate the similarities between choosing materials for these items and choosing materials for their toys. If time allows, ask students how they have used argumentation before to achieve a goal or make a decision at home or with their community." (Lesson 6, Teacher Guide)
- Lesson 10, Explore Section, Step 3: "Present to kindergartners. Explain to the kindergarten students that their new toys have been made, and the second graders are ready to show and tell all about them! Divide the students into the groups they were in during the interview and let the students know they can begin presenting their new toy. Let the kindergartners know they will have time to play with the toy, but first, it is important to listen to the second-grade students talk about the process of designing and building the toy. Once the second graders complete their presentation, allow kindergartners to try out the new toy." (Lesson 10, Teacher Guidance)

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 1, Explore Section, Step 4: "Point out to students that we have defined a problem; we want to see if we can build toys from a set of objects in our classroom and we made a plan to build our toys, our design sketch." (Teacher Edition, Lesson 1)

- Lesson 2, Explore Section, Step 2: "Broadening Access To empower learners to take charge of their own learning and support student access, make connections to the toys that students want to make or certain aspects of the toy they want to improve to optimize value and authenticity. Look for ways to bring up specific needs or issues that arose when students were building toys to make a more personal relevant connection to the investigation. Referring back to these specific moments will support student's ongoing investment, reflection and interest in the investigation and the improvement of their toy." (Lesson 2, Teacher Guide).
- Lesson 7, Navigate Section, Step 1: "When we designed a toy for ourselves, we thought about what we liked. What can help us design a toy for kindergartners?" (Lesson 7, 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 ideas with peers directly, to elicit ideas from others, and to use others' ideas to improve or change their own thinking. The students are supported to communicate their ideas in ways that are meaningful to them and respectful of their cultures. Student artifacts show how students' reflective thinking has changed over time. There are both oral and written teacher-to-student and peer-to-peer feedback loops to help students design their toys.

Student ideas are clarified, justified, and built upon.

- Unit Front Matter: "Consider ways to engage all students in science talks through the Scientists Circle. This is an opportunity for students to see and hear one another to build community learning across the class. During the Scientists Circle discussions, it is important to look for how students are sharing their ideas in addition to what ideas and questions they might be sharing. Students might share ideas through talk, motions, gestures, facial expressions, etc. Young children have many rich ways of communicating, and it is important to welcome, recognize, and value all their ways of communicating. Throughout this unit, students will develop additional language resources and practices that will further support their scientific communication." (Unit Front Matter, page 31)
- Lesson 2, Explore Section, Step 2: " Remind students of the purpose of observing and recording information about each object by asking them why it is important that we test the objects. Hold up some of the objects students will be testing. As you hold up each object, ask the following prompts to help students come up with common procedures for how to observe the different objects for each test. As the class comes to a consensus on how to perform the tests, record ideas on the board for students to reference when investigating. See Sample Investigation Plan for a sample investigation plan. (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 3: "Display **slide F** and ask students to use the prompts on the slide to share ideas for possible back up materials. Circulate during these conversations and listen for students to share ideas for materials that are based on the properties of those materials. After 1-2 minutes bring students back together and ask a few students to share what their partner said." (Lesson 3, Teacher Guide)

- Lesson 4, Explore Section, Step 3: "Organize students into small groups so that each person in the group used at least one similar material. Have students use the Material Changes handout to find out how other students changed the materials. Circulate around the room and support students in their discussion by using the following prompts: It looks like you all used _____ material, did you change it for your toy? How? What evidence do you have that the material changed?" (Lesson 4, Teacher Guide)
- Lesson 5, Explore Section, Step 5: "Share data and come to a consensus on the type of change. Display The Changes in Materials Chart (refer to slide I) and ask one partner group to share an example of a change that they thought was reversible. Ask them to come up and tape the card to the chart and to provide evidence for their decision. Use the sample prompts below to support students in determining where to put each example of a change. After the student places the card and provides their evidence, have the class give a thumbs up or down to share if they agree or disagree with the type of change. If there are any students who disagree, ask them to provide their evidence for why they disagree. Support students in using evidence to support their claims." (Lesson 5, Teacher Guide)
- Lesson 7, Explore Section, Step 3: "Share ideas for toys. Display slide G and create small groups (see the teacher tip about creating small groups) with two to three pairs to do a Think, Pair, Share discussion about their kindergartners' answers to gather possible ideas for their toy design solution. Explain to students that getting feedback from others can be valuable for gathering multiple ideas and expanding their thinking. Before beginning group discussions, it is important to look back at your Classroom Agreements. Ask students to point out important agreements when listening and giving ideas to their peers. Emphasize the agreements for the expectations of peer feedback: Supporting a student who is unsure about sharing. Looking at the person speaking. Allowing our ideas to grow and change. Use and build on others' ideas...Brainstorm and decide on a toy design. Display slide I and distribute Toy Design Sketch handout to each pair of students. Remind students that they had time to discuss ideas in small groups and receive peer feedback. Now, they will work with their partner to decide which toy design they want. Have the students turn and talk with their partner about which toy design idea was their favorite and why. Then, they will need to agree upon one toy to design and build. Encourage students to use their Kindergarten Interview handout as evidence to support why that idea is the best based on the kindergartners' interests. Allow a couple of minutes for students to discuss and prompt them when the time is running out, and a decision needs to be made for their final decision for their toy design." (Lesson 7, Teacher Guide)

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

- Lesson 1, Lesson Materials and Preparation, "Throughout the unit, students will use handouts to support their science and engineering learning. It is recommended to prepare engineering notebooks for the unit before this lesson. For more information on how engineering notebooks support students' science and engineering sensemaking, refer to the Teacher Handbook." (Lesson 1, Teacher Guide)
- Lesson 1, Navigate Section, Step 6: " Explain that engineering a toy will take us a while and that we should keep track of our design ideas over time. Tell students that we will be starting an engineering notebook and that our design sketch will be our first item to add." (Lesson 1, Teacher Guide)
- Lesson 3, Explore Section, Step 3: "Update our design sketch from lesson 1. Display slide E. Help students to recall that during lesson 1 we drew our design before building our toys. Suggest that we return to our engineering notebooks and update our sketches with our new ideas for materials we want to include. Encourage students to write across any languages they prefer. Pass out a copy of Updated Design Sketch. Ask students to draw and update their designs and circulate while they are drawing. As you circulate, ask students to share reasons for the material choices they are making. Look for students to base their choices on the properties of the materials." (Lesson 3, Teacher Guide).
- Lesson 3, Explore Section Step 3, "Add backup material ideas to our design sketch. Display slide G and ask students to update their designs. Circulate during this time and ask students to provide reasoning for their choices. Look for them to use the properties of materials to support the choices they are making." (Lesson 3, Teacher Guide).

The materials prompt the teacher to start an "Our Growing Ideas chart" in Lesson 2. This chart is used to record the question that is the focus of the lesson and the class's response to "What did we figure out?" and "How did we figure it out?" The "Our Growing Ideas chart" is revisited and updated in lessons 3, 4, 5, 6, 7, 8, 9, and 10.

- Lesson 2, Synthesize Section, Step 6: "Gather students in the Scientists Circle and display our Growing Ideas Chart. Explain to students the chart will be used to record what we learn in each lesson. Remind students of the lesson question, "What do we notice about different objects and the materials they are made of? Ask students to share with a partner what they have figured out and how they figured it out. After 1-2 minutes bring students together and engage in a Building Understandings Discussion. As students share answers, explain that a claim is an idea that answers a scientific question. Listen for ideas that a material can have the same and different properties. Add the ideas to the "What did we figure out?" column...Explain to students that in science we always want to support our claims with evidence from what we did or observed. Evidence is the observations, data, and information that helps answer a scientific question. Ask students what they did that helps them know that. Listen for observations from their investigation that support the claim. Add the evidence to the "How did we figure it out?" column...Ask students what pictures we could add to our chart to represent what we figured out. Look for students to suggest we include pictures of the materials we tested. As students share, fill in the third column of Our Growing Ideas chart." (Lesson 2, Teacher Guide)
- Lesson 3, Navigate Section, Step 1: "Display Our Growing Ideas chart (refer to slide A) with material, properties and design learning from Lesson 2. Using the prompts below, have students revisit Our Growing Ideas chart and recall that last time we investigated objects made of different materials to figure out whether their properties were similar or different." (Lesson 3, Teacher Guide)

Students receive feedback and revise their thinking accordingly.

- Lesson 3, Lesson Assessment Guidance Section: "Use this formative assessment opportunity to see if students need more support in understanding that a small set of materials can be used to make a variety of toys. If students need more support identifying additional materials that can be used, have them focus on one piece of the toy, explain the function of that piece, and then visit the chart with the properties that closely match. If students need more support seeing that many different toys can be made from a small set of materials ask several students to share the ways they are using 1 particular material. Highlight that several students are using this 1 material in many different ways. Use students' self reflections to consider which students might need additional support in Lesson 4, and use the time when students are building to conference with them" (Lesson 3, Teacher Guide)
- Lesson 3, Navigate Section, Step 6: "Collect design sketches. Remind students that building toys will take some time and we are using our engineering notebooks to keep track of our process. Ask students to add their updated design sketch to their engineering notebooks. Tell students that you are excited to look over all of the great ways they plan to use the materials to build their toy. Use Lesson 3 Instructional Guidance to provide students with written feedback for them to use in lesson 4 and 6. In the next lesson consider taking time during the Explore, when students are building, to conference with students who need additional support." (Lesson 4, Teacher Guide)
- Lesson 3, Instructional Guidance: possible feedback is provided for teachers to give to students whose design sketches demonstrate "secure", "secure with prompting", and "secure" understanding.
- Lesson 4, Explore Section, Step 2: "Review feedback on our design sketches. Emphasize how excited you are to see the toys get built. Tell students that you wrote some feedback on their designs for them to consider before they build. Give students 1-2 minutes to review the feedback then ask students to consider how they might use the feedback when they are building today." (Lesson 4, Teacher Guide)

- L3-4, 7-9 Following Student Sensemaking Tool provides the teacher with possible feedback for lessons 3, 4, 7, and 8.
  - "Possible lesson 3 feedback, "I see you drew _____ on your sketch, what will that part be made of? Let's work together to add some labels to your drawings. What word should we write here? What sound does that word begin with? I see you want to use _____, how will you change that material to make it part of your toy"
  - "Possible Lesson 4 feedback How will you assemble these parts of your toy together? I see you are putting those pieces together, how will that help your toy? Can you show me which part of your toy is not working? Why do you think that is?"
  - "Possible lesson 7 feedback I see you drew _____ on your sketch, what will that part be made of? Let's work together to add some labels to your drawings. What word should we write here? What sound does that word begin with? I see you want to use _____, how will that change the material to make it part of your toy?"
  - "Possible Lesson 8 feedback How will you assemble these parts of your toy together? I see you are putting those pieces together, how will that help your toy? Can you show me which part of your toy is not working? Why do you think that is?"
- Lesson 7, Explore Section, Step 3: "Share ideas for toys. Display slide G and create small groups (see the teacher tip about creating small groups) with two to three pairs to do a Think, Pair, Share discussion about their kindergartners' answers to gather possible ideas for their toy design solution. Explain to students that getting feedback from others can be valuable for gathering multiple ideas and expanding their thinking. Before beginning group discussions, it is important to look back at your Classroom Agreements. Ask students to point out important agreements when listening and giving ideas to their peers. Emphasize the agreements for the expectations of peer feedback:
- Supporting a student who is unsure about sharing. Looking at the person speaking. Allowing our ideas to grow and change. Use and build on others' ideas." (Lesson 7, Teacher Guide)
- Lesson 9, Explore Section, Step 2: "Set up the purpose for revising our designs. Suggest to students that it is important to use the feedback they received from their peers to revise and retest their designs. Ask students the following prompts. How can we use the feedback we receive from our peers? We can use their ideas to revise our toy design solutions. Change our toys. Make our toys better. Fix the toys. How can we decide with our partner what changes to make to our design? We can talk with our partner and agree on the changes we want to make. Once you revise your toy design solutions, how will you know if the toy is ready to share with kindergartners? We can test our toys to see if they work better. We can test our toys again. We can try our toys." (Lesson 9, 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 because the materials explicitly identify prior learning expected for all three dimensions and describe how the prior learning will be built upon. The materials 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: The Unit Front Matter describes prior learning related to the science ideas developed in the unit; however, the materials do not specify the DCI elements to which this prior learning is related.

- Unit Front Matter: "Students may have observed objects made of different materials. For example, students may know the different material names like wood, rubber, plastic, etc. Some students may connect the sorting materials by their properties to the sorting of recyclables by their materials. The word material can have many meanings and in school it may be used to refer to students' supplies or other classroom objects. In this unit students will work to understand the difference between an object and a material. For example kids may refer to paper and a piece of paper as the same thing. Students will work to differentiate between the word object and material starting in Lesson 2." (Unit Front Matter)
- Unit Front Matter: "Students come to school with many experiences of touching or observing objects made of different materials in their homes and communities. Students will likely have experience with the texture of things; it feels soft, smooth, rough, or bumpy. Students may have even used properties to describe characteristics of materials. Some students may be familiar with property names like texture, flexibility, strength, etc." (Unit Front Matter)

Science and Engineering Practices: The Unit Front Matter describes prior learning related to the science practices developed in the unit; however, the materials do not specify the SEP elements to which this prior learning is related.

- Unit Front Matter: "Students may have seen or used models before. In Unit 2.1, "Why does land change shape and how can we prevent land from changing?" students used beach models to show the effects of erosion of beaches. Students built 3D models, drew 2D models and maps to show the effects of wind and water erosion on shorelines." (Unit Front Matter)
- Unit Front Matter: "Constructing Explanations and Designing Solutions Students likely have many experiences explaining the world around them and working to design solutions to problems they have experienced. Students who have experienced *Unit 2.1: How do wind and water change the shape of land and what can we do about it?* and/or any prior units in kindergarten or 1st grade, will come to this unit with exposure to the engineering design process and what it means to use engineering to solve problems. It is important to keep in mind that some students may consider a "problem" to be a bad thing, whereas in engineering it refers to a situation that people want to improve in the world around them. Students may consider that engineers only build things to solve problems. This unit will engage students in other aspects of engineering like planning, modeling, testing, evaluating and communicating design." (Unit Front Matter)

- Lesson 4, Explore Section, Step 2: "If students have previously engaged in Unit 2.1: How do wind and water change the shape of land and what can we do about it? support students in recalling the different ways that they used models in that unit. Guide students to understand that models can take on many different forms, they can be drawings or physical representations, that are used to explain or test an idea about how something works." (Lesson 4, Teacher Guide)

Crosscutting Concepts: The Unit Front Matter describes prior learning related to the crosscutting concepts developed in the unit; however, the materials do not specify the CCC elements to which this prior learning is related.

- Students will continue to expand their understanding of crosscutting concepts related to energy in Unit 4.2: How do we power clocks and other devices? and matter in Unit 5.2: How can we make water healthy for all living things?
- In Unit 2.1: How do wind and water change the shape of land and what can we do about it? students used structure and function to design a solution that can reduce the changes in land due to wind and water. Students will also use structure and function in Unit 2.4: How can plants grow in different places? as they work to figure out what plants need to grow.

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

- In the About the Science document, a list of resources is provided to support adult learning related to the targeted DCIs and engineering in the elementary classroom.
- Unit Front Matter: "Students may have observed objects made of different materials. For example, students may know the different material names like wood, rubber, plastic, etc. Some students may connect the sorting materials by their properties to the sorting of recyclables by their materials. The word material can have many meanings and in school it may be used to refer to students' supplies or other classroom objects. In this unit students will work to understand the difference between an object and a material. For example kids may refer to paper and a piece of paper as the same thing. Students will work to differentiate between the word object and material starting in Lesson 2." (Unit Front Matter, page 19)
- Unit Front Matter: "Students likely have many experiences explaining the world around them and working to design solutions to problems they have experienced. Students who have experienced Unit 2.1: How do wind and water change the shape of land and what can we do about it? and/or any prior units in kindergarten or 1st grade, will come to this unit with exposure to the engineering design process and what it means to use engineering to solve problems. It is important to keep in mind that some students may consider a "problem" to be a bad thing, whereas in engineering it refers to a situation that people want to improve in the world around them. Students may consider that engineers only build things to solve problems. This unit will engage students in other aspects of engineering like planning, modeling, testing, evaluating and communicating design." (Unit Front Matter, page 20)
- Lesson 2, Synthesize Section, Step 4: "Broadening Access Students will likely have a different understanding of what property means. Some students may know the definition of property as something that belongs to someone. Explain to students some words have different meanings and both are correct, but are used in different ways.: (Lesson 2, Teacher Guide).

Criterion-Based Suggestions for Improvement

- Consider describing how prior student learning is expected specific to the claimed elements in all three dimensions.

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.

- Unit Front Matter: "It is important to keep in mind that some students may consider a "problem" to be a bad thing, whereas in engineering it refers to a situation that people want to improve in the world around them. Students may consider that engineers only build things to solve problems. This unit will engage students in other aspects of engineering like planning, modeling, testing, evaluating and communicating design." (Unit Front Matter, page 24)
- Unit Front Matter: "Students may have observed objects made of different materials. For example, students may know the different material names like wood, rubber, plastic, etc. Some students may connect the sorting materials by their properties to the sorting of recyclables by their materials. The word material can have many meanings and in school it may be used to refer to students' supplies or other classroom objects. In this unit students will work to understand the difference between an object and a material. For example kids may refer to paper and a piece of paper as the same thing. Students will work to differentiate between the word object and material starting in Lesson 2." (Unit Front Matter)
- Lesson 6, Engineers Make Arguments Book, "Some people hear the word "argument" and think that an argument is a bad thing. Argumentation in engineering is different from arguing about what to eat for dinner or whose turn it is to throw the ball. Science and engineering arguments help everyone learn from each other's ideas, and make sense of the world around us." (Lesson 6, Engineers Make Arguments, Page 7).

Criterion-Based Suggestions for Improvement: N/A

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 of guidance for teachers to support differentiated instruction. The materials provided guidance for teachers to support multiple modality expressions and multiple means of engagement. In most cases, detailed guidance and support that teachers would recognize for multilingual learners—including students who are learning English, those who read well below grade level, those with high interest, and/or those who have already met the performance expectations—are also included in the materials.

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: "Students at this age are still working on developing writing skills, so it is important to allow students to share their ideas using many different modes of communication. In this unit, there are opportunities for speaking, writing, drawing, and gesturing/acting out to share their ideas about sensemaking. The Lesson 6 assessment opportunity allows students to share their ideas in writing and/or drawing. If they struggle to write down their ideas, you can ask them to verbally share their thoughts and then scribe their answers. In both the Lesson 6 and Following Student Sensemaking assessment opportunities, support students in communicating their ideas."
- Lesson 1, Explore Section, Step 4: "Teaching Tip Students may struggle to get started with what they would like to build. Support students by drawing their attention to the toys we read about using the images on slide D. Use questioning and prompts to support the students in thinking about the kinds of toys they like to play with. Use their ideas to help them develop an idea for a toy. Remind students that engineering a toy takes time and we will get more than one chance to work on our toy design. We want to start somewhere to let our ideas change and grow" (Lesson 1, Teacher Guide).
- Lesson 2, Explore Section, Step 2: "Teaching Tip If students need more support with differentiating between an object and a material create a two column chart on the board. Label the left column object and the right column material. Hold up a few objects and have students name the object and the material it is made out of. Record students' answers for each object."
- Lesson 2, Synthesize Section, Step 4: "Broadening Access Provide options for physical action and response by considering having the bags of materials accessible as students identify patterns. To support multilingual and/or speech-impaired students, encourage students to use whatever modalities of expression they choose. For example, allow students to point to specific materials, gesture the way they tested them, and show movement of specific materials to help them communicate any patterns they saw. Encourage both scientific and everyday language to express their ideas." (Lesson 2, Teacher Guide)

- Lesson 6, Synthesize Section, Step 5: "Broadening Access If students struggle with putting their words down on paper, provide multiple means of action and expression such as speech-to-text software so that they can speak their thoughts regarding the claim and evidence. Students can also verbally express their thoughts to the teacher to help them process their thinking as they write. Validate all the ways they share their ideas such as drawings, gestures and across named languages." (Lesson 6, Teacher Guide).

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

- Lesson 2, Explore Section, Step 2: "If applicable, you might encourage your multilingual students to add vocabulary words across named languages (e.g., Spanish, Mandarin, Arabic) to the word wall if it would support their sensemaking throughout the unit." (Lesson 2, Teacher Guide)
- Lesson 2, Synthesize Section, Step 4: "Broadening Access Provide options for physical action and response by considering having the bags of materials accessible as students identify patterns. To support multilingual and/or speech-impaired students, encourage students to use whatever modalities of expression they choose. For example, allow students to point to specific materials, gesture the way they tested them, and show movement of specific materials to help them communicate any patterns they saw. Encourage both scientific and everyday language to express their ideas." (Lesson 2, Teacher Guide).
- Lesson 7, Connect Section, Step 2: "It might be beneficial to plan ahead with the kindergarten teacher to pair up multilingual students together if it will support the second-grade multilingual student to gather their data." (Lesson 7, Teacher Edition)

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

- Unit Front Matter: "Throughout this unit, students will be designing and building toys. There are many ways students can participate in the process and it is important that they engage in as many aspects of design as they can. That said, students at this age have varied fine motor skills that may impact the ways that they engage in the design and building processes. As students work, encourage them to practice fine motor skills and to develop other skills, such as noting observations of what worked and didn't work as they designed and build their toys." (Unit Front Matter)
- Lesson 1, Navigate Section, Step 6: "Broadening Access While bringing in materials from home provides a wonderful connection between the classroom and home, it is not a requirement. If you ask students to bring in objects from home, make sure to be clear that you will also provide objects so students do not feel left out if they are not able to bring in supplies.) (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize Section, Step 4: "Provide options for physical action and response by considering having the bags of materials accessible as students identify patterns. To support multilingual and/or speech-impaired students, encourage students to use whatever modalities of expression they choose. For example, allow students to point to specific materials, gesture the way they tested them, and show movement of specific materials to help them communicate any patterns they saw. Encourage both scientific and everyday language to express their ideas." (Lesson 2, Teacher Guide)

Learners reading below grade level

- Most of the unit's reading is done aloud, and the materials provide prompts to support student comprehension. In Lesson 2, students read an infographic and engage in a jigsaw activity. This lesson does not provide support for students who read below grade level.

- Lesson 1, Connect Section, Step 2: "Explain to students that they will be reading about toys from around the world. Read the title and turn to the Table of Contents. Ask students how they can use the Table of Contents when reading informational texts like this one. Read Way to Play: Toys Around the World using the associated prompts. Ask the following questions during the read aloud to help students begin to notice and wonder about different toys and the objects they are made of." (Lesson 1, Teacher Guide)
- Lesson 2, Connect Section, Step 5: "Explain to students that you found a type of text that might help us to figure out more about other properties. Introduce Properties Infographics to students. Point out that there are three additional properties that we can read about. Tell students that we will jigsaw the properties infographics, with each student reading about only 1 property. Explain that we will then come back together to share what we have figured out about these other properties." (Lesson 5, Teacher Guide) While a jigsaw is a differentiation strategy, in this lesson, a jigsaw does not support students reading below grade level in reading the infographic independently.
- Lesson 5, Connect Section, Step 3: "Read a book and discuss the associated prompts. Refer to slide F and introduce the Changing Materials in Our Communities book. Refer to the Table of Contents and ask students which page we should start reading. Read the book aloud and discuss using the prompts below." (Lesson 5, Teacher Guide)

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

- The Assessment Guidance in most lessons suggests supports teachers can provide to complete the given task.
  - Lesson 9, Lesson Assessment Guidance: "As students continue to work on related learning goals in the next lesson, check in with those students who need more support. If students are not considering the objects' properties and how they can be utilized in the designs to meet the shape and structure of the toy, ask them to revisit the Material Properties Chart and point to a property the toy needs. Ask students to consider how that material/object may work in the toy design for the shape and structure of the toy. If students are not giving feedback about the shape and stability of the structures to each other, ask students to consider what would happen if the shape of the design or the objects and/or materials of the objects the partners picked were different and how that might impact how well the design would work. If students are not making connections between their structure and the function it should serve, ask students to explain why we are designing this toy. From there, ask students what they believe the toy would need to do to function as intended." (Lesson 9, Teacher Guide)
- Unit Front Matter: "Developing an idea for a toy can be difficult for students and they may need extra support to get started. Support students by returning to the book in Lesson 1 and use probing questions like, do you have experiences with a toy like this? Is this a toy you might like to play with? Another approach to help students develop an idea would be to use the interview question found in Lesson 7. These questions can help students to clarify the ways they may like to play and spark an idea for a toy. If students have internet access in the classroom consider having students search popular toys from various decades to generate additional inspiration." (Unit Front Matter, page 32)
- Lesson 5, Connect Section, Step 3: "If students are struggling with the idea of the crayon going back to the way it was, consider supporting them by going back to the example of the cars being made using a mold in the Changing Materials in Our Communities book (pgs. 5, 13). If time permits you can also play [this video] to show students the wax being poured into a crayon mold." (Lesson 5, Teacher guide)
- Lesson 5, Teacher Assessment Tool: "Possible Next Steps, Before starting Lesson 6 project before and after photos with different materials (e.g., images from Lessons 4-5) and guide students in comparing how the properties of materials compare before the heating and after the cooling. If possible, create images of before and after for the individual students or small groups to use. Images from the Changing Materials in Our Communities book or

Material Card Sort can be reused. Use a similar structure to the comparison of the crayon and the paper in Lesson 5. Ask students to look for differences in the two pictures, and use words to describe the differences of the properties before and after. From there, expand the datasets to two or three more examples, allowing students to look for patterns across those changes. Before starting Lesson 6 (or during the first Navigate), reflect on the examples from Lesson 4 and lesson 5. Have students return to the crayon and paper example. Choose one property to focus on and ask students to describe the property before the change and then after the change. From there expand and add two to three more properties, having students compare the properties before and after the change. Ask students to then apply these observations of properties to a different example from Changing Materials in Our Communities or the [Changing Materials document], first with focusing on one specific property, and then adding one to two more properties." (Lesson 5, Teacher Assessment Tool)

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 2, Explore Section, Step 2: "Extension Opportunity: The Material Investigation handout contains a blank column for students to extend their observations beyond what is listed. If students have a high interest in other properties (beyond what the class planned to investigate) encourage them to write or draw what they observe in the last column of the handout. During the Synthesize, encourage students to share out additional observations they recorded." (Lesson 2, Teacher Guide)
- Lesson 2, Navigate Section, Step 7: "Teaching Tip Extension Opportunity: After the lesson, consider giving students the opportunity to read about the other properties from the Properties Infographics infographics that the student did not directly read about. If there is time, allow interested students to read about these properties as a small group in class. If there is no time, give students the opportunity to 'borrow' the infographic to read in their free time." (Lesson 2, Teacher Guide).
- Lesson 5, Navigate Section, Step 8: "Teaching Tip Extension Opportunity If you have students with high interest in changing materials you can invite them to discover more about 3D printers and help them connect what they figured out about changing materials with heat to understanding more about how 3D printers work. Consider looking for grade-appropriate books in the library or contacting other staff in the district that may be able to share expertise. See Extension: 3D printing resources for resources students can use to extend their learning." (Lesson 5, Teacher Guide).

Criterion-Based Suggestions for Improvement

- Ensure students who are reading below grade level are given support for all independent reading activities.

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 routines such as the Navigate Sections discussions and tools such as the Notice and Wonder chart to ensure student engagement across lessons. Updating student design sketches and discussion questions ensure students are linking their learning to their toy designs.

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.).

The materials prompt teachers to make a Notice and Wonder chart in Lesson 1. This Notice and Wonder chart is revisited in Lessons 2, 3, 4, 5, 6, 7, 8, 9, and 10

- Lesson 1, Explore Section, Step 3: "Discuss notices and wonders about toys and materials to answer in later lessons... Display the Notice and Wonder chart. Use the prompts below to ask students to first share what they noticed about the toys, then move into asking what wonders they had. As students share, record these noticings and wonderings in the Notice and Wonder columns." (Lesson 1, Teacher Guide)
- Lesson 2, Navigate Section, Step 1: "Revisit the brainstormed Notice and Wonder chart with students and add any new questions students have about their found objects. If students did not bring in materials, ask students to share what objects they saw in their communities between lessons that could be used to create a new toy. Add any new noticings or wondering that students have to the Notice and Wonder chart." (Lesson 2, Teacher Guide)
- Lesson 8, Connect Section, Step 4: "Point out we have done a lot of the same work that toy designers do. Ask students for ideas of what we can do next with our toys. Listen for ideas to test and revise them. Suggest we return to our Notice and Wonder chart to add any new wonders about testing and revising our toys." (Lesson 8, Teacher Guide)

Each lesson begins with a Navigate Section, where the teacher is provided with strategies to use student ideas and questions to develop a lesson question that becomes the focus of the lesson.

- Lesson 3, Navigate Section, Step 1: "Craft the lesson question. Validate students' questions and statements about what still needs to be figured out about material properties by circling or staring a few relevant questions to revisit as we learn more. Recall that we ended last class with ideas that we may want to pick materials based on their properties. Work with students to develop a question like, "How can we use the properties of materials to decide what we need for our toys? However, feel free to use terms and phrasing that reflect your class's ideas." (Lesson 3, Teacher Guide)

- Lesson 7, Navigate Section, Step 1: "Gather in a Scientists Circle. Display slide A and remind students that the kindergarteners heard we were building toys and were wondering if we could build new toys for their classroom. Use the following discussion prompts to support students in interviewing kindergarten students to learn more about what toys they like. Encourage students to think back to Lesson 1 when they discussed toys they enjoyed and how that helped them design their toy...Introduce the lesson question. Point out that we want to design a toy that the kindergartners will enjoy. Suggest that our work today center around figuring out what toys kindergartners like to play with and how they like to play with them so that we can make them toys they will enjoy. Work with students to develop a question like, "How can we use kindergartners' interests to design toys?" However, feel free to use terms and phrasing that reflect your class's ideas." (Lesson 7, Teacher Guide)

Each lesson ends with a Navigate Section, where teachers are provided with strategies for cultivating new student questions and ideas that logically lead to the next lesson.

- Lesson 3, Navigate Section, Step 6: "Take stock of what we figured out. Revisit the class Notice and Wonder Chart (refer to slide J) and add new noticings to the chart. Review the noticings and questions about objects and materials from Lesson 1-3. Remind students that scientists use their observations and data from their investigations or from texts to answer their questions. Ask students if there are questions they can now answer based on their testing and decisions about which materials have the different properties that work best for what our toy needs, or from the text. Place a checkmark next to questions that have been answered." (Lesson 3, Teacher Guide)
- Lesson 9, Navigate Section, Step 6: "Set a purpose for sharing toys. Use the following prompts to motivate the students to meet with the kindergartners again and share the toys they have designed and built for them. Prompts to use...What should we do with the toys now that they are built?...We should give the toys to the kindergartners. We could show them this (holds up engineering notebook). We should take the toys to the kindergartners and see if they like playing with them. We should share the toys with the kindergartners so they can play with them." (Lesson 9, Teacher Guide)

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

The materials prompt students to update their toy sketches in Lessons 3 and 6 after they have gained new knowledge. Students apply what they have learned as they update their toy designs.

- Lesson 3, helping them apply what they have learned to their toy design Explore Section, Step 3: "Ask students to draw and update their designs and circulate while they are drawing. As you circulate, ask students to share reasons for the material choices they are making. Look for students to base their choices on the properties of the materials." (Lesson 3, Teacher Guide)
- Lesson 6, Synthesize Section, Step 5: "Choose one material you would like to use in your toy design solution and write an argument to answer the question: Why is this material a good choice to use for your toy?" (Lesson 6, Student Assessment Written Argument) (Lesson 6, Teacher Guide)

The materials regularly provide discussion prompts to support students in linking new learning to their toy design.

- Lesson 4, Synthesize Section, Step 6: "How did you change materials or objects today? What did we figure out today about ways we can change materials or objects? We read about materials that change when heated, how could that help us? We have limited objects that are available to use. Why is it important to think about how we can change these objects to use in our toy design solutions?" (Lesson 4, Teacher Guide)

- Lesson 8, Synthesize Section, Step 3: "Let's look back at our question, How can we use our design sketches to build a toy? What did we figure out about that? We can use ideas from the design sketches to build and test our toys. We planned what it would look like and the properties it needed. Can you say more about that? Can anyone add to _____ idea? How did we figure that out? We chose our objects to build with ideas from our design sketches. We built the toy like the sketch we drew. We looked at the shapes we drew and made the objects like the shapes. We tested the toys as we were building to check if our plans worked. How did you know which objects to use? How did you know which structure/shapes to make? Who can add to that idea?" (Lesson 8, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

II.G. Scaffolded Differentiation Over Time

EXTENSIVE

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 **extensive** evidence that support is provided to help students engage in the practices as needed and to gradually adjust supports over time so that students are increasingly responsible for making sense of phenomena and/or designing solutions to problems for all of the intentionally developed SEP elements. In the unit, students engage in the practice as a class with teacher support and transition to independent use of the practice in later lessons. Scaffolds for the unit of the intentionally developed SEPs are gradually reduced throughout the unit.

MOD: Developing and Using Models

Claimed Element: MOD: P4 Develop a simple model based on evidence to represent a proposed object or tool.

The first time students use this element, the materials encourage teachers to circulate and ask questions to help students use evidence to inform their models. The second time students use this element, they do so independently as part of a summative assessment task. Students use this element again in small groups in Lessons 7 and 8.

- Lesson 3, Explore Section, Step 3: "Update our design sketch from lesson 1. Display slide E. Help students to recall that during lesson 1 we drew our design before building our toys. Suggest that we return to our engineering notebooks and update our sketches with our new ideas for materials we want to include. Encourage students to write across any languages they prefer. Pass out a copy of Updated Design Sketch. Ask students to draw and update their designs and circulate while they are drawing. As you circulate, ask students to share reasons for the material choices they are making. Look for students to base their choices on the properties of the materials." (Lesson 3, Teacher Guide) The "Alignment with the Three-Dimensions of NGSS" document claims MOD-2.P2 (Compare models to identify common features and differences.) In this lesson, students are using MOD 2.P4 (Develop a simple model based on evidence to represent a proposed object or tool.)
- Lesson 6, Synthesize Section, Step 5: "Sketch your updated design idea using the box below." (Lesson 6, Assessment Written Argument)

DATA: Analyzing and Interpreting Data

Claimed Element: DATA: P3 Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.

Students first use observations to describe patterns in a class discussion. The teacher provides the definition of a pattern. A class discussion is used to identify patterns the second time students engage with the element. Then, students use the element independently when they use patterns to identify a backup material that has similar properties.

- Lesson 2, Synthesize Section, Step 4: " Use the following prompts to have students think, pair, and share with another partner group to compare objects and the materials they are made out of to discover similarities and differences in materials. After 2-3 minutes bring students back together and have them share out. As students share, listen for ideas that materials that are different AND materials that are the same can have similar and different properties. Records the similarities and differences on the Materials Patterns Chart. Recognize the patterns students point out as patterns are something that happens over and over again....Prompts to use...What do you notice about objects made of the same materials?...Ideas to look and listen for...Wood objects are smooth, strong, and do not bend. Metal objects are smooth, strong, and somewhat bend. Paper objects are smooth or rough, bend, and are either strong or weak. Fabric objects are fluffy or rough, bend, and are weak. Plastic objects are smooth, bend, and can be strong or weak. The glass object is smooth, does not bend, and is strong. They are all different colors." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 3: "Engage students in identifying the properties of different materials to explore how materials can be used based on the purpose of the properties and connect to the students' toy design needs. The following prompts can be used to engage students in analyzing the properties of the materials tested. As students notice patterns in the materials, move cards around to group materials together." (Lesson 3, Teacher Guide).
- Lesson 3, Explore Section, Step 3: "Suggest considering a backup material. Bring students back together and point out that we are sharing the same materials as we all make our different toys. Ask students to consider what they could do if we run out of a certain material. Accept all responses. Tell students that we may not be able to get more materials and ask students to consider picking a second material that could work for at least one part of their toy in case their first choice is not available. Point out that we discovered that many materials have some properties in common." (Lesson 3, Teacher Guide)

Claimed Element: DATA: P5 Analyze data from tests of an object or tool to determine if it works as intended.

The first time students use this element (Lesson 3), the materials encourage teachers to circulate and ask questions that encourage students to use data to ensure the materials they are choosing match their intended purpose. The second time students engage in the element (Lesson 6), the teacher models the analysis of the data. In Lesson 9, students engage in the element with a partner without explicit teacher support.

- Lesson 3, Explore Section, Step 3: "Update our design sketch from lesson 1. Display slide E. Help students to recall that during lesson 1 we drew our design before building our toys. Suggest that we return to our engineering notebooks and update our sketches with our new ideas for materials we want to include. Encourage students to write across any languages they prefer. Pass out a copy of Updated Design Sketch. Ask students to draw and update their designs and circulate while they are drawing. As you circulate, ask students to share reasons for the material choices they are making. Look for students to base their choices on the properties of the materials." (Lesson 3, Teacher Guide)
- Lesson 6, Synthesize Section, Step 4: "Prompts to use...For my design, I want something that is strong and is not flexible. How can I find a material like this?...Ideas to look and listen for...Look at the chart with the properties of materials. Look in the "strength" category for materials that are strong. Look in the "flexible" category for materials that do not bend. See if any materials are listed in both categories. Wood is listed in both categories." (Lesson 6, Teacher Guide)

- Lesson 9, Explore Section, Step 3: "Have partners use their Feedback Tracker handout to review the feedback they received from their peers and then agree on one or two small changes to improve their toys... Encourage students to put a star next to one or two changes that they will complete first. " (Lesson 9, Teacher Guide)

CEDS: Constructing Explanations and Designing Solutions

Claimed Element: CEDS: P1 Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.

Students progress from making observations to constructing evidence-based accounts for natural phenomena in class discussions where the teacher is prompted to suggest evidence they use more independently in small groups.

- Lesson 3, Synthesis Section, Step 5: "Prompts to use...How are we able to make so many different toys with our set of materials?....Ideas to look and listen for...We can put them together in different ways. We can change objects and then put them on our toys. We all have different ideas on how to put them together." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize Section. Step 4 " Display slide F Ask students to consider their toy designs and share how they or a partner assembled something or disassembled something. Have students refer back to Material Changes to share what they learned from talking with others in their group. As students share examples, record them on a blank chart with an assemble column and a disassemble column. Discussion Questions: What did you disassemble to build your toy? How did you assemble objects or materials to build your toy?" (Lesson 4, Teacher Guide)
- Lesson 5, Explore Section, Step 5: "As students work, circulate the room and ask students to share their thinking for placing a card in a particular category. Use the sample prompts below to support students in using evidence to support their claims. Can you tell me/show me why you put _____ in the category for a reversible change? Can you tell me/show me why you put _____ in the category for a reversible change?" (Lesson 5, Teacher Guide)

ARG: Engaging in Argument From Evidence

Claimed Element: ARG: P6 Construct an argument with evidence to support a claim.

In Lesson 2, students are supported in developing the use of the element as the teacher describes what a claim and evidence are. In Lesson 3, students engage in the element in a whole class discussion in which they listen to the reasoning of classmates and come to a consensus. In Lesson 5, students engage in the element with a partner. In Lesson 6, students use the element independently on two different summative assessment tasks.

- Lesson 2, Synthesize Section, Step 6: "As students share answers, explain that a claim is an idea that answers a scientific question. Listen for ideas that a material can have the same and different properties...Use evidence to support claims. Explain to students that in science we always want to support our claims with evidence from what we did or observed. Evidence is the observations, data, and information that helps answer a scientific question. Ask students what they did that helps them know that. Listen for observations from their investigation that support the claim. Add the evidence to the "How did we figure it out?" column." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 3: "Begin a whole class discussion to analyze the material properties data on their Material Properties Charts to uncover where consensus on image placement is needed. If more than one partner group tested the same object and disagrees about where image is on a Material Properties Charts, engage the pairs in a discussion, inviting the students to agree/disagree or share their thinking. Probe students to use evidence from their Material Investigation handouts to support their arguments for the properties of the materials." (Lesson 3, Teacher Guide)

- Lesson 5, Explore Section, Step 5: "Explain that they will work with a partner to sort the cards into two categories, a reversible change or an irreversible change. Tell students that as they look at each card and decide where it goes they should record it on Reversible or Irreversible Change. Ask students to consider what we might do if we disagree on where a card goes. Use the prompts below to support students in developing strategies for how to work through disagreements. Prompts to use...How would we know where to put a card in the first place? What evidence have we seen so far?...If something was a reversible change what might we see?...If something was an irreversible change what might we see?...What if you and your partner do not agree on where to put a card?" (Lesson 5, Teacher Edition)
- Lesson 6, Explore Section, Step 2: Students draw a picture of glue before it is heated, while it is heated and after it is heated. They respond to the prompt "I think this was a ____ change because _____" (Lesson 6, Handout Changing Glue)
- Lesson 6, Synthesize Section, Step 5: "Choose one material you would like to use in your toy design solution and write an argument to answer the question: Why is this material a good choice to use for your toy?...List two properties that make this material a good choice for your design." (Lesson 6, Assessment Written Argument)

Claimed Element: ARG: P7 Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence.

In Lesson 8, students engage in the element while working in small groups. The teacher is prompted to ask follow-up questions to ensure students are using evidence to support their claims. In Lesson 9, students use the element independently.

- Lesson 8, Explore Section, Step 2: "Prompts to use...I see that you chose ____ to use. Why did you choose that?..Ideas to look and listen for...We used the pipe cleaners because it is flexible. *gestures bending with hands* We used the marble because it rolls (students roll the marble)...Follow-up response...What properties does that object have that make it good for this part of your toy? Could you use other objects? Why would those also work?" (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 2: Students evaluate the toy designs of their classmates and answer the questions "What works well?, What can be improved? How can it be improved?" (Lesson 9, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

CATEGORY III

Monitoring NGSS Student Progress

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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 design solutions. Student artifacts that require grade-appropriate elements of all three dimensions to be used together are used frequently, including to evaluate targeted learning objectives. Each targeted SEP, CCC, and DCI element is routinely used in service of sensemaking, in contrast to just stating the idea of a CCC or DCI, using the mechanics of an SEP, or using the SEP to represent previously learned information/processes. One of the summative tasks is very similar to a task that students engaged in earlier in the unit and therefore does not require student reasoning with new information to construct a new understanding of the problem presented.

Well-crafted phenomena drive formal tasks in the materials- and problem-based scenarios that can elicit rich student performances. The materials identify two summative assessment opportunities in Lesson 6 and 1 summative assessment opportunity in Lesson 10.

- Lesson 6, Synthesize Section, Step 5: " Instruct students to use Written Argument to draw their final design sketch and then construct an argument about a material they want to include in their toy." (Lesson 6, Teacher Guide) Students described the materials they would use to build their toy design using properties as evidence in Lesson 3, Explore Section, Step 3. This task does not require student reasoning to connect their existing understanding to new information to construct a new understanding of the scenario presented.
- Lesson 6, Explore Section, Step 2: "Direct the students' attention to the hot glue gun and squeeze out some glue onto a piece of paper. Tell students to watch to see if there are any changes as the glue cools. Students will observe the glue harden again. Have students draw a picture of these changes on Changing Glue handout...Now that students have observed the glue, ask students to independently consider which type of change is happening to the glue. Show students where they can record their thinking on Changing Glue. Allow them a few minutes to record the type of change that they think occurred along with evidence to support their claim." (Lesson 6, Teacher Guide)
- Lesson 10, Explore Section, Step 2: "Prompts to use...If you were a kindergarten student, what would you want to know about a new toy? What can we share about the process of designing the toy? Where can we find information that we figured out to help us with our design?...Display slide D and pass out a Toy Presentation assessment to each pair and explain to students that we can record important pieces to share with their kindergartners about how and why they built the toy they did. Ask the following prompts and have the students complete their *Toy Presentation* assessment while going through the prompts. Encourage the pairs to share writing responsibilities on the *Toy Presentation* assessment." (Lesson 10, Teacher Guide)

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

- Lesson 3, Explore Section, Step 3: "Update our design sketch from lesson 1. Display slide E. Help students to recall that during lesson 1 we drew our design before building our toys. Suggest that we return to our engineering notebooks and update our sketches with our new ideas for materials we want to include. Encourage students to write across any languages they prefer. Pass out a copy of Updated Design Sketch. Ask students to draw and update their designs and circulate while they are drawing. As you circulate, ask students to share reasons for the material choices they are making. Look for students to base their choices on the properties of the materials. Suggest considering a backup material. Bring students back together and point out that we are sharing the same materials as we all make our different toys. Ask students to consider what they could do if we run out of a certain material. Accept all

responses. Tell students that we may not be able to get more materials and ask students to consider picking a second material that could work for at least one part of their toy in case their first choice is not available. Point out that we discovered that many materials have some properties in common." (Lesson 3, Teacher Guide) **MOD: 2.P4 Develop a simple model based on evidence to represent a proposed object or tool. 2-PS1.A.2: Different properties are suited to different purposes. PAT: 1.P.1: Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.**

- Lesson 10, Explore Section, Step 2: "Display slide D and pass out a Toy Presentation assessment to each pair and explain to students that we can record important pieces to share with their kindergartners about how and why they built the toy they did. Ask the following prompts and have the students complete their *Toy Presentation* assessment while going through the prompts. Encourage the pairs to share writing responsibilities on the *Toy Presentation* assessment." (Lesson 10, Teacher Guide) **INFO: 8.P4 Communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, and/or design ideas. 2-PS1.A.2: Different properties are suited to different purposes. SF: 6.P1: The shape and stability of structures of natural and designed objects are related to their function(s).**

Students routinely produce artifacts that demonstrate their use of the grade-appropriate elements of SEPs, CCCs, and DCIs, which are targeted as learning objectives.

Lesson 3, **Analyze and interpret data** to identify **patterns** in the **properties of different materials** and use the **patterns** to **determine materials to use in a toy design**.

- Lesson 3, Explore Section, Step 3: students sketch the materials they will use for their toy design and describe a backup material they could use to build their design in the Updated Design Sketch document. (Lesson 3, Handout Updated Design Sketch)

Lesson 5, **Construct an argument using observations as evidence** that **heating a material** can **sometimes cause a reversible change** and **sometimes cause an irreversible change.**

- Lesson 5, Explore Section, Step 5: students determine if the changes observed are reversible or irreversible for different materials and describe the evidence they used to make their claim on the Reversible or Irreversible Change handout. (Lesson 5, Handout Reversible or Irreversible)

Lesson 6, **Use observations as evidence to construct an argument** about how **heating a material can cause a reversible change**.

- Lesson 6, Explore Section, Step 2: On the Changing Glue document students record observations of the glue before it is heated, while it is heated, and after it is heated and use evidence to support a claim if the observed changes are reversible or irreversible. (Lesson 6, Assessment Changing Glue)

Lesson 7, **Design a sketch of a toy (model)** that includes specific **properties and shapes (structures)** that support the proposed **purpose (function) of the toy**.

- Lesson 7, Explore Section, Step 3: Students sketch their design for a toy and describe its function and properties using the Toy Design Sketch document. (Lesson 7, Handout Toy Design Sketch)

Criterion-Based Suggestions for Improvement

- Ensure that summative assessment tasks require students to apply reasoning to construct a new understanding using new information. [Detailed Guidance, p. 35]

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 evaluate student learning to inform instruction. There are opportunities in every lesson for formative assessment information to be gathered, recorded, and used to inform future instruction.

Materials include explicit, frequent, and varied supports for formative assessment processes. The materials identify formative assessment opportunities in Lessons 2, 3, 4, 5, 7, 8, and 9. The Lesson Assessment Guidance section of these lessons describes where to check for understanding, what evidence for student learning looks or sounds like, and how to use evidence of student learning.

- Lesson 2, Lesson Assessment Guidance: "Where to check for understanding: In the Explore, on the Material Investigation handout. During the Synthesize, when students share observations from the investigation during the discussion. (slide G)" (Lesson 2, Teacher Guide)
- Lesson 2, Lesson Assessment Guidance: "What to look and listen for: Look for evidence that students have planned (collaboratively) and conducted an investigation to describe and identify patterns of observable properties of materials. Students using observations to identify patterns in the properties of different types of materials (wood, plastic, glass, metal, rubber, paper and fabric). Students using observations to describe patterns of different material types that can have some properties in common. Students using observations to describe that materials have more than one property." (Lesson 2, Teacher Guide)
- Lesson 2, Lesson Assessment Guidance: "If students need support carrying out the investigation, return to the board to review the steps we agreed upon. If students need more support identifying the material that an object is made up of, consider asking students to share experiences around that object. Use questions like: Have you seen something like this before? What does this remind you of? If students need help identifying that different materials can have some properties in common, focus their attention on two objects and ask targeted questions about specific properties. If students need help identifying that materials can have more than one property, hold one up object and ask targeted questions about several properties. During the investigation students may identify additional properties, such as the way light interacts with the object (transparent/reflective) or the way it feels (heavy / light). Properties related to light and water (waterproof vs absorbent) will be explored during the Connect. If students identify additional properties (density/magnetism, etc) that are not covered, honor their recognition and have them add them to their handout." (Lesson 2, Teacher Guide)

"Key Formative Assessments" are identified in Lesson 3, 5, and 9. Assessment Tool documents accompany these formative assessments.

- The Lesson 3 Assessment Tool document has examples of student sketches labeled "Not yet secure", "Secure with prompting," and "Secure," and possible feedback the teacher could give students at each level. (Lesson 3 Assessment Tool)
- The Lesson 3, Lesson 5, and Lesson 9 Assessment Tool documents have descriptions of evidence of student learning in a "If you notice..." column and suggestions to help teachers determine how to adjust instruction in a "Possible next steps" column. (Lesson 3, 5, and 9 Assessment Tool)
- The Lesson 9 Assessment Tool describes ways to adjust instruction if the possible next step "if this applies to a few students in your class" or "if this applies to most or all of your class." (Lesson 9 Assessment Tool)

The L3-4, 7-9 Following Student Sensemaking Tool describes what students might write, draw, say, or gesture in response to the formative assessment tasks in 3, 4, 7, and 8. The document also describes possible feedback.

- Following Student Sensemaking Tool, "Students might write: Words and/or labels indicating what they want their toy to do. Words and/or labels to describe how they changed materials to allow them to fit together. Words and/or labels to indicate the smaller objects that will make up the toy. Words and/or labels for the materials to fit the need of the toy. Words and/or labels to explain how the parts of the toy work together." (Following Student Sensemaking Tool)
- Following Student Sensemaking Tool, "Possible Lesson 3 feedback: I see you drew _____ on your sketch, what will that part be made of? Let's work together to add some labels to your drawings. What word should we write here? What sound does that word begin with? I see you want to use _____, how will you change that material to make it part of your toy? How will you assemble these parts of your toy together? Is there a different material that has the same properties that you could use? Labeling those parts will help you to remember how to put your toy together. Did you see someone else use this material? How did they use it? Was it similar or different to how you used it?" (Following Student Sensemaking Tool)

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

- Lesson 3, Explore Section, Step 3: "Formative Assessment: During these discussions, you have an opportunity to formatively assess students' understanding of the learning goal. Listen for students to describe and compare properties (color, texture, flexibility and strength) of the materials tested in Lesson 2. Students should be able to describe that materials have multiple properties and that different properties lend themselves to different purposes. Listen for students to use evidence from the class properties charts to support their ideas. Continue to assess and follow up using [*link*] with students as you circulate during the time they are updating their design sketches.
- Lesson 4, Explore Section, Step 3: "Formative assessment: During these small discussions, you have an opportunity to formatively assess students' understanding of the Learning Goal 4. Listen for students to show how some objects are made of smaller pieces and how they can be taken apart and put together in different ways to make another, larger object. Use the L3-4, 7-9 Following Student Sensemaking Tool to record evidence of students' developing sensemaking. Use the suggestions at the beginning of the lesson for providing feedback and supporting students." (Lesson 4, Teacher Guide)

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

- The L3-4, 7-9 Following Student Sensemaking Tool describes what students might write, draw, say, or gesture in response to the formative assessment tasks in 3, 4, 7, and 8. "Possible evidence of student sensemaking: Remember that students are often using multiple means of communication to express their sensemaking. As you are looking for evidence that students have a secure grasp of the assessment statement, look and listen for these examples." (L3-4, 7-9 Following Student Sensemaking Tool)
- The Lesson 9 Assessment Tool describes ways to adjust instruction if the possible next step is " if this applies to a few students in your class" or "if this applies to most or all of your class." (Lesson 9 Assessment Tool)

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 that the materials include 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.

Support for planning instruction

Lessons 1-10 include a Lesson Assessment Guidelines section, which describes what evidence of student learning to look for and listen for in assessment tasks and provides suggestions for how to provide students with additional support. (Lessons 1-10, Teacher Guide)

- Lesson 3, Lesson Assessment Guidance: "Use the information you gather to determine if students need more support in understanding that materials have certain properties that can be used to make their toy work a certain way. If students need additional support identifying patterns in the properties of materials, ask them to focus on one property at a time to notice the materials that have that property in common. If students need additional support identifying patterns in the properties of materials, ask them to compare and contrast two properties like flexibility and strength..." (Lesson 3, Teacher Guide)
- Lesson 7, Lesson Assessment Guidance: "As you look and listen for students' ideas, notice how they used ideas from their previous experiences to sketch a toy design and include the properties needed for the materials to build the toy to support the purpose (function) of the toy. Provide feedback to students by using questions such as: Tell me about your toy design. What do you want your toy to do? What structure/shape does your toy need to do that? What properties are needed for that structure/shape?" (Lesson 7, Teacher Guide)

The L3-4, 7-9 Following Student Sensemaking Tool describes what teachers should look and listen for relative to Assessment Statement 2. It describes possible student responses and provides suggestions for feedback. (Following Student Sensemaking Tool)

- "Possible lesson 4 feedback: How will you assemble these parts of your toy together? I see you are putting those pieces together, how will that help your toy? Can you show me which part of your toy is not working? Why do you think that is?" (L3-4, 7-9 Following Student Sensemaking Tool)
- "Possible lesson 8 feedback How will you assemble these parts of your toy together? I see you are putting those pieces together, how will that help your toy? Can you show me which part of your toy is not working? Why do you think that is?" (L3-4, 7-9 Following Student Sensemaking Tool)

The Lesson 3, 5, and 9 Assessment Tool provide the next steps in planning instructions based on student responses to the formative assessment task in Lesson 5 (Lesson 3, 5 and 9 Assessment Tool)

- Lesson 3 Assessment Tool: "Possible next steps...Ask students to label the parts of their toy with what they will be made out of. Have students return to the Properties of Materials Charts to determine which materials have the properties they need for the components in their toy. Provide a scaffold such as a label or pre-drawn component that the student can build onto through drawing, writing, or speaking. (Lesson 3 Assessment Tool)

- Lesson 9 Assessment Tool: "Possible next steps...If this applies to a few students in your class: During the first Explore in Lesson 10, work with these students as they plan for their Toy Presentation on Toy Presentation in connecting the smaller objects' shape, materials, properties, and functions. You may ask them questions such as: Why did you choose [object] for that part of your toy? Would that object have worked for a different part of your toy? Why or why not?...If this applies to most or all of your class: Prior to Lesson 10, choose one toy to focus on, then revisit the Example Material Properties Charts chart and point to a property the toy needs. Ask students to consider how that material/object may work in the toy design for the shape and structure of the toy." (Lesson 9 Assessment Tool)
- The Lesson 3 Assessment tool provides examples of student sketches of their toy that represent "Not Yet Secure", "Secure with Prompting", and "Secure" learning relative to the assessment statement associated with the Change Glue assessment. It provides suggested feedback for each level of response. (Lesson 3 Assessment Tool)
- The Lesson 6 Hot Glue and Materials Argument Assessment Guidance document provides examples of student responses that represent "Beginning", "Developing", and "Secure" learning relative to the assessment statement associated with the Written assessment. To provide feedback based on student responses using the rubric, the document suggests teachers use the Lesson 3 Instructional Guidance document. Lesson 3 Instructional Guidance provides teachers with possible feedback and next steps based on student responses. (Hot Glue and Materials Argument Assessment Guidance)
- The Lesson 10 Assessment Tool document describes student responses at the "Beginning", "Developing", and "Secure" levels. It provides suggested feedback for each of these levels. (Lesson 10 Assessment Tool)

Support for ongoing feedback

- Lessons 1 - 10 Lesson Assessment Guidance, Where can I check for understanding?, How can I use this assessment information?
- Lesson 2, Where can I check for understanding?, "What to look and listen for: Look for evidence that students have **planned (collaboratively) and conducted an investigation** to **describe and identify patterns** of **observable properties of materials.** How can I use this assessment information?, 'If students need help identifying that different materials can have some properties in common, focus their attention on two objects and ask targeted questions about specific properties.'" (Lesson 2 Teacher Guide).
- Lesson 6, Where can I check for understanding?, What to look and listen for: Students **Using observations as evidence to construct an argument** independently that **the heat caused the glue to go through a reversible change**. How can I use this assessment information? "This is a key formative assessment opportunity where you will take stock of students' progressing sensemaking. Use the ideas that students write and draw on Changing Glue handout to determine if students would benefit from small group discussions that return to the videos, book, and/or cards from lesson 5. Circulate to support and assess their current thinking and representations. See the Lesson 6 Hot Glue and Materials Argument Assessment Guidance tool for instructional guidance suggestions based on students' current sensemaking." (Lesson 6, Teacher Guide)
- Lesson 9, Where can I check for understanding?, "What to look and listen for: **Testing** a **toy to determine** if the **properties** and, **shape, and stability of structures cause it to work as intended."** How can I use this assessment information?, "This is a key formative assessment opportunity where you will take stock of students' progressing sensemaking. Use the L3-4, 7-9 Following Student Sensemaking Tool tool to jot notes about which students you were able to hear/see evidence from during this lesson and plan to focus on seeking evidence from other students in Lesson 10. That tool also provides a range of sample student responses and ideas for how you can provide feedback. As students continue to work on related learning goals in the next lesson, check in with those students who need more support." (Lesson 9, Teacher Guide).

- Lesson 1 Teacher Reference, Engineering Notebook Guidance, "The developers recommended developing an engineering notebook over the course of the unit with students. This notebook will allow for students to collect individual feedback and have a way to reflect on what they figured out in the unit.".
- Lesson 2, Navigation Section, Step 7: "Add Material Investigation to our engineering notebooks. Close the lesson by collecting the Material Investigation and adding the handout to students's engineering notebooks."
- Lesson 4, Synthesize Section, Step 6: "Display slide I and bring students together in a Scientists Circle to engage in a Building Understandings Discussion. Have students bring their engineering notebooks or the following handout: Updated Design Sketch. Use the following prompts for students to share their experiences of changing objects and materials and what they figured out from the book." (Lesson 4, Teacher Guide).
- Lesson 5, Synthesize Section, Step 7: "Display slide J and bring students together in a Scientists Circle to engage in a Building Understandings Discussion. Have students bring their engineering notebooks or the following handouts: Changing Materials and Reversible or Irreversible Change. Use the following prompts for students to share their experiences with what happens to materials when they are heated or cooled." (Lesson 5, Teacher Guide).
- Lesson 9, Explore Section, Step 2: "Remind students to use their engineering notebooks (or handouts) to explain the design and to use them as evidence for their choices." (Lesson 9, Teacher Guide).

Criterion-Based Suggestions for Improvement: N/A

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.

Multiple modes of communication

All summative assessments in the unit focus on phenomena or problems that students have experienced firsthand and provide opportunities for students to communicate in multiple modalities.

- Unit Front Matter: "Students at this age are still working on developing writing skills, so it is important to allow students to share their ideas using many different modes of communication. In this unit, there are opportunities for speaking, writing, drawing, and gesturing/acting out to share their ideas about sensemaking. The Lesson 6 assessment opportunity allows students to share their ideas in writing and/or drawing. If they struggle to write down their ideas, you can ask them to verbally share their thoughts and then scribe their answers. In both the Lesson 6 and Following Student Sensemaking assessment opportunities, support students in communicating their ideas." (Unit Front Matter)
- Lesson 6, Explore Section, Step 2: "Display slide F. Pass around the low-heat glue sticks and allow each student to observe the properties of the glue stick by looking at it and feeling it. Have students draw a picture of the glue stick on Changing Glue handout. Direct the students' attention to the hot glue gun and squeeze out some glue onto a piece of paper. Tell students to watch to see if there are any changes as the glue cools. Students will observe the glue

harden again. Have students draw a picture of these changes on *Changing Glue* handout.... Display slide F. Now that students have observed the glue, ask students to independently consider which type of change is happening to the glue. Show students where they can record their thinking on Changing Glue. Allow them a few minutes to record the type of change that they think occurred along with evidence to support their claim." (Lesson 6, Teacher Guide)

- Lesson 6, Synthesize Section, Step 5: "Sketch your updated design idea using the box below....Choose one material you would like to use in your toy design solution and write an argument to answer the question: Why is this material a good choice to use for your toy?" (Lesson 6, Student Assessment)
- Lesson 10, Explore Section, Step 2: "Display slide D and pass out a Toy Presentation assessment to each pair and explain to students that we can record important pieces to share with their kindergartners about how and why they built the toy they did. Ask the following prompts and have the students complete their *Toy Presentation* assessment while going through the prompts. Encourage the pairs to share writing responsibilities on the *Toy Presentation* assessment." (Lesson 10, Teacher Guide)

Supports success for all students

- Lesson 3 Assessment Tool, "Possible evidence of student sensemaking: Remember that students are often using multiple means of communication to express their sensemaking. As you are looking for evidence that students have a secure grasp of the assessment statement, look and listen for these examples." The document describes evidence of student learning if they write, draw, speak, or gesture. (Lesson 3, Assessment Tool)
- Lesson 6, Synthesize Section, Step 5: "If students struggle with putting their words down on paper, provide multiple means of action and expression such as speech-to-text software so that they can speak their thoughts regarding the claim and evidence. Students can also verbally express their thoughts to the teacher to help them process their thinking as they write. Validate all the ways they share their ideas such as drawings, gestures and across named languages." (Lesson 6, Teacher Guide)

Multiple modalities and student choice

- Lesson 1, Explore Section, Step 3: "Transition to building a toy. After students share ideas about the toys in the book, explain that they will have the opportunity to make their own toy today. Ask students if they think we could use some classroom materials to try building a new toy. Display slide F and introduce the unit question, How can we design a new toy?....Build the toys. Explain to students that we will stop building after 20 minutes to discuss any new noticings and wonderings that we may have. Tell students that you do not expect them to finish their toy and assure them they will have more time in future lessons to work on the toy." (Lesson 1, Teacher Guide)
- Lesson 6, Student Assessment, "1. Draw a picture of the glue before it is heated. 2. Draw a picture of the glue while it is being heated. 3. Draw a picture of the glue after it is cooled.....I think this was a...change because...." (Lesson 6, Student Assessment)

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.

Matches three-dimensional learning objectives

- Lesson 3, the three-dimensional learning objective is **analyze and interpret data** to identify **patterns** in the **properties of different materials** and use the **patterns** to **determine materials to use in a toy design**.
  - Lesson 3, Explore Section, Step 3: "Identify patterns in the data. Engage students in identifying the properties of different materials to explore how materials can be used based on the purpose of the properties and connect to the students' toy design needs. The following prompts can be used to engage students in analyzing the properties of the materials tested. As students notice patterns in the materials, move cards around to group materials together." (Lesson 3, Teacher Guide)
- Lesson 7, the three-dimensional learning objective is **Design a sketch of a toy (model)** that includes specific **properties and shapes (structures)** that support the proposed **purpose (function) of the toy**.
  - Lesson 7, Explore Section, Step 3: "Remind students when they sketched their toy designs for themselves in an earlier lesson, they drew a model for their design. They will also use the engineering process to sketch their design ideas and communicate how their toy may look. Display **slide J** and have students draw their design ideas on their handouts. Allow students to draw their designs and then have a quick discussion with them to motivate the need to add more details to their sketches. Ask students for ideas they may need and/or want to add to their sketches. Listen for ideas of objects to build with, materials of the objects, what the toy will do (function of the toy/pieces of the toy), shapes of the toy, etc...For each function, have students use a different colored pencil to connect the function to its structure and the properties for stability of the structure. Have students add as many functions as needed for their toys." (Lesson 7, Teacher Guide)
- Lesson 5, the three-dimensional learning objective is **construct an argument using observations as evidence** that **heating a material** can **sometimes cause** a **reversible change** and **sometimes cause an irreversible change.**
  - Lesson 5, Explore Section, Step 5: " Explain that they will work with a partner to sort the cards into two categories, a reversible change or an irreversible change. Tell students that as they look at each card and decide where it goes they should record it on Reversible or Irreversible Change. Ask students to consider what we might do if we disagree on where a card goes. Use the prompts below to support students in developing strategies for how to work through disagreements. Prompts to use...How would we know where to put a card in the first place? What evidence have we seen so far?...If something was a reversible change what might we see?...If something was an irreversible change what might we see?...What if you and your partner do not agree on where to put a card?" (Lesson 5, Teacher Edition)

Pre-, formative, summative, and self-assessment

Pre-Assessment

The Assessment System Overview document describes tasks in Lesson 1 that can be used as pre-assessment opportunities. (Assessment System Overview)

- Lesson 1, Explore Section, Step 3: "Pre-assessment: This discussion and sharing of questions provides an opportunity to gather evidence about Learning Goal 1a (aligned to Assessment Statement 1), to determine the support students may need in upcoming lessons as they ask questions and identify problems related to engineering new toys. In future lessons, students will have the opportunity to develop questions with their small group without sharing as a class and answer those questions based on observations used as data. Refer to the Assessment Guidance at the beginning of the lesson for more information." (Lesson 1, Teacher Guide)

Formative Assessment

The Assessment System Overview document describes formative assessment opportunities in Lessons 2, 3, 4, 5, 7, 8, and 9. Formative assessments in Lessons 3, 5, and 9 are described as "key formative assessments" and include an Assessment Tool to support teachers in interpreting student responses, providing feedback, and planning for the next instructional steps.

- Lesson 3, Key Formative Assessment "In Lesson 3, use the ideas students share on their Updated Design Sketch handout to evaluate students' progress toward Assessment Statement #1 (aligned to 2-PS1-1 and 2-PS1-2) Use the Lesson 3 Instructional Guidance to provide feedback to students and plan your upcoming instruction." (Assessment System Overview)
- Lesson 5, Key Formative Assessment "In Lesson 5, use the ideas students share on their Reversible or Irreversible Change handout and peer discussions during the cardsort to evaluate students' progress toward Learning Goal 5A (aligned to PE 2-PS1-4). Use the Lesson 5 Assessment Guidance to provide feedback to students and plan your upcoming instruction." (Assessment System Overview)
- Lesson 9, Key Formative Assessment "In Lesson 9, use students' *Toy Design Sketch* handout and ideas that you capture on Lesson 3 Instructional Guidance tool as you circulate while students test their designs to evaluate students' progress toward Assessment Statement 2. Use the Lesson 9 Instructional Guidance to provide feedback to students and plan your upcoming instruction." (Assessment System Overview)

Summative Assessment

The Assessment System Overview document describes summative assessment opportunities in Lesson 6 and Lesson 10.

- Lesson 6, Explore Section, Step 2: "Key formative assessment: Students' observations and written claims about the glue on Changing Glue handout provide an opportunity to gather evidence about learning goal 6a, with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Refer to the Lesson 6 Hot Glue and Materials Argument Assessment Guidance tool and the Assessment Guidance at the beginning of the lesson." (Lesson 6, Teacher Guide) This is described as a summative task in the Assessment Overview document, but the Assessment Opportunity box in the teacher guide in Lesson 6 describes it as a Key formative assessment.
- Lesson 6, Synthesize Section, Step 5: "Summative Assessment: Students' individual work on Written Argument provides an opportunity to gather evidence about learning goal 6B, with the purpose of summatively assessing students' arguments about a choice to include a material in the design of their toy. Use Lesson 6 Hot Glue and Materials Argument Assessment Guidance to interpret students' answers and provide feedback to students." (Lesson 6, Teacher Guide)

- Lesson 10, Explore Section, Step 2: "Summative assessment: Toy Presentation assessment provides an opportunity to gather evidence about Learning Goal 10, with the purpose of summatively assessing students analyzing and using data from tests of an object (toy) to determine if the set of smaller objects, when put together, allows the toy (larger object) to work as intended. Use Summative Guidance to provide feedback to students. Ask questions and listen to students who may not yet share their ideas clearly through writing. The Consensus Discussion is an additional opportunity to gather evidence of sensemaking." (Lesson 10, Teacher Guide)

Self Assessment

- Lesson 1, Lesson Materials and Preparation, "Throughout the unit, students will use handouts to support their science and engineering learning. It is recommended to prepare engineering notebooks for the unit before this lesson. For more information on how engineering notebooks support students' science and engineering sensemaking, refer to the Teacher Handbook" (Lesson 1, Teacher Guide).
- Lesson 3, Self-Reflection "In Lesson 3 the prompts on Observations Self Reflection handout support students in considering their own progress in using observations of material properties as evidence to support choices they are making to design their toy. These reflections will allow students to review their sensemaking about the properties of materials and how those properties can be suited for a specific purpose." (Assessment System Overview)
  - Lesson 3, Connect Section, Step 4: "Reflect on our progress. Distribute the Observations Self Reflection handout to each student. Tell students that this is an opportunity for them to pause and reflect on their own sensemaking and that it is OK if they still think that they need to work on their sensemaking." (Lesson 3, Teacher Guide)

The rationale for the coherent three-dimensional assessment system is clearly described in the Assessment System Overview. The materials include different types of assessment, and the Assessment Opportunity boxes in the teacher guide describe how each assessment should be used.

- "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." (Assessment System Overview)
- Lesson 4, Explore Section, Step 3: "Formative assessment: During these small discussions, you have an opportunity to formatively assess students' understanding of the Learning Goal 4. Listen for students to show how some objects are made of smaller pieces and how they can be taken apart and put together in different ways to make another, larger object. Use the L3-4, 7-9 Following Student Sensemaking Tool to record evidence of students' developing sensemaking. Use the suggestions at the beginning of the lesson for providing feedback and supporting students." (Lesson 4, Teacher Guide).
- Lesson 5, Explore Section, Step 5: "Key formative assessment: Students' Changing Materials and the surrounding discussions provide an opportunity to gather evidence about Learning Goal 5, with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Refer to the Lesson 5 Assessment Guidance tool and the Assessment Guidance at the beginning of the lesson." (Lesson 5, Teacher Guide)

- Lesson 6, Synthesize Section, Step 5: "Summative Assessment: Students' individual work on Written Argument provides an opportunity to gather evidence about learning goal 6B, with the purpose of summatively assessing students' arguments about a choice to include a material in the design of their toy. Use Lesson 6 Hot Glue and Materials Argument Assessment Guidance to interpret students' answers and provide feedback to students." (Lesson 6, Teacher Guide)

Criterion-Based Suggestions for Improvement

- Ensure the description of the type of assessment is the same across different documents.

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 opportunities for students to demonstrate use of practices connected with their understanding of Disciplinary Core Ideas and Crosscutting Concepts for the claimed Assessment Statements (learning objectives) in more than one activity and assessment, allowing students to develop and improve their performance over time. Students also have opportunities to apply peer and teacher feedback from prior activities to help them progress in their learning.

Multiple interconnected opportunities over time

Assessment Statement 1: **Use observations (from first hand investigations and media)** and patterns **as evidence to make an argument** that **different properties are suited to different purposes**.

- Lesson 2, Synthesize Section, Step 4: " Use the following prompts to have students think, pair, and share with another partner group to compare objects and the materials they are made out of to discover similarities and differences in materials. After 2-3 minutes bring students back together and have them share out. As students share, listen for ideas that materials that are different AND materials that are the same can have similar and different properties. Records the similarities and differences on the Materials Patterns Chart. Recognize the patterns students point out as patterns are something that happens over and over again … .Prompts to use...What do you notice about objects made of the same materials?...Ideas to look and listen for...Wood objects are smooth, strong, and do not bend. Metal objects are smooth, strong, and somewhat bend. Paper objects are smooth or rough, bend, and are either strong or weak. Fabric objects are fluffy or rough, bend, and are weak. Plastic objects are smooth, bend, and can be strong or weak. The glass object is smooth, does not bend, and is strong. They are all different colors." (Lesson 2, Teacher Guide)
- Lesson 2, Synthesize Section, Step 6: "As students share answers, explain that a claim is an idea that answers a scientific question. Listen for ideas that a material can have the same and different properties...Use evidence to support claims. Explain to students that in science we always want to support our claims with evidence from what we did or observed. Evidence is the observations, data, and information that helps answer a scientific question. Ask students what they did that helps them know that. Listen for observations from their investigation that support the claim. Add the evidence to the "How did we figure it out?" column." (Lesson 2, Teacher Guide)

- Lesson 3, Explore Section, Step 2: "After students have visited all of the charts, invite them to form a scientist circle on the rug. Use the example prompts below to help guide students toward looking for patterns in their observations of properties … .Prompts to use…(Hold up a craft stick) What is this craft stick made of? What are some properties we noticed about it?…Is that true of the other objects made of wood? What other objects are made of wood that you have experienced before?…It sounds like there might be some patterns in our materials, but we are not sure. How could we find out more?" (Lesson 3, Teacher Guide)
- Lesson 3, Explore Section, Step 3: "Engage students in identifying the properties of different materials to explore how materials can be used based on the purpose of the properties and connect to the students' toy design needs. The following prompts can be used to engage students in analyzing the properties of the materials tested. As students notice patterns in the materials, move cards around to group materials together." (Lesson 3, Teacher Guide).
- Lesson 3, Explore Section, Step 3: "Begin a whole class discussion to analyze the material properties data on their Material Properties Charts to uncover where consensus on image placement is needed. If more than one partner group tested the same object and disagrees about where image is on a Material Properties Charts, engage the pairs in a discussion, inviting the students to agree/disagree or share their thinking. Probe students to use evidence from their Material Investigation handouts to support their arguments for the properties of the materials." (Lesson 3, Teacher Guide)
- Lesson 3, Explore Section, Step 3: "Suggest considering a backup material. Bring students back together and point out that we are sharing the same materials as we all make our different toys. Ask students to consider what they could do if we run out of a certain material. Accept all responses. Tell students that we may not be able to get more materials and ask students to consider picking a second material that could work for at least one part of their toy in case their first choice is not available. Point out that we discovered that many materials have some properties in common." (Lesson 3, Teacher Guide)
- Lesson 6, Synthesize Section, Step 5: "Demonstrate how to use this information to answer the questions for the "claim" of the argument on Written Argument. Ask students, When I was trying to choose a material, which properties did I look for on the Materials Investigation chart? (i.e., strong, not flexible) How will these properties help my design? (i.e., The wood can support the roof of the house. It will not bend when used for building.) Demonstrate how to use this information to answer the questions for the "evidence" of the argument on Written Argument." (Lesson 6, Teacher Guide)
- Lesson 6, Synthesize Section, Step 5: "Choose one material you would like to use in your toy design solution and write an argument to answer the question: Why is this material a good choice to use for your toy?…List two properties that make this material a good choice for your design." (Lesson 6, Assessment Written Argument)

Assessment Statement 2: Students can **analyze and use data from tests of an object (toy)** to **determine if the** set of smaller objects, when put together, allows **the toy (larger object) to work as intended.**

- Lesson 3, Explore Section, Step 3: "Identify patterns in the data. Engage students in identifying the properties of different materials to explore how materials can be used based on the purpose of the properties and connect to the students' toy design needs. The following prompts can be used to engage students in analyzing the properties of the materials tested. As students notice patterns in the materials, move cards around to group materials together." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize Section, Step 4: " Display slide F Ask students to consider their toy designs and share how they or a partner assembled something or disassembled something. Have students refer back to Material Changes to share what they learned from talking with others in their group. As students share examples, record them on a blank chart with an assemble column and a disassemble column." (Lesson 4, Teacher Guide))

- Lesson 7, Explore Section, Step 3: "Remind students when they sketched their toy designs for themselves in an earlier lesson, they drew a model for their design. They will also use the engineering process to sketch their design ideas and communicate how their toy may look. Display slide J and have students draw their design ideas on their handouts. Allow students to draw their designs and then have a quick discussion with them to motivate the need to add more details to their sketches. Ask students for ideas they may need and/or want to add to their sketches. Listen for ideas of objects to build with, materials of the objects, what the toy will do (function of the toy/pieces of the toy), shapes of the toy, etc...For each function, have students use a different colored pencil to connect the function to its structure and the properties for stability of the structure. Have students add as many functions as needed for their toys." (Lesson 7, Teacher Guide)
- Lesson 8, Explore Section, Step 2: Students use their design sketches and the evidence they collected about the properties of materials to build their toy designs. (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 3: "Have partners use their Feedback Tracker handout to review the feedback they received from their peers and then agree on one or two small changes to improve their toys... Encourage students to put a star next to one or two changes that they will complete first." (Lesson 9, Teacher Guide)

Multi-modal feedback loops

- Lesson 3, Navigate Section, Step 6: "Collect design sketches. Remind students that building toys will take some time and we are using our engineering notebooks to keep track of our process. Ask students to add their updated design sketch to their engineering notebooks. Tell students that you are excited to look over all of the great ways they plan to use the materials to build their toy. Use Lesson 3 Instructional Guidance to provide students with written feedback for them to use in lesson 4 and 6. In the next lesson consider taking time during the Explore, when students are building, to conference with students who need additional support." (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 2: "Review feedback on our design sketches. Emphasize how excited you are to see the toys get built. Tell students that you wrote some feedback on their designs for them to consider before they build. Give students 1-2 minutes to review the feedback then ask students to consider how they might use the feedback when they are building today." (Lesson 4, Teacher Guide)
- Lesson 9, Explore Section, Step 2: "Test toy design solutions with another pair. Have student pairs partner up with their toy and engineering notebooks or the following handouts: Material Investigation and Toy Design Sketch handout. Have each group of pairs choose a Pair A and Pair B to present their toy design solutions to each other. Pass out a Peer Feedback Discussion Prompts table tent to each set of pairs and read through the discussion prompts for both giving feedback and receiving feedback. Show how pairs can use the Peer Feedback Discussion Prompts table tent to help them with sentence starters to use when sharing their feedback with the other pair." (Lesson 9, Teacher Guide)
- Lesson 9, Explore Section, Step 2: "Set up the purpose for revising our designs. Suggest to students that it is important to use the feedback they received from their peers to revise and retest their designs. Ask students the following prompts. How can we use the feedback we receive from our peers? We can use their ideas to revise our toy design solutions. Change our toys. Make our toys better. Fix the toys. How can we decide with our partner what changes to make to our design? We can talk with our partner and agree on the changes we want to make. Once you revise your toy design solutions, how will you know if the toy is ready to share with kindergartners? We can test our toys to see if they work better. We can test our toys again. We can try our toys." (Lesson 9, 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