EQuIP Rubric for Science

Trait Variations:

Why do animals look and act the way they do?

Curriculum Developer: OpenSciEd

GRADE 3 | JULY 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
ADEQUATE	EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE

Score Category I: 2

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	ADEQUATE	EXTENSIVE	ADEQUATE

Score Category II: 3

Category III Rating

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

Score Category III: 3

UNIT 3.3

Sum Categories	**8**
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:

- **Integrating the Three Dimensions.** The unit materials demonstrate clear evidence of students using grade-appropriate elements of the three dimensions together throughout the learning process in service of explaining a phenomenon.
- **Student Ideas.** This unit offers several opportunities for students to express, clarify, justify, interpret, and represent their ideas. The materials also provide opportunities for students to provide peer feedback and to receive and reflect on feedback related to their thinking and reasoning.

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.

- **Scaffolded Differentiation Over Time.** The unit materials do not have a consistent change in the level of independence in student use of the elements of the unit focal SEPs. The materials could be strengthened with such guidance and with teacher support to help all students explicitly build an understanding and proficiency in specific elements of the SEPs over the course of the unit.
- **Opportunity to Learn.** The materials provide students with multiple opportunities to evaluate and adapt their thinking; however, there are few opportunities for students to apply feedback related to targeted learning objectives from one assessment to improve performance on the next assessment. The materials could be strengthened by incorporating opportunities that provide explicit feedback to students, enabling them to grow in proficiency toward the targeted learning objectives.

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

ADEQUATE

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 **adequate** evidence that making sense of phenomena drives student learning. Materials are organized so that students are figuring out the central phenomenon of newborn puppies looking and acting differently from adult dogs. Student questions and prior experiences related to the phenomenon or problem adequately motivate sensemaking and/or problem solving. However, sometimes the materials have inconsistent student-driven learning. In some lessons, the teacher drives the learning by providing students with questions, then presents the phenomenon as a means to answer the posed question. The introduction of an additional phenomenon to connect Lesson Set 3 to the previous lessons does not follow a logical progression from the students' point of view.

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

- Lesson 1, Synthesize, Step 7: "Remind students of all the things they have done so far to investigate this phenomenon, such observing similarities and differences in newborn puppies and adults and trying to match them up to each other, as well as explaining why they start out more similar as newborns but end up different kinds of dogs. Display slide X and share that now they will ask questions they want to investigate to understand this phenomenon better. Explain that they are going to share all their questions to create the class' Driving Question Board, which will become their mission to answer as they investigate the phenomenon further. Push students for questions that can be investigated and prepare for brainstorming ideas for investigation by asking, How could we figure that out in our classroom? What other information could we use to help us answer that?" (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 7: Make the lesson question explicit. Work together to add the lesson question to the "Our Questions" column of the chart using the wording your class used; this is something like: What is happening between being a newborn and being an adult? Ask students if they have questions similar to this one on the DQB. If so, move those sticky note questions over to the Our Growing Ideas chart just below the lesson question. (Lesson 2, Teacher Guide)
- Lesson 3, Connect, Step 5: "Display slide L. Remind students that back in Lesson 1, we shared examples of animals that were special to us, other than canines. Read the questions from the slide, and then ask students to discuss them with a partner. After a few minutes, ask students to share their ideas with the class. Transition to deciding where we should go next. Point out that we have lots of great questions about how our special animals grow and develop, but we also have additional questions so we need to figure out where to go next." (Lesson 3, Teacher Guide)
- Lesson 4, Navigate, Step 1: Students follow up on their research on special animals as they wonder if all species have a similar life cycle: "Remind students that they spent some time looking at animals in their community. Have a few students, maybe 2-3, share what they wrote about their animals from last time when they filled out Sharing Community Examples-Lifecycles. Ask students to share their initial thinking about whether other animals

may also share the same life cycle stages (newborn, young adults, adult, and senior) and changes (birth, growth & development, reproduction, aging, and dying) as canines, even though the animals may be very different from canines. Ideas to look and listen for: They would all be the same because they are all animals. It depends on the type of animal if it would be similar to canines. They would not be the same - canines are mammals, but spiders are insects. Elevate areas of disagreement or uncertainty and remind students that disagreements and uncertainty are clues that we, as scientists, need to find out more information. Use this moment to co-construct something similar to the lesson question with students, How do other animals change over their lifetime?, to guide our investigations in this lesson." (Lesson 4, Teacher Guide)

- Lesson 5, Navigate, Step 5: "Navigate to the next lesson. Remind students that we've already learned a lot about how puppies look and also a lot about how puppies act in our previous lessons. We've figured out that the way a puppy looks is based on traits they get from their parents. Do you have any other questions about how puppies look or act?? If students want to know whether puppies' behaviors are traits that they get from their parents, tell them that will be an interesting way to go in the next lesson, then Show slide T.If students do not come up with a similar question to this, show slide T and ask the class to consider if behaviors are traits that can be passed from parent to offspring? Facilitate a brief discussion to spark curiosity and motivate the need to explore behaviors in the next lesson." (Lesson 5, Teacher Guide)
- Lesson 8, Explore, Step 5: "Observe coyotes. Display slide I and ask students to describe some of the traits they notice in the coyote. Ask if they think all coyotes look the same. What might be some variations in their traits? Listen for students to describe traits related to the color, shape, fur, ears, tail, legs, and/or hunting abilities of the coyote. Display slide J and explain that you have some images of coyotes from around the United States for students to observe. Distribute a set of Coyote Images to groups of 4 students and ask them to observe the images and talk about what they notice and wonder about the trait variations between the different coyotes." (Lesson 8, Teacher Guide) In this lesson, students investigate the phenomenon of physical variations in coyotes, as they wonder whether physical traits in wild canids work the same as those in domesticated dogs.
- Lesson 9, Connect, Step 2: "When finished reading and discussing the first page of the article, summarize what you learned about wolves living in Yellowstone National Park. Students will likely have a ton of questions about wolves. Acknowledge their questions but remind students that since we wanted to figure out why wild canines look and act the way they do, we will make observations about wolves living in the park in order to help us understand wild canines." (Lesson 9, Teacher Guide) Students investigate the phenomenon of wolf fur color and virus resistance as a lens to understand how traits can affect survival.
- Lesson 10, Connect, Step 2: "While students work, circulate among the groups to provide guidance as needed. Use prompts that will help students start thinking of their specific animal and how the ideas we figured out might explain a new thing we noticed about our animal: You said your animal does _____. That seems [similar/different] from canines. Do you see an idea we figured out about canines that might explain this? How similar or different is _____ from canines? How would you make a slight change to our idea about canines to fit what you are noticing about your animal?" (Lesson 10, Teacher Guide) Students read about the phenomenon of different animal babies acting like their parents, to expand their model of inheritance to other species.
- Lesson 11, Synthesize, Step 3: "Add to the DQB. Display slide T and provide think time for students to think about questions they want to add to the DQB. Students can work on their own or with a partner to generate questions. Keep the "Notice and Wonder" chart and the "Comparing Our Models" chart visible for students. Also, remind students to look back at their initial models to help think about questions. Write each question on a separate sticky note and add them to the DQB." (Lesson 11, Teacher Guide)

The materials have some inconsistent student-driven learning over time. Student-created questions are referenced throughout the unit. The Our Growing Ideas chart is used frequently throughout the unit to help the class keep track of their new learnings and for the teacher to guide the students in organizing their thoughts. However, in some lessons, students are not the primary drivers of learning; rather, a question is posed by the teacher, and a phenomenon is introduced afterwards as a means for students to find an answer to the teacher's question.

- Lesson 2, Synthesize, Step 7 Teaching Tip: "Most lessons in this unit include time to update Our Growing Ideas chart, but not every lesson. Third grade is the transition year from every-lesson use of Our Growing Ideas chart in grades K-2 to fourth grade, where students will independently record their thinking on My Growing Ideas charts, which also may not occur in every lesson. If your students would benefit from updating Our Growing Ideas chart in every lesson of this unit, feel free to make time for that. Alternatively, you might decide to make updates less frequently if that better supports your students' needs." (Teacher Guide, Lesson 2)
- Lesson 3, Navigate, Step 1: "Motivate the need for investigating canines' lives more closely. Point to the arrows on the slide between 'newborn' and 'adult' and connect to questions from the [DQB] related to the growth and development of all canines. Using students' questions, co-establish that today we want to figure out something like what adult canines do that puppies cannot do (and why)?" (Lesson 3, Teacher Guide)
- Lesson 3, Explore, Step 2 Broadening Access: "Create a motivating learning context by drawing upon students' ideas for investigations, which likely includes finding out more information about the canines they explored in Lessons 1 and 2 or their special animals. Your students may be curious about how long the canines live, how much they grow, what they eat, and why they change fur color. This lesson will allow them to gather information that will help answer their questions." (Lesson 3, Teacher Guide) Students co-construct a life cycle model as they investigate similarities and differences between domesticated and wild canids.
- Lesson 4, Synthesize, Step 4: "Update Our Growing Ideas chart. Gather students in a scientist circle. Place Our Growing Ideas chart next to the revised An Animal's Life model and Our Animal Life Stages chart. Add the lesson question to the "Our Questions" column of the chart: Record ideas we figure out through a Consensus Discussion. Use the prompts on the slide J and below to elicit student ideas that synthesize what we have figured out about the stages of life experienced by all animals. Wait to record student ideas onto the chart until multiple students have responded to a prompt so that you can synthesize an idea. As students share ideas, ask the class if we are all in agreement before you synthesize ideas on the Our Growing Ideas chart. If you synthesize student ideas by paraphrasing, check back with students who shared to confirm that you captured what they meant." (Lesson 4, Teacher Guide)
- Lesson 7, Synthesize, Step 5: "Update the class model and Our Growing Ideas chart. Celebrate that we figured out some new ideas. Display the class' Consensus Model (see slide L) near the class' Our Growing Ideas chart (see slide M).Point to the part of the model where the class concluded that the way a dog looks and acts changes as it develops and helps the dog do a job. Ask students what we should add to our Consensus Model so it includes how learning affects the way a dog looks and acts. Give students time to think or partner talk, then elicit suggestions for updating the model." (Lesson 7, Teacher Guide)
- Lesson 8, Synthesize, Step 4: "Celebrate all the ideas we've figured out about domesticated dogs, and use the prompts below to transition to investigating wild canines: Do wild canines have jobs too? What jobs would wild canines have? Do they have trait variations that help them do the jobs that domestic dogs do? Point out any questions students have on the DQB about how wild canines survive and suggest that we explore how their traits might help them do the job of surviving. (Lesson 8, Teacher Guide) After the teacher has instructed the students to consider if wild canines have jobs, the teacher then introduces the phenomenon of trait variations in coyotes.

- Lesson 9, Navigate, Step 1: "Remind ourselves of our new questions. Display slide A. Point to the [DQB] and ask students to take turns sharing their new questions with the class, such as: Can wild canines learn? How do they learn? Are wild canines mostly the same? What similarities and differences do we see in wild canines? How do wild canines get their behaviors? Do they inherit some behaviors from their parents? Why do wild canines behave the way they do? What are the jobs a wild canine must do? Identify next steps. Display slide B. Remind students that since we have questions about traits in wild canines, we will need to gather more information. Lead a brief whole class discussion to support students in suggesting finding out more through additional research." (Lesson 9, Teacher Guide)
- Lesson 10, Connect, Step 2: "Add information to the class Our Growing Ideas chart. Display slide G. Remind students that one way scientists share information is by combining what they've learned. Because each small group researched different animals, we will all add our information to our class chart to organize and combine the information. Show students how to add their animal to the class's Our Growing Ideas chart using sticky notes with their animal name written on them. Remind them they did a similar sharing using sticky notes in Lesson 4." (Lesson 10, Teacher Guide)
- Lesson 10, Navigate, Step 5: "Generate a sense of puzzlement for students. Display slide M. Remark about how, even with all the animals they have investigated, dogs seem to be uniquely connected to humans. At the very beginning of Lesson 1, students may have shared stories about their pet dogs, and you can connect back to these. If not, connect to previous discussions in Lessons 6, 7, and 8 focused on dogs' unique roles in the lives of people, helping with specific jobs. Ask students how long ago they think humans and dogs developed this special relationship. Give students a moment to turn and talk about when and how dogs and people began working together. As needed, support students to recognize that we are not talking about the time it takes to train a dog, but for how long we think humans and dogs have worked together throughout history. [Teacher] Prompts to use: When and how do we think people and dogs began working together? (Lesson 10, Teacher Guide)
- Lesson 11, Synthesize, Step 3: "Develop an individual initial model. Display slide R. Tell students that they will individually create a model that answers the question, How have people and dogs been working together over time? Distribute Dogs Working With People Through History to each student. Read the directions from the slide or the more detailed instructions on the handout. For the first step, students choose a point on the timeline from "Long Ago" that they will compare to "Today", which represents everything students know about how people work with dogs from previous lessons. For the second step, students create a model to describe how people and dogs worked together today and long ago. Encourage students to use a combination of drawings, symbols, words, and numbers as part of their model" (Lesson 11, Teacher Guide). The task that students complete is not related to explaining a phenomenon. Rather, students are asked to compare and contrast information from a timeline that has been provided, showing dogs and people at various times in history. Students are describing the given information, not explaining or predicting a phenomenon.

Multiple phenomena are used, and they coherently build on each other most of the time.

- Lesson Sets 1 and 2 (Lessons 1-10) involve a logical progression around the anchor phenomenon from Lesson Set 1: newborn dogs looking and acting differently than adults. The Lesson Set 2 lesson-level phenomena encompass physical traits, innate behavioral traits, and learned behaviors in both domestic and wild species, which are clearly connected to each other in a logical way from the students' perspective.
- Lesson Set 3 (Lessons 11-14) does not relate, from the student's perspective, to the earlier anchor phenomenon of individual animals changing over their lifespans. The Lesson Set 3 anchor phenomenon is "How long have people and dogs been working together?" Students do not experience an explicit need to find an answer to that question. The focus shifts from the present to historical relationships between people and dogs. This shift is then followed by students' use of fossils to infer what past habitats were like. Prior to this lesson set, students have only discussed how animals change throughout their lives; they have not discussed the possibility that when an animal dies, it could potentially become a fossil. This lesson set's re-anchor phenomena do not clearly connect from the students' perspective.

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

- The anchoring phenomenon connects to three-dimensional learning goals. The goals relate to the lesson/level phenomenon in that lesson, and even when these goals do not directly mention the anchoring phenomenon, they still serve to help students make sense of the lesson-level phenomenon presented. For example
- Lesson 2 Learning Goal: "**Use a model describing evidence of similarities and differences between wolf and dog puppies to explain the ways puppies change to become more like adults."**
  - Lesson 2, Synthesize, Step 5:" Annotate puppy development differences with sticky dots. Display slide J. Explain that comparing these timelines more carefully can help us figure out more about the changes that happen as puppies become adults. Point out that we already noticed similarities, so we also want to notice differences. Provide each student with a colored sticky dot and invite them to stick it on the chart where they see a difference between how the 2 puppies develop. These differences might be in what they do (e.g., eat food their parent hunts for or eat food provided by a human) or in their rates of development (both begin eating solid food but in different weeks of life)." (Lesson 2, Teacher Guide)
- Lesson 4 Learning Goal: "**Develop a model to describe that while animals have unique and diverse life cycles, they all follow the same pattern**."
  - Lesson 4, Explore, Step 2: "Distribute a copy of the An Animal's Life Notes handout to each student, help students orient to the website Animal Changes Over Time Website. Review the steps of the handout and ask students if they have any questions. Although each student will record notes on their own handout, give them the opportunity to work with a partner or small group while reading about the same animal on the website, if helpful. Remind students of the question we are investigating: What are the changes that happen to other newborn animals as they become adults? Ask them to consider strategies they can use to read the new infographics." (Lesson 4, Teacher Guide)
- Lesson 5 Learning Goal: "**Analyze and interpret data to provide evidence that related dogs inherit similar patterns of traits from their parents."**
  - Lesson 5, Explore, Step 2: "Analyze co-constructed Traits of Parents and Puppies posters to establish a baseline expectation. Show slide L and as a class discuss any observed patterns in the Traits of Parents and Puppies posters. Encourage students to stand up and point to places on the poster they are describing." (Lesson 5, Teacher Guide)
- Lesson 9 Learning Goal: "**Use observations and patterns as evidence to support an explanation that variations in wolf traits can result in an advantage to survival."**
  - Lesson 9, Explore, Step 3: "Make observations about wolf traits using data cards. Display slide E. Introduce the Wolf Cards as a tool that we can use to help us figure out some information about the traits of wild canines. Preview with students what kinds of information they will find in these new texts. Divide students into groups of __#__ students. Distribute a set of cards to each group. Each set contains 6 cards. Remind students of the question we are investigating: *What causes wild canines to look and act the way they do?* Ask them to use the cards to discuss answers to the prompts on the slide. While students discuss traits on the wolf cards, circulate among the groups to provide guidance as needed." (Lesson 9, Teacher Guide)

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

- N/A, engineering is not a learning focus of this unit.

Criterion-Based Suggestions for Improvement:

- Ensure "[s]tudent questions or prior experiences related to the phenomena and problems consistently create *an explicit need*, from the students' perspective, for the students to engage in learning throughout the materials." [Detailed Guidance, p. 7]
  - In Lessons 8 and 12, consider using phenomena to generate student questions, rather than having the teacher pose a question that a phenomenon can answer.
- Ensure "[p]henomena and/or problems are clearly connected to each other in a logical way from the students' perspective and build on each other coherently." [Detailed Guidance, p. 7]
  - Consider strengthening the connection between Lesson Sets 1–2 and Lesson Set 3 from the students' perspective. Currently, the phenomena are not logically connected from the students' perspective.

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 provide students with opportunities to build an understanding of grade-appropriate elements across the three dimensions, as students regularly engage with elements of all three dimensions to make sense of the anchoring or lesson-level phenomenon. The unit centers on students using targeted elements of all three dimensions that are clearly identified and addressed throughout the unit to explain why newborn puppies look and act differently from adult dogs.

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. These SEPs are claimed to have been intentionally developed: AQDP (Asking Questions and Defining Problems), MOD (Developing and Using Models), DATA (Analyzing and Interpreting Data), and CEDS (Constructing Explanations and Designing Solutions). These SEPs are claimed as opportunities to practice: MATH—Using Mathematics and Computational Thinking, and INFO—Obtaining, Evaluating, and Communicating Information.

AQDP: Asking Questions and Defining Problems

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

This SEP is identified as an opportunity to practice in the Unit Front Matter. The Matrix claims the element of AQDP E3 in Lessons 1, 11, and 14. Evidence was found in all claimed lessons, examples include:

- Lesson 1, Explore, Step 2: "Have students turn and talk with a partner about wonderings. Record these on the Notice and Wonder chart; they will be useful for supporting students to generate questions later when your class builds the [DQB]." Synthesize, Step 7: "Explain that they are going to share all their questions to create the class' [DQB], which will become their mission to answer as they investigate the phenomenon further. Push students for questions that can be investigated and prepare for brainstorming ideas for investigation by asking, How could we figure that out in our classroom? What other information could we use to help us answer that?" Teaching Tip Callout: "Your students have asked questions about phenomena in prior units, which you can leverage now. In this moment, however, focus students on asking questions based on the patterns they noticed as they explored newborn and adult canines." (Lesson 1, Teacher Guide)
- Lesson 11, Synthesize, Step 3: "Add to the (DQB). Display slide T and provide think time for students to think about questions they want to add to the DQB. Students can work on their own or with a partner to generate questions. Keep the "Notice and Wonder" chart and the "Comparing Our Models" chart visible for students. Also, remind students to look back at their initial models to help think about questions. Write each question on a separate sticky note and add them to the DQB." (Lesson 11, Teacher Guide)
- Lesson 14, Synthesize, Asking Questions and Defining Problems Callout: "Revisiting the DQB at the end of the unit helps students see the progress they have made toward answering questions that are important to them at the onset of the unit. Students were tasked with asking questions "that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships". Through the investigations in the unit and individual and whole-group sensemaking, they can now answer many of the questions. This final visit to the DQB also allows students to see how their hard work toward a shared learning goal helps them figure out the phenomena in the unit, and explain a lot of other phenomena in the world." (Lesson 14, Teacher Guide)

MOD: Developing and Using Models

Claimed Element: **MOD-E1 Identify limitations of models.**

This SEP is identified as intentionally developed in the Unit Front Matter. The Matrix claims the element of MOD-E1 in Lessons 3, 4, and 10. Evidence was found in all claimed lessons; examples include:

- Lesson 3, Synthesize, Step 4: "Discuss the limitations of models. Facilitate a class discussion to reflect on modeling to help students understand that one model may be useful for some purposes (uncovering the similarities in canine life cycles), but may not useful for other purposes (noticing the differences between different canines). Remind students that we compared our individual models to help us see what all the canines had in common, in order to create a consensus model. Ask students if we can use our consensus model to describe the differences between canines. When students struggle with this, point out that our consensus model only shows the similarities, but that our infographics and our diagrams also tell us about the differences (such as "how big the canine grows" or "how long each canine lives"). Explain that if we want to know more about the differences between different kinds of canines, then we may need a different model." (Lesson 3, Teacher Guide)
- Lesson 4, Navigate, Step 6: "When we made our consensus model to describe all our canines, what limitations did we see with it? It didn't show things about each dog. It only showed the big things across the dogs and not the special things about them. It only explained canines' life cycles and not other animals'" (Lesson 4, Teacher Guide)
- Lesson 10, Synthesize, Step 3: "Remember that sometimes scientists find that their models work to help explain some phenomena/ideas/patterns, but not all. Models have limitations. We've found all these patterns that are similar across many different animals, and we have those similarities in our models. But what does our model not help us explain?" (Lesson 10, Teacher Guide)

Claimed Element: **MOD-E4 Develop and/or use models to describe and/or predict phenomena**

This SEP is claimed as intentionally developed in the Unit Front Matter. The Matrix claims the element of MOD-E4 in Lessons 1, 2, 3, 4, 6, 10, 11, 13, and 14. Evidence was found in all claimed lessons, examples include

- Lesson 1, Synthesize, Step 3: "Develop an individual initial model. Use slide I to review what modeling is if your students are unfamiliar with this practice. Display slide J and distribute the Initial Model handout and read the directions and prompts aloud. Give students time to explain how the newborns and adults they observed look and behave differently. Remind students that "how" questions ask for the ways something happens, so they should describe details about the ways newborns and adults are different. If they have ideas about reasons why that happens, they can explain those, too" (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Developing and Using Models Callout: "In this lesson, the teacher facilitates developing an initial model to gather and visualize the ideas students have figured out so far. When the class uses their model to try to explain why a newborn canine becomes an adult that looks and acts the way it does, they elevate gaps that still need to be investigated to fully explain that question. In Lesson 3, students will dig deeper into the practice of modeling by reading a book and working in small groups to revise the model the class begins here." (Lesson 2, Teacher Guide)
- Lesson 3, Synthesize, Step 4: "Add to the class consensus model from Lesson 2. Display the consensus model from Lesson 2. Continue the work from lesson 2 by drawing the four life stages (white boxes). Once consensus is reached for the names of the life stages, record those terms on the model. Repeat this process by then comparing what happens between stages (green boxes) across the canine types. For example, focus on what each group included between the Newborn and Young Adult stages across all canine types. Again, highlight words or ideas that seem similar between each stage. The final life process, *Aging and Dying*, can be used as an example since all models end

with this life process. Remind students that we also have a new term, development, that may help describe some of the changes we notice between stages. Add this term to the Word Wall." (Lesson 3, Teacher Guide)

- Lesson 4, Synthesize, Step 3: "Work with students to annotate class consensus model with similarities (e.g., the main life stages and processes are similar across organisms) and to note differences (e.g., lifespan, way they are born, etc.). Use check marks to note similarities and cross off/edit parts of the model to note differences. Once annotated, ask students whether this model still only represents canines. Listen for students to suggest that it now represents more animals. Suggest that maybe our consensus model now represents all animals' life cycles." (Lesson 4, Teacher Guide)
- Lesson 6, Synthesize, Step 6: "After students have surfaced their ideas and agreed on ideas they have evidence to support, say something like, It sounds like we are saying that animals don't just inherit the information for the way that they look - their physical traits - but can also inherit information for the way that they act - their instinctive behaviors. Revise the Class Consensus Model to reflect what we have figured out about instincts." (Lesson 6, Teacher Guide)
- Lesson 10, Synthesize, Step 3: "Update our model to include other animals. Have students turn and talk with a partner to consider how we should revise our model, then elicit suggestions from students for how we might update the Class Consensus Model to show that many of the new ideas we figured out explain more than dogs or canines. Listen for students to suggest places where "dogs" or "canines" appear, we could change to "animals" or "many kinds of animals". Make sure the class is in agreement before revising the model. Consider inviting a student to revise the model following the suggestions agreed upon by the class." (Lesson 10, Teacher Guide)
- Lesson 11, Synthesize, Step 3: "Develop an individual initial model. Display slide R. Tell students that they will individually create a model that answers the question, How have people and dogs been working together over time? Distribute Dogs Working With People Through History to each student. Read the directions from the slide or the more detailed instructions on the handout. For the first step, students choose a point on the timeline from "Long Ago" that they will compare to "Today", which represents everything students know about how people work with dogs from previous lessons. For the second step, students create a model to describe how people and dogs worked together today and long ago. Encourage students to use a combination of drawings, symbols, words, and numbers as part of their model" (Lesson 11, Teacher Guide).
- Lesson 13, Synthesize, Step 5: "Revise our Animal Life Cycle model through a Consensus Discussion. Use the first prompt on the slide to elicit student ideas to explain which parts of the life cycle might have been disrupted if the wooly mammoth and wooly rhinoceros are no longer alive today. After students share a few ideas, ask how we can revise our model to explain why some animals are no longer found today." (Lesson 13, Teacher Guide)
- Lesson 14, Navigate, Step 1: "Revisit the class' Animal Life Cycle model. Have the model prominently displayed. Remind students that artists can make these kinds of illustrations based on evidence we have collected from long ago, including fossils. Remind them of the fossil evidence they explored across Lessons 12 and 13 and then pose the question on the slide." (Lesson 14, Teacher Guide)

Claimed Element: MOD-E6 Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.

This SEP is claimed as intentionally developed in the Unit Front Matter. The Matrix claims the element of MOD-E6 in Lessons 7 and 9. Partial evidence was found in all claimed lessons, examples include

- Lesson 7, Synthesize, Step 5: "Update the class model and Our Growing Ideas chart. Celebrate that we figured out some new ideas. Display the class' Consensus Model (see slide L) near the class' Our Growing Ideas chart. Point to the part of the model where the class concluded that the way a dog looks and acts changes as it develops and helps the dog do a job. Ask students what we should add to our Consensus Model so it includes how learning affects the

way a dog looks and acts. Give students time to think or partner talk, then elicit suggestions for updating the model." (Lesson 7, Teacher Guide) While students are adding information about cause and effect to their models after discussing it in argument form, they do not use the model to test the relationship.

- Lesson 9, Explore, Step 4: "Add possible cause-effect relationship. Some students may recognize the role of the environment in determining which trait variation will be more important at any moment in time, i.e., black fur will be more advantageous during times of disease outbreak, but not during times without outbreak. Layer on this cause and effect thinking to the chart." (Lesson 9, Teacher Guide) The teacher adds a cause-and-effect relationship to the class consensus model. Students do not use the model to test any cause-and-effect relationships.

DATA: Analyzing and Interpreting Data

Claimed Element: DATA-E1 Represent data in tables and/or various graphical displays (bar graphs, pictographs, and/or pie charts) to reveal patterns that indicate relationships.

This SEP is claimed as intentionally developed in the Unit Front Matter. The Matrix claims the element of DATA-E1 in Lessons 5, 6, 9, 11, 12, and 13. Evidence was found in lessons 5, 6, 9, 11, and 12. Examples include

- Lesson 5, Explore, Step 2: "Invite students to co-construct the bar graphs based on their observations of the Parent and Puppy Trait Cards. Ask students to identify different features of the graphs to draw their attention to the labels and how they can aid in graphing the data. As students share what they notice, begin filling in the bar graph on the class chart to represent the data. After modeling how to fill in the graph, prompt students to use their prior bar graph experiences in math class to complete the bar graphs and make interpretations about the data. Use the following questions to guide their reasoning." (Lesson 5, Teacher Guide)
- Lesson 6, Explore, Step 2: "Make observations of the Labrador puppies' retrieving. Display slide F. Distribute the Behavior Data Table handout to each student and explain that we are going to make observations of puppies retrieving. The handout is a data table that we will use to keep track of our observations and includes the behaviors we noticed in our first video, along with a few others that we will observe. Briefly, as a class, come to a consensus for how we will describe the behavior of each puppy we observe (check mark or "X" in the box). Then introduce the Labrador Puppies Retrieving Test video on slide G by sharing with students that, when puppies are about seven weeks old, people test to see how they behave in different situations." (Lesson 6, Teacher Guide)
- Lesson 9, Explore, Step 4: "Illustrate data on strips. Display slide N. Explain that we will work together as a group to build a special kind of graph called a scaled pictograph. Divide students into small groups to have 8 groups total and pass out one copy of Wolf Data Sheet to each student. Assign each student in a group a year. Each student should complete two data strips for their year, one for each fur color. Show students where to get the materials needed for cutting and coloring their data strips. Point out the importance of talking as a group and coming to an agreement before coloring and cutting the data strip. Allow time for students to complete their data strips and then complete the group graph. Circulate between groups to offer guidance as necessary. As groups finish, ask them to add their data strip to the appropriate location on the group graph. Circulate as the groups complete this task to ensure that the groups accurately identify where to add their data strip." (Lesson 9, Teacher Guide)
- Lesson 11, Explore, Step 2: "Create a longer timeline. Use Guidance for Constructing the Timeline as a pictorial guide to building the timeline. Have students gather in a Scientists Circle with significant floor space in the middle. Orient students to the scale of the next timeline representation by showing them one unifix cube and telling them it represents 100 years, or most of the time on Timeline for People and Dogs." (Lesson 11, Teacher Guide)

- Lesson 12, Explore, Step 3: "Organize data to visualize the differences in how long dogs and humans have been on Earth. Organize students into pairs to complete their timelines. Show slide F. On Dog-Human Fossil Timelines students will find separate timelines for dogs and humans. Read the instructions together and direct student pairs to mark points along the timelines for where they have fossil evidence for humans and dogs. Once they mark these points, students can use colored pencils to shade in the length of time that we have evidence for the presence of dogs and humans. Analyze and interpret data in table groups. Once students have had enough time to construct their Fossil Timelines, show slide G and have table groups analyze and interpret the fossil data by discussing the slide prompts." (Lesson 12, Teacher Guide)
- Lesson 13, Explore, Step 3: "Add fossils to the timeline. Transition the discussion to talking about when these animals lived. Point to the Fossil Timeline which has the fossil evidence for humans and dogs. Ask 1-2 students to remind the class what we figured out from our last investigation. Listen for students to share that we have fossil and other evidence for humans from 315,000 years ago to today and we have fossil and other evidence for dogs from 14,000 - 33,500 years ago to today. Add to the Fossil Timeline chart by co-constructing additional timelines for the wooly mammoth similar to how you did this before for humans and dogs. First, invite students to identify how long ago or how many units correspond to each piece of evidence we have for the wooly mammoth. Mark the appropriate places on the timeline, then color in the interval to represent the time period that we have evidence that the wooly mammoth lived on Earth." (Lesson 13, Teacher Guide)

Claimed Element: DATA-E2- Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.

This SEP is claimed as intentionally developed in the Unit Front Matter. The Matrix claims the element of DATA-E2 in Lessons 5, 6, 10, 11, 12, 13, and 14. Evidence was found in lessons 5, 6, 10, and 14. Partial evidence found in lessons 11, 12, and 13, examples include

- Lesson 5, Explore, Step 3: "Analyze the Trait Data for the Poodle/Labrador puppies. Show slide N and distribute Labrador and Poodle Puppy Data. Explain to students that while you don't have pictures of the offspring of the brown Lab and the brown Poodle, you do have data they can use to figure out what they would look like. Direct students to work in small groups to analyze the Traits of Parents and Puppies of a Mixed Breed graph, using the three prompts to guide their analysis. As you circulate, listen and record student thinking in the Following Student Sensemaking (Lessons 5-9)." (Lesson 5, Teacher Guide)
- Lesson 6, Synthesize, Step 6: "Point to the Timeline of Needs and Changes charts and use the first and second prompts on the slide to ask students to recall how we observed the puppies acting when they were born and how their behaviors have changed. When students share their thinking that the puppies behave similarly to their parents, ask students to clarify why. This will support students to differentiate between instinctive behaviors that the puppies inherited and learned behaviors that we will investigate in the next lesson." (Lesson 6, Teacher Guide)
- Lesson 10, Connect, Analyzing and Interpreting Data Callout: "Students analyze new data in the form of pictures of parents and offspring of animals. They use this new data to help them make sense of how offspring of other types of animals look similar to, but also different from parents and siblings. Students also get additional information through text to help them understand the purpose of different physical traits they observe in the photos." (Lesson 10, Teacher Guide)
- Lesson 11 students analyze data by comparing and contrasting modern and ancient images. Lesson 11 Handout 2 Dogs Working With People: "Step 1: Choose a 'Long Ago' time that you will compare to 'Today'. Write the time you chose here: _____. Step 2: Create a model to describe the ways people and dogs have been working together today and long ago. You may use drawings, symbols, and words in your model. Include as many ways as you can for both parts

of your model." (Lesson 11, Student Handout) Students use the analysis to support a claim (about whether humans and dogs have worked together for a long time) rather than to explain a phenomenon.

- Lesson 12 students analyze data from a timeline. Synthesize, Step 4: "Have a discussion where the class analyzes and interprets the Fossil Timeline together." (Lesson 12, Teacher Guide) The purpose of the analysis and discussion is to answer a factual question (how long have people and dogs worked together?) rather than to try to explain a phenomenon.
- Lesson 13 students analyze data from a timeline about wooly mammoths. Students use the analysis to answer a factual question rather than to explain a phenomenon. Explore, Step 2: Analyzing and Interpreting Data Callout 1: "During the class discussion students analyze and interpret fossil evidence to determine when wooly mammoths lived on Earth." (Lesson 13, Teacher Guide)
- Lesson 14, Connect, Analyzing and Interpreting Data Callout: "Students will interpret fossil data and use logical reasoning to draw conclusions about what a place was likely like long ago. This involves students making observations of physical traits they notice in fossils, and also using their knowledge of similar kinds of animals alive today and the environments where they live. This interpretation of fossils and use of knowledge combine to help students explain what a place might have been like long ago. At this moment you interpret the data and use logical reasoning together as a class." (Lesson 14, Teacher Edition)

CEDS: Constructing Explanations and Designing Solutions

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

This SEP is claimed as intentionally developed in the Unit Front Matter. The Matrix claims the element of CEDS-E2 in Lessons 1, 2, 6, 7, 8, 9, and 10. Evidence was found in all claimed lessons, examples include

- Lesson 1, Synthesize, Step 6: "Share the explanation template. Share with students that they will develop an initial explanation about what is happening to explain how and why dogs look and act the way they do. Display slide T. You can allow for students to choose their own dog for the explanation or you can assign them to pair groups to make sure that each dog is represented. Pass out 1 copy of Initial Explanation for Changes in Dogs to each student. Arrange students into partners or small groups of students who chose the same kind of canine. Share that they will create their own explanations, but that they can talk with each other if they need support" (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 5: "Discuss differences and similarities. Use the prompts that follow and guide students to support explanations with evidence of what they saw and heard in the video and text. When commenting on similarities, expect students to point out that both domesticated and wolf puppies need their parents to keep them alive when they are newborn and then start to need their parents less as they get older. When this comes up, co-construct a shared definition of what it means to survive based on what we figured out (e.g., to stay alive by meeting needs for food and safety)" (Lesson 2, Teacher Guide)
- Lesson 6, Synthesize, Step 5: "Construct an explanation about instincts in dogs. Display slide S. Say something like, The expert in the video said that she picked Haven and Elvis as parents for the litter because she wanted puppies who might become service dogs. Use the prompts on the slide and the follow-up responses below to support students in explaining, using evidence why the expert selected Haven and Elvis as parents for the litter. Students may need to rewatch videos during this discussion to consider their evidence, so make the videos available to students as needed." (Lesson 6, Teacher Guide)

- Lesson 7, Synthesize, Step 4: "Introduce constructing an explanation. Display slide J and point out that we are ready to explain the causes of a dog's behavioral traits. Explain to students that first, they'll work with a partner to use the sentence starters on their handout to construct their explanation. Then, we'll come together as a class and notice what pieces are important to have in an explanation so we can create a checklist to help us construct other explanations in the future." (Lesson 7, Teacher Guide)
- Lesson 8, Navigate, Step 5: "Use student noticings and wonderings to facilitate a discussion about coyote size. Display slide L. Say something like, We think the coyotes have variations in their size. What would we measure to know if they are different sizes? Listen for students to suggest measuring their height or weight. Display slide M and discuss the graphs comparing coyote weights in different parts of the United States. Explain that scientists collected data on the weights of many coyotes and noticed that they had similar weights to what is shown in the graphs. Discuss what students notice and wonder about the graphs." (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize, Step 6: "Push students to use multiple sources of evidence from the article, the video and images, and the data to support their ideas as the class works towards an explanation they construct together." (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize, Constructing Explanations and Designing Solutions Callout: "In previous lessons, students have been developing their use of evidence from observations and patterns to construct explanations as a whole class and with small groups and partners. At this moment, students work individually to develop explanations. Refer students to 'What Does an Explanation Need?' chart the class co-constructed in Lesson 7 and used in Lesson 8 as a tool to support them on this task." (Lesson 10, Teacher Guide)

Claimed Element: CEDS-E3 Identify the evidence that supports particular points in an explanation.

This SEP is claimed as intentionally developed in the Unit Front Matter. The Matrix claims the element of CEDS-E3 in Lessons 7, 8, and 9. Evidence was found in all claimed lessons, examples include

- Lesson 7, Synthesize, Step 4: "We also know that Alaskan Malamutes are born with certain information that affects their instincts and natural behaviors, like wanting to run and pull. What evidence do we have that learning to be a sled dog could influence traits? They have to learn to work as a team. They have to learn to wear a harness and not get tangled up. They learn certain words and what to do. What evidence did we see that these are new behaviors they have to learn (and they wouldn't know how to do these things without training? Where did we find that evidence?" (Lesson 7, Teacher Guide)
- Lesson 8, Synthesize, Step 3, Constructing Explanations and Designing Solutions Callout: "An important element of this practice is to use evidence (such as observations or patterns) to construct an explanation. On the Poodle Explanation assessment, students construct an explanation using observations and descriptions for how certain dog traits were intentionally chosen by humans to help various breeds accomplish certain jobs. In this lesson, students will give and receive peer feedback to support the construction of their explanation, and then in Lesson 10 they will have another opportunity to independently construct an explanation about animal trait variations." (Lesson 8, Teacher Guide)
- Lesson 9, Explore, Step 4: "Ask students if there are clues in the article about which fur color might be better for survival and listen for ideas related to the growing number of wolves with black fur relative to the wolves with gray fur. Suggest that we look at some data about the number of wolves with black and gray fur over time." (Lesson 9, Teacher Guide)

MATH: Using Mathematics and Computational Thinking

Claimed Element: MATH-E2 Organize simple data sets to reveal patterns that suggest relationships.

This SEP is claimed as an opportunity to practice in the Unit Front Matter. The Matrix claims the element of MATH-E2 in Lessons 5 and 12. Evidence was found in all claimed lessons, examples include

- Lesson 5, Explore, Step 2: "Consider how to organize our data. Show slide J and bring up the fact that we've seen a lot of different dogs and puppies. Each of these dogs have similar, yet different traits. In our past science or math classes, what are some other ways we've seen big data sets organized? If we were to see whether we could organize this data into a graph or table, what types of information would be helpful to include?" (Lesson 5, Teacher Guide)
- Lesson 12, Synthesize, Step 4: "Add the dogs to the Fossil Timeline. Next, support students in constructing the dog portion of the timeline on top of the human portion, and, importantly, evaluate what the fossil evidence tells us about whether dogs were domesticated or not." (Lesson 12, Teacher Guide)

Claimed Element: MATH-E3 Describe, measure, estimate, and/or graph quantities such as area, volume, weight, and time to address scientific and engineering questions and problems.

This SEP is claimed as an opportunity to practice in the Unit Front Matter. The Matrix claims the element of MATH-E3 in Lesson 11. Evidence was found in all claimed lessons, examples include

- Lesson 11, Explore, Step 2: "Create a longer timeline. Use Guidance for Constructing the Timeline as a pictorial guide to building the timeline. Have students gather in a Scientists Circle with significant floor space in the middle. Orient students to the scale of the next timeline representation by showing them one unifix cube and telling them it represents 100 years, or most of the time on Timeline for People and Dogs. Ask students how many unifix cubes they would need to represent 1000 years. Then hold up the string that has 10 unifix cubes in two alternating colors every 5 cubes strung onto it and choral count by 100 years for each unifix cube to confirm students' ideas that 10 unifix cubes represent 1000 years. Label the leftmost cube on the timeline with the paper tent labeled "1000 years ago." Secure the timeline to the wall, or lay it on the floor in the middle of the scientists circle." (Lesson 11, Teacher Guide)

INFO: Obtaining, Evaluating and Communicating Information

Claimed Element: INFO E1- Read and comprehend grade-appropriate complex texts and/or other reliable media to summarize and obtain scientific and technical ideas and describe how they are supported by evidence.

This SEP is claimed as an opportunity to practice in the Unit Front Matter. The Matrix claims the element of INFO-E1 in Lessons 3, 4, and 8. Evidence was found in all claimed lessons, examples include

- Lesson 3, Explore, Step 2: "During this task, students work in groups to obtain information from research cards to construct a representation of the life stages and processes for their assigned canine. The representation becomes a model that helps students explain how a canine changes during its lifetime." (Lesson 3, Teacher Guide)
- Lesson 4, Explore, Step 2: "Distribute a copy of the An Animal's Life Notes handout to each student, help students orient to the website Animal Changes Over Time Website. Review the steps of the handout and ask students if they have any questions. Although each student will record notes on their own handout, give them the opportunity to work with a partner or small group while reading about the same animal on the website, if helpful. Remind students of the question we are investigating: What are the changes that happen to other newborn animals as they become adults? Ask them to consider strategies they can use to read the new infographics." (Lesson 4, Teacher Guide) While students are summarizing and obtaining scientific ideas, they are not describing how these ideas are supported by evidence.

- Lesson 8, Explore, Step 2: "Arrange students into pairs and distribute a deck of Dog Breed Cards to each pair. Direct students to notice the information provided on the cards and then sort the cards into groups based on some of that information. Invite partnerships to share how they grouped the cards, and encourage the class to show silent hand signals if they also noticed or used that trait or category. As students share, record the traits and variations they describe on a chart titled Variations in Dog Traits. Write the trait word (e.g., size, paws, bite) on the left side of the page and invite students to help you affix the trait variation images from Printable Chart Images to indicate the variations they noticed. When students identify the dog jobs noted on the cards (companion, protection, retriever, working dog), list those in different colors at the top of the chart." (Lesson 8, Teacher Guide)

Claimed Element: INFO E4- Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.

This SEP is claimed as an opportunity to practice in the Unit Front Matter. The Matrix claims the element of INFO-E4 in Lessons 2, 6, 7, and 10. Evidence was found in all claimed lessons, examples include

- Lesson 2, Explore, Step 3: "Watch the Domesticated Canine video as a class (7:30 minutes). Pause the video after each week and use the following prompts to add student observations to the Timeline of Needs and Changes chart (see slide G), including taping relevant images from the Timeline Chart Images reference to the chart when needed. Record both physical characteristics (how they look) and behaviors (how they act). Encourage students to support their ideas with specific evidence of what they saw and heard in the video (e.g., What did you notice from the video that supports your idea? Did anyone else notice the same thing or something different?). Obtain information about wolf puppies compared to domesticated puppies. Display slide H. Introduce the book, A Tale of Two Puppies: The First Eight Weeks of Life, and share with students that this is a non-fiction book about domesticated and wolf puppies during their first 8 weeks of life. Explain to students that one useful strategy for gathering evidence from text is to know the question we are trying to answer before we start reading. Ask students to recall the question we are trying to figure out (some version of What is happening between being a newborn and being an adult?), and emphasize that they have identified our purpose for reading the book. Before reading, direct students to be listening, looking, or otherwise observing for the different ways puppies change over time." (Lesson 2, Teacher Guide)
- Lesson 6, Synthesize, Step 5: "Construct an explanation about instincts in dogs. Display slide S. Say something like, The expert in the video said that she picked Haven and Elvis as parents for the litter because she wanted puppies who might become service dogs. Use the prompts on the slide and the follow-up responses below to support students in explaining, using evidence why the expert selected Haven and Elvis as parents for the litter. Students may need to rewatch videos during this discussion to consider their evidence, so make the videos available to students as needed." (Lesson 6, Teacher Guide)
- Lesson 7, Explore, Step 3: "Watch the first video (guide dog) to make noticings and share initial ideas. Display slide G. Share that this is a video of a guide dog learning its job. Preview the first two questions on the slide, What does the dog need to learn? How does the dog learn new skills? Watch the Dog Learning to be a Guide Dog video together, pausing as needed. Give students a moment to turn and talk about one or two things they noticed the dog needed to learn and how it learned that thing. Watch the second video (sled dog) to make noticings and share initial ideas. Display slide H. Share that this is a video of a sled dog learning its job. Remind students of their questions. Then, watch the Dog Learning to be a Sled Dog video together, pausing as needed. Replay if needed, too. Give students a moment to turn and talk about one thing they noticed the dog needed to learn and how it learned that thing. When ready, reconvene the class to share." (Lesson 7, Teacher Guide)
- Lesson 10, Connect, Step 2: "Preview the text. Have students practice locating their animal in the book and scanning the pages for their section, but not yet reading it. Remind students of the question we are investigating: Why do

animals look and act the way that they do? Ask them to consider strategies they can use to read the text to answer this question, and also use Our Growing Ideas to guide us. Add information to the class Our Growing Ideas chart. Display slide G. Remind students that one way scientists share information is by combining what they've learned. Because each small group researched different animals, we will all add our information to our class chart to organize and combine the information." (Lesson 10, Teacher Guide)

Claimed Element: INFO E5- Communicate scientific and/or technical information orally and/or in written formats, including various forms of media and may include tables, diagrams, and charts.

This SEP is claimed as an opportunity to practice in the Unit Front Matter. The Matrix claims the element of INFO-E5 in Lessons 2 and 4. Evidence was found in all claimed lessons, examples include

- Lesson 2, Synthesize, Step 5: "Explain that comparing these timelines more carefully can help us figure out more about the changes that happen as puppies become adults. Point out that we already noticed similarities, so we also want to notice differences. Provide each student with a colored sticky dot and invite them to stick it on the chart where they see a difference between how the 2 puppies develop. These differences might be in what they do (e.g., eat food their parent hunts for or eat food provided by a human) or in their rates of development (both begin eating solid food but in different weeks of life)." (Lesson 2, Teacher Guide)
- Lesson 4, Explore, Step 2: "Add data to our class chart. Point out the class chart, Our Animal Life Stages. Remind students that one way scientists share information is through data charts. Because each small group researched different animals, we will all add our information to a shared chart to organize and combine the information. Show students how to add their data to the chart by first adding 8 sticky notes with "canine" written on them together. Elicit suggestions from students where we should place the canine sticky notes, and add them to the chart." (Lesson 4, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

Rating for Criterion: DCI **EXTENSIVE**

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

The reviewers found **extensive** evidence that the materials provide opportunities to develop and use specific elements of the DCIs. Students have multiple opportunities to build the following science ideas: LS1.B Growth and Development of Organisms, LS3.A Inheritance of Traits, LS3.B Variation of Traits, LS4.A Evidence of Common Ancestry and Diversity, and LS4.B Natural Selection.

LS1.B Growth and Development of Organisms

Claimed Element: LS1.B-E1 Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. The strikethrough text is included in the 3.3 Lesson Unit Overview but not in the 3.3 Trait Variations SEP-DCI-CCC-ELA-Math Matrix or the Teacher Guides. From the 3.3 Trait Variations Matrix: This unit does not explore life cycles of plants as those are addressed in Unit 3.2: Why do plants only grow well in certain places, and how can we protect them?"

Claimed in Lessons 1, 2, 3, 4, 13, and 14. Evidence was found in claimed lessons 1, 2, 3, 4, 13, and 14.

- Lesson 1, Explore, Step 2: "Facilitate a brief sharing and push students to articulate what feature or characteristic they used to help them match up the newborns and to adults. In doing so, a key move to make in this discussion is to work toward the idea that the newborns, while born looking somewhat different from each other, were more similar and harder to distinguish from each other compared to the adults who looked very different from each other and that the newborns did not start 'looking like themselves' until they were a little older." (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 5: "Explain that comparing these timelines more carefully can help us figure out more about the changes that happen as puppies become adults. Point out that we already noticed similarities, so we also want to notice differences. Provide each student with a colored sticky dot and invite them to stick it on the chart where they see a difference between how the 2 puppies develop. These differences might be in what they do (e.g., eat food their parent hunts for or eat food provided by a human) or in their rates of development (both begin eating solid food but in different weeks of life)." (Lesson 2, Teacher Guide) Though students do not engage with ideas around reproduction in this lesson, the 3.3 Trait Variations SEP-DCI-CCC-ELA-Math-Matrix states, "Students will build on this understanding about how parent canines help their young survive when in Lesson 3 they figure out that reproduction is essential to the continued existence of canines." (3.3 Trait Variations SEP-DCI-CCC-ELA-Math-Matrix)
- Lesson 3 students expand the class life cycle model by adding more life stages, and generalizing among several canid species. They define "reproduction" and incorporate it into their life cycle model, although they do not yet describe its importance for species survival. They also look to further investigate the life cycles of additional species.
  - Synthesize, Step 4: "Add to the class consensus model from Lesson 2. Display the consensus model from Lesson 2. Continue the work from lesson 2 by drawing the four life stages (white boxes). Once consensus is reached for the names of the life stages, record those terms on the model. Repeat this process by then comparing what happens between stages (green boxes) across the canine types. For example, focus on what each group included between the Newborn and Young Adult stages across all canine types. Again, highlight words or ideas that seem similar between each stage." (Lesson 3, Teacher Guide)
  - Synthesize, Step 4: Teaching Tip: "Students should understand that newborns only come from adults through mating. If students decide to include a separate 'reproduction' arrow branching off from the adult to create a newborn, include that as part of the class model. Later in this unit, students will add this to their life cycle model as they investigate why offspring sometimes resemble their parents, and why siblings may share similar features." (Lesson 3, Teacher Guide)
  - Synthesize, Step 4: "Celebrate how much we have figured out about developing models and canine life cycles but recall that students also were curious about their special animals. Ask something like, Do we think the consensus model we just updated could explain the life cycles of other animals that are special to us? Establish that as another limitation of our current model: is it focused only on canines. Ask students what we could do to be able to further revise our model to explain more animals, and decide together that figuring out the life cycles of our special animals would be helpful." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize, Step 3: "Ask students how we could revise our consensus model (from Lesson 3) to show what we figured out about our other animals. Ideas to look and listen for: Add our animals to the model at each stage. Add the same life stages for animals. Keep our arrows the same because those are the same for all the animals. Add different ways animals are born. Add different lifespans. Add different size they might grow up to be. Work with students to annotate class consensus model with similarities (e.g., the main life stages and processes are similar across organisms) and to note differences (e.g., lifespan, way they are born, etc.). Use check marks to note similarities

and cross off/edit parts of the model to note differences. Once annotated, ask students whether this model still only represents canines. Listen for students to suggest that it now represents more animals." (Lesson 4, Teacher Guide) Students do not yet consider the importance of reproduction for a species' continued existence.

- Lesson 13, Synthesize, Step 5: "Gather students in a Scientist's Circle around the consensus model. Point to the Fossil Timeline chart. Use the first prompt on the slide to elicit student ideas to explain which parts of the life cycle might have been disrupted since the wooly mammoth is no longer alive today. After students share a few ideas, ask how we can revise our model to explain why some animals are no longer found today." (Lesson 13, Teacher Guide)
- Lesson 14 slide deck slide A: "We have investigated canine and wooly mammoth fossils. What does fossil evidence tell us about how successful these two kinds of animals were in passing on information to offspring?" (Lesson 14, Slide Deck)

LS3.A Inheritance of Traits

Claimed Element: **LS3.A-E1 Many characteristics of organisms are inherited from their parents.**

Claimed in Lessons: 1, 5, 6, 9, and 10. Evidence was found in all claimed lessons, examples include

- Lesson 1, Synthesize, Step 6: "Identify the changes patterns we observed. Display slide S. Remind students that we have seen four different newborns and adults, and it will probably be helpful to capture everything we learned about all four in one place. Distribute the "Changes We Observed in Newborns and Adults" handout. Give students time in pairs to complete the handout. Review the handout as a class making sure to highlight the pattern that as newborns all the dogs look and act the same, but as adults they are all so different." (Lesson 1, Teacher Guide)
- Lesson 5, Explore, Step 2: "Introduce the first set of dog parents. Show slide F and introduce students to two dog parents, Abby and Toby, who are both Labradors. Distribute Abby and Toby parent cards from the Parent and Puppy Trait Cards. Building off the Navigate discussion, ask students to take a look at our first pair of dog parents. Do they notice any similarities, or patterns, in the way they look? Then ask students to use the traits of Abby and Toby to predict what sorts of fur traits they'd expect to see in their offspring." (Lesson 5, Teacher Guide)
- Lesson 6, Synthesize, Step 5: "Construct an explanation about instincts in dogs. Display slide S. Say something like, The expert in the video said that she picked Haven and Elvis as parents for the litter because she wanted puppies who might become service dogs. Use the prompts on the slide and the follow-up responses below to support students in explaining, using evidence why the expert selected Haven and Elvis as parents for the litter. Students may need to rewatch videos during this discussion to consider their evidence, so make the videos available to students as needed." (Lesson 5, Teacher Guide)
- Lesson 9, Explore, Step 3: "Make observations about wolf traits using data cards. Display slide E. Introduce the Wolf Cards as a tool that we can use to help us figure out some information about the traits of wild canines. Preview with students what kinds of information they will find in these new texts. While students discuss traits on the wolf cards, circulate among the groups to provide guidance as needed. Use prompts that will help students start thinking of the different kinds of traits and the variations in those traits: What are some traits that you can see by looking at the pictures? How would you describe _____ trait in this picture? Do you notice any variations in _____ trait? What are some examples of behavior traits? Do you think _____ behavior is inherited or learned? What makes you think that?" (Lesson 9, Teacher Guide) While students consider whether fur color is an observable trait and learn about inherited fur traits in Lesson 5, it is implied that they would make the connection that in Gray Wolves, a variety of fur colors is an inherited trait.

- Lesson 10, Connect, Step 2: "Broaden from canines to other animals. Using slide C, remind students that we began our unit thinking about animals special to us. We thought that if we investigated canines, we might figure out new ideas that would help us understand many animals. Remind students that our unit question is: Why do animals look and act the way that they do? and ask whether they think we've answered that question for all animals yet. Ask students to turn and talk about what they think we should do so we can answer that question for all animals. If necessary, prompt them with how we've been investigating physical and behavioral traits so far (i.e., why they have certain traits, who they get them from, and why they need them, etc.). Listen for ideas like: Look at the traits other animals have. Get information if they get traits from their parents. Learn more about traits that are similar or different from parents. Check to see if other animal babies look alike or different. We can get information if traits help them survive (or do a job)." (Lesson 10, Teacher Guide)

Claimed Element: **LS3.A-E2 Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.**

Claimed in Lessons: 1, 7, and 10. Evidence was found in all claimed lessons, examples include

- Lesson 1, Trait Variations SEP-DCI-CCC-ELA-Math-Matrix: "In this first lesson of the unit, students share initial ideas about why different canines grow up to look and behave in certain ways, which may tap into students' initial ideas about the influence of diet and learning on the canine's look or behavior. This lesson only surfaces prior knowledge and will not fully develop any part of the DCI, but rather sets the stage for future learning in subsequent lessons." (Traits Unit Matrix)
- Lesson 7, Explore, Step 3: "It sounds like we have ideas that learning to be a guide dog might not affect a dog's looks or physical traits, but it could affect how they act in their lifetime - could affect their behavioral traits, maybe doing new behaviors they wouldn't have done if they had not been trained to be a guide dog. Let's see what could be similar or different about learning to be a sled dog." (Lesson 7, Teacher Guide)
- Lesson 10,
  - Connect, Step 2: "Ask students to turn and talk about what they think we should do so we can answer that question for all animals. If necessary, prompt them with how we've been investigating physical and behavioral traits so far (i.e., why they have certain traits, who they get them from, and why they need them, etc.). Listen for ideas like: Look at the traits other animals have. Get information if they get traits from their parents. Learn more about traits that are similar or different from parents. Check to see if other animal babies look alike or different. We can get information if traits help them survive (or do a job)."
  - Synthesize, Step 3: Prompts to use: "I heard something special about poison frogs - that their diet influences how poisonous they are. Can diet, what animals eat, influence how well they survive?" Patterns Callout: "Use questions to support students in focusing on the similarities across all the animals. This will help students broaden their ideas to many animals. It's OK if there are also differences, such as the idea that diet influences traits (poison frogs). Students may not feel they have enough evidence to broaden all the ideas across all animals, which is OK, too."
  - Synthesize, Step 3, Teaching Tip Callout: "Help students recognize that in the wild, traits are important for survival and reproduction. This ensures that the animal will have an opportunity to pass on its traits to its offspring." For more information about this important idea, see Chapter 9 Core Idea LS4 by Passmore, Gouvea, Guy, and Griesemer in Duncan, Krajcik, and Rivet (Eds.), Disciplinary Core Ideas: Reshaping Teaching and Learning. Arlington, VA: NSTA Press. (Lesson 10, Teacher Guide)

LS3.B Variation of Traits

Claimed Element: LS3.B-E1 Different organisms vary in how they look and function because they have different inherited information

Claimed in Lessons: 1, 2, 5, 6, 8, and 10. Evidence was found in all claimed lessons, examples include

- Lesson 1, Synthesize, Step 6: "Identify patterns of similarities and differences. Display slide W Focus students on identifying patterns across their ideas about all 4 dogs. Ask students to notice similarities. When they identify a similarity, ask a student to circle instances of it using one color or mark it with a symbol. Continue eliciting ideas for new patterns, circling each new pattern with a different color or noting it with a symbol." (Lesson 1, Teacher Guide)
- Lesson 2, Explore, Step 4: "As you read the book aloud, pause after each interval of time and ask students how the puppies and their needs have changed. Add student observations to the Timeline of Needs and Changes chart for the wolf puppies (see slide I), using words and taping on images. Record both physical characteristics (how they look) and behaviors (how they act)." (Lesson 2, Teacher Guide) While there is a focus on comparing wolf/dog puppies and also comparing puppies to the parents, neither of these activities explicitly supports students' understanding of Variation of Traits.
- Lesson 5, Synthesize, Step 4: "Make sense of the co-constructed Model for Dog Trait Inheritance. Show slide Q and continue the Building Understanding Discussion to further make sense of the Model for Dog Trait inheritance. Further unpack the understanding of information being passed during reproduction. Press students to think about what we mean by "an offspring receives a trait from their parent". Show slide R and ask students what they exactly mean when we say this? What is being transferred when this happens?" (Lesson 5, Teacher Guide)
- Lesson 6, Explore, Step 3: "Name our observations as behavioral traits. Explain to students that they have made an important observation: that some behaviors can be passed from parents to their offspring. We call these behavioral traits, or certain kinds of behavior that we can observe, like fetching. Co-construct a definition with students, or provide the suggested definition on the Word Wall Card. Ask students to suggest ideas for how behavioral traits are different from traits we have observed in other lessons. After a few students share, use these ideas to explain that other traits we have observed are physical traits. In science, physical traits are characteristics that we can see or measure, like size. Co-construct a definition with students, or provide the suggested definition on the Word Wall Card. Then, have students provide examples of both physical and behavioral traits that they have observed so far in this unit." (Lesson 6, Teacher Guide)
- Lesson 8, Explore, Step 2: "Discuss how trait variations help these dogs do their jobs. Display slide D and give students a moment to re-sort their Dog Breed cards by the jobs shown under the breed's name (companion, protection, retrieving, working dog). Then, use the prompts on the slide to facilitate a discussion connecting trait variations to these jobs." (Lesson 8, Teacher Guide)
- Lesson 10, Connect, Step 2: "Ask students to turn and talk about what they think we should do so we can answer that question for all animals. If necessary, prompt them with how we've been investigating physical and behavioral traits so far (i.e., why they have certain traits, who they get them from, and why they need them, etc.). Listen for ideas like: Look at the traits other animals have. Get information if they get traits from their parents. Learn more about traits that are similar or different from parents. Check to see if other animal babies look alike or different. We can get information if traits help them survive (or do a job)." Analyzing and Interpreting Data Callout: "Students analyze new data in the form of pictures of parents and offspring of animals. They use this new data to help them make sense of how offspring of other types of animals look similar to, but also different from parents and siblings. Students also get additional information through text to help them understand the purpose of different physical traits they observe in the photos." (Lesson 10, Teacher Guide)

Claimed Element: **LS3.B-E2- The environment also affects the traits that an organism develops.**

Claimed in Lessons: 1, 7, and 10. Evidence was found in all of the claimed lessons, examples include

- Lesson 1 3.3 Trait Variations Matrix: "This lesson only surfaces prior knowledge and will not fully develop any part of the DCI, but rather sets the stage for future learning in subsequent lessons." Students may mention environmental factors as they create an initial model explaining how puppies change and grow to develop adult traits.
- Lesson 7, Synthesize, Step 4: "Facilitate a Building Understandings Discussion. Display slide I, which continues from the previous discussion. Convene students in a Scientists Circle. Pose the question about how practicing to become a sled dog would change the dog's traits. When you read the word environment, pause to co-construct the meaning of the term. Ask students what their environment includes at school. Ask students to notice the environments in each of the photos on the slide. As students share ideas about the things that surround us, work toward a definition for the environment of all the things together that surround animals. It's OK to focus this discussion on the everyday meaning of environment, which relates to the scientific term, but with less focus on clarifying the living and nonliving components." (Lesson 7, Teacher Guide)
- Lesson 10, Synthesize, Step 3: "What patterns are we noticing for the new information we have about other animals? Feel free to use the text or available materials to explain your ideas...All the [monkeys/koalas/tigers] look similar, but they also have small differences. They all have to learn things to survive. Parents are the main ones to teach them these things." (Lesson 10, Teacher Guide)

LS4.A Evidence of Common Ancestry and Diversity

Claimed Element: **LS4.A-E1 Some kinds of plants and animals that once lived on Earth are no longer found anywhere.**

Claimed in Lessons: 12, 13, and 14. Evidence was found in all claimed lessons, examples include

- Lesson 12, Navigate, Step 1: "Tell the students that you heard them say the word fossil, but pose the question, What exactly are fossils? And are they good sources of evidence? Invite students to explore fossils more deeply. If your students have not brought up the idea of fossils, tell them that you heard them say they wanted evidence from longer ago than our photographs provided. Then introduce the idea that you know there are things called fossils that people sometimes find in rocks that can show parts of plants or animals from very long ago before there were photographs or even cave paintings. Then invite them to explore fossils more deeply." (Lesson 12, Teacher Guide) While students read about and explore infographics about fossils, these fossils are of humans, dogs, and other canids, which are still found on Earth.
- Lesson 13, Explore, Step 3: "Discuss the timeline. Follow the prompts on the slide and below to discuss what the timelines for the wooly mammoth tell us about when they lived, compared to humans and dogs. Listen for students to make the connection that the length of the timeline represents that we only have fossil evidence that these animals lived and that unlike humans and dogs, our evidence for these animals ends before the present day, so they are no longer around. You may need to confirm for students that there are no photographs of mammoths in existence, and that no one alive has ever seen one, though there are cave paintings of them from long ago. The most recent evidence we have of mammoths is the teeth found in North Dakota." (Lesson 13, Teacher Guide)
- Lesson 14, Connect, Step 2: "Introduce the fossils found in this place. Share with students many fossils are found here from around 50 million years ago. Using your work on timelines in Lesson 12 and 13, remind students that they worked with fossils and artifacts from thousands of years ago, but now they are looking at some from 50 million

years ago, which is much, much longer back. Facilitate a discussion about noticings for the fossils." (Lesson 14, Teacher Guide) While the lesson discusses fossils from long ago, it is not explicit that the animals the fossils represent are no longer found anywhere on Earth.

Claimed Element: LS4.A-E2 Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.

Claimed in Lessons: 11, 12, 13, and 14. Evidence was found in all claimed lessons, examples include

- Lesson 11, Navigation, Step 4: "Brainstorm evidence that might help answer our questions. Display a blank chart titled 'Evidence That Might Help'. Place it next to the [DQB]. Display slide M. Remind students that we saw one piece of evidence that was 8,000 years old." (Lesson 11, Teacher Guide) However, according to the 3.3 Trait Variations SEP-DCI-CCC-ELA-Math-Matrix, "students do not yet formally engage with this DCI. This lesson surfaces prior knowledge students may have about examining historical evidence to understand something about the past, including aspects of Earth's past environment. Though this lesson does not fully develop any part of the DCI, it sets the stage (in lessons 12 and 13) for students to explain using evidence that some living organisms once living on Earth, are now extinct." (3.3 Trait Variations Matrix)
- Lesson 12, Connect, Step 2: "Distribute What are fossils? and a highlighter to each pair of students and show slide C. Have partners analyze the poster What are Fossils by discussing the questions on the slide. While students discuss, direct the partners to highlight passages they would use as evidence for the slide prompts. Once students have had enough time to analyze the poster, show slide D and have students share what they found about fossils." (Lesson 12 Teacher Guide)
- Lesson 13, Explore, Step 2: "Make observations and organize fossil evidence. Use student ideas for investigating additional fossils and cave paintings to introduce the Wooly Mammoth and Wooly Rhinoceroses Cards. Prompt student groups to lay the evidence cards out on their table and use the prompts on the slide to discuss what they notice, our evidence for when these animals lived, and any wonders that they have about their environment." (Lesson 13, Teacher Guide)
- Lesson 14, Connect, Step 2: "Use the fossil evidence to interpret what this place was like long ago. Remind students that in the previous lesson they used traits of wooly mammoths and wooly rhinoceroses to interpret that they live in colder environments. Cue students to use the traits they can glean from the fossil images, additional information about the fossils, and their knowledge of living things today to try to interpret what Wyoming was like 50 million years ago. Use the evidence to represent the class' ideas." (Lesson 14, Teacher Edition)

LS4.B Natural Selection

Claimed Element: **LS4.B-E1 Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.**

Claimed in Lessons: 8, 9, and 10. Evidence was found in all claimed lessons, examples include

- Lesson 8, Explore, Step 5: "Observe coyotes. Display slide I and ask students to describe some of the traits they notice in the coyote. Ask if they think all coyotes look the same. What might be some variations in their traits? Listen for students to describe traits related to the color, shape, fur, ears, tail, legs, and/or hunting abilities of the coyote. Display slide J and explain that you have some images of coyotes from around the United States for students to observe. Distribute a set of Coyote Images to groups of 4 students and ask them to observe the images and talk about what they notice and wonder about the trait variations between the different coyotes." (Lesson 8, Teacher Guide) Although students investigate differences in coyote characteristics, the lesson does not address how these traits affect survival, finding mates, or reproduction.

- Lesson 9, Explore, Step 3: "The goal of this part of the discussion is to help students use a visible trait (fur color) to keep track of a non-visible trait (disease resistance). Take care not to imply that the black fur color causes the disease resistance (or vice versa); these two trait variations just happen to occur together, which makes it easier for humans who are collecting data to notice patterns in which wolves are surviving." (Lesson 9, Teacher Guide)
- Lesson 9, Explore, Step 3: The teacher prompts "Why might wolves have variations in their traits?" Students are expected to respond by saying, "A bigger pack gives more protection. Being faster might help them hunt. Maybe different fur colors help them blend in and sneak up on their prey" (Teacher Guide, Lesson 9)
- Lesson 10, Student Assessment: Both student assessments ask students to leverage this idea to explain why a wild animal turns white in winter and how the timing could aid its survival. Student Assessment Explanation about Dogs: "How could changing fur color at the right time help the Arctic Fox survive?" (Lesson 10 Student Assessment Explanation about Dogs). Student assessment: Explanation about Bunnies: "How could changing fur color at the right time help the snowshoe hare survive?" (Lesson 10 Student Assessment Explanation about Bunnies).

Criterion-Based Suggestions for Improvement:

- Ensure "[s]tudents are supported to develop deep competence in specific elements such that they could be applied to more than one context." [Detailed Guidance, p. 10]
  - Consider how students could be directly scaffolded to make the connection that in Gray Wolves, a variety of fur colors is an inherited trait that comes in white, gray, and black.

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. These CCCs are claimed as intentionally developed: PAT—Patterns, CE—Cause and Effect, and SPQ—Scale, Proportion, and Quantity. The CCC SC—Stability and Change is claimed as an opportunity to practice.

PAT: Patterns

Claimed Element: PAT-E1:Similarities and differences in patterns can be used to sort and classify natural phenomena.

This CCC is claimed as intentionally developed in the Unit Front Matter. The Matrix claims evidence is located in Lessons 1, 2, 3, 4, 8, and 10. Evidence was found in all claimed lessons, examples include

- Lesson 1, Explore, Step 2 Patterns Callout: "Support students in using patterns to sort and classify in this activity and the next, by circulating to small groups and probing how they are using similarities and differences to sort and classify by characteristics: What are some similarities and differences among the newborns? Can you use your words or body to share your ideas? What is one way you could classify or group these newborns? Can you create groups of newborns that are similar to each other when looking at 1 thing about them?"

- Lesson 2, Synthesize, Step 5: "Explain that comparing these timelines more carefully can help us figure out more about the changes that happen as puppies become adults. Point out that we already noticed similarities, so we also want to notice differences. Provide each student with a colored sticky dot and invite them to stick it on the chart where they see a difference between how the 2 puppies develop. Discuss differences and similarities. Use the prompts that follow and guide students to support explanations with evidence of what they saw and heard in the video and text." (Lesson 2, Teacher Guide)
- Lesson 3, Synthesize, Step 4: "Facilitate a whole class discussion to add to the class consensus model to explain a canine's life cycle. Start by asking students what similarities they notice when comparing the group models. For example, point to the stages (white boxes) and ask students to discuss how many there are across all the canine types, and to compare the names given to each stage. To help, highlight words or ideas that seem similar at each stage. As students share, ask for verbal or non-verbal agreement from the rest of the class." (Lesson 3, Teacher Guide)
- Lesson 4, Explore, Step 2: "While students work, circulate among the groups to guide as needed. Use prompts that will help students start thinking of their specific animal and how they may experience a life stage or change that could be either a pattern across animals or unique to their specific animal: You said your animal is _____. That seems [similar/different] from canines. Do you think that may happen in other animals or special to the one you are investigating? How similar or different is _____ from canines? Can you point to evidence from the texts? How quickly does _____ become fully grown? Is that faster or slower than we saw in canines?" (Lesson 4, Teacher Guide)
- Lesson 8, Explore, Step 2: "Arrange students into pairs and distribute a deck of Dog Breed Cards to each pair. Direct students to notice the information provided on the cards and then sort the cards into groups based on some of that information…You may need to reassure students that there is not one "right" way to sort the cards, and in fact, they might choose to re-sort using different categories if time allows before the class comes back together… Invite partnerships to share how they grouped the cards, and encourage the class to show silent hand signals if they also noticed or used that trait or category. As students share, record the traits and variations they describe on a chart titled Variations in Dog Traits. Write the trait word (e.g. size, paws, bite) on the left side of the page and invite students to help you affix the trait variation images from Printable Chart Images to indicate the variations they noticed. When students identify the dog jobs noted on the cards (companion, protection, retriever, working dog), list those in different colors at the top of the chart…Display slide D and give students a moment to re-sort their Dog Breed cards by the jobs shown under the breed's name (companion, protection, retrieving, working dog). Then, use the prompts on the slide to facilitate a discussion connecting trait variations to these jobs." (Lesson 8, Teacher Guide)
- Lesson 10, Connect, Step 2: "Establish the goal of the group work. Emphasize that the goal of our work is to work in groups and then share what we find out with each other to look for patterns in similarities and differences. Remind students that patterns mean something repeats again and again. Explain that they will research one kind of animal, but ultimately, we want to see what patterns exist across the animals, if any…Discuss when and how to check off ideas. Display slide F to share instructions with students about what they will do using the Amazing Animal Traits: Parents and Offspring text and the Our Growing Ideas Checklist handout. Pause to discuss step 3." (Lesson 10, Teacher Guide)

Claimed Element: **PAT-E2 Patterns of change can be used to make predictions.**

This CCC is claimed as intentionally developed in the Unit Front Matter. The Matrix claims the element of PAT-E2 in Lessons 4 and 5. Evidence was found in all claimed lessons, examples include

- Lesson 4, Synthesize, Step 5: "Tell students that they will have the opportunity to use what they have learned about the life stages of other animals to make predictions about a newly discovered animal. Distribute New Animal

Predictions and read through the scenario and questions. Ask students if they have any questions about the scenario or prompts. Give students 15 minutes to work individually on questions 1-3. Tell students they can refer back to their previous work, the Class Consensus Model, and Our Growing Ideas chart as evidence. As students work, you can challenge their thinking with questions like: How does that data/evidence support your claim? Did you consider the patterns true for other animals?" (Lesson 4, Teacher Guide)

- Lesson 5, Explore, Step 2: "Introduce the first set of dog parents. Show slide F and introduce students to two dog parents, Abby and Toby, who are both Labradors. Distribute Abby and Toby parent cards from the Parent and Puppy Trait Cards. Building off the Navigate discussion, ask students to take a look at our first pair of dog parents. Do they notice any similarities, or patterns, in the way they look? Then ask students to use the traits of Abby and Toby to predict what sorts of fur traits they'd expect to see in their offspring." (Lesson 5, Teacher Guide)

Claimed Element: PAT-E3 Patterns can be used as evidence to support an explanation

This CCC is claimed as intentionally developed in the Unit Front Matter. The Matrix claims the element of PAT-E3 in Lessons 6, 8, 10, and 14. Evidence was found in all claimed lessons, examples include

- Lesson 6, Synthesize, Step 5: "Then, return to the first prompt again (Why did the expert select Haven and Elvis as parents for the litter?). Have students turn and talk with a partner about how they would answer this question, using what they know about traits that puppies can inherit as evidence to support their explanation. Invite a few student pairs to share their explanations with the class. Tell students that they have figured out a lot of ideas and suggest that they take some time to update their model." (Lesson 6, Teacher Guide)
- Lesson 8, Synthesize, Step 3: "As students demonstrate their understanding for why people often chose poodles for retrieving wild game, ask them to provide evidence to support their claims. Use the Poodle Explanation Instructional Guidance tool to guide your assessment and decide on next steps for students based on their responses." (Lesson 8, Teacher Guide)
- Lesson 8, Explore, Step 5: "What do you notice about the way the coyotes look in the west and the northeast?... What do you notice about the coyote habitat in the west and the northeast?... What do you wonder about the coyotes now?" (Lesson 8, Teacher Guide) The lesson ends with Driving Questions that are not revisited; therefore, students do not use patterns in coyote traits to support their explanation. Students create an argument about a job that poodles would be good at, but are not asked to use patterns in their evidence. Students identify patterns in coyote physical traits, but are not asked to use those patterns to support an explanation.
- Lesson 10, Synthesize, Step 3: "Look for patterns. Display slide H. Restate that we are wondering why animals look and act the way that they do. Point out that we figured out a lot of ideas for canines, but now we have some new animals to consider with our research on them. Ask students to look at the sticky notes now posted to Our Growing Ideas chart to see if there are patterns they notice where the idea we figured out about canines may explain more kinds of animals. Have them articulate the patterns they see." (Lesson 10, Teacher Guide)
- Lesson 14, Synthesize, Step 3: "Move the discussion to using fossil evidence to describe this place. Point out that these fossils are helping us understand the kinds of organisms that lived in this area long, long ago. Suggest that now we can also use them as evidence to support inferences we make, like Jonathan and Nicole (from the Meet the Experts: Ancient Fossils and Environments book) do, about what this area was like way back then. Explain that in the same way we make inferences while we read by using information in the text and our own ideas and experiences to make connections between ideas. We can use data and our ideas to make inferences in science, too." (Lesson 14, Teacher Guide)

CE: Cause and Effect

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

This CCC is claimed as intentionally developed in the Unit Front Matter. The Matrix claims the element of CE-E1 in Lessons 1, 5, 7, 9, and 10. Evidence was found in all claimed lessons, examples include

- Lesson 1, Synthesize, Step 6: "At the end, have students summarize the patterns they identified in their ideas for each question. Example might be: We think they are born a certain dog because either their parents, something about the breed, the genes they have, or just how it happens. We think they become adult dogs that look and act in a certain way because they were born as that kind of dog, they had training/learning, genes/something from parents, they got older/grew up." (Lesson 1, Teacher Guide)
- Lesson 5, Synthesize, Cause and Effect Callout: "In Unit 3.1: How can we design objects to balance and move in different ways? and Unit 3.2: Why do plants only grow well in certain places, and how can we protect them?, students used cause and effect relationships to make sense of phenomena. Connect back to students' prior uses of cause and effect during this discussion to help them identify the relationship between parent dogs' trait variations and those of their puppies to help students explain why the puppies have those trait variations." (Lesson 5, Teacher Guide)
- Lesson 7, Explore, Step 3: "Patterns (e.g., treats seem to be a common motivator) and Cause and Effect (e.g., do the behavior, give a treat, repeat the behavior) can be useful to this sharing of ideas. Use prompts like, What patterns do we notice in how the dog learns a new thing? What causes the dog to do the new thing and want to repeat it?" (Lesson 7, Teacher Guide)
- Lesson 9, Explore, Step 4: "Add possible cause-effect relationship. Some students may recognize the role of the environment in determining which trait variation will be more important at any moment in time, i.e. black fur will be more advantageous during times of disease outbreak, but not during times without outbreak. Layer on this cause and effect thinking to the chart." (Lesson 9, Teacher Guide)
- Lesson 10, Explore, Step 4: "Discuss scientific explanations. Display slide I and refer to the What does an explanation need? chart to remind students that explanations in science are when scientists make observations and collect measurements of something that is happening, and over time, they use the evidence to figure out how and why it happened. When scientists feel they understand how and why something happens, they say they have an explanation for the phenomenon." (Lesson 10, Teacher Guide)

SPQ: Scale, Proportion and Quantity

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

This CCC is claimed as intentionally developed in the Unit Front Matter. The Matrix claims the element of SPQ-E1 in Lessons 11, 12, 13, and 14. Evidence was found in all claimed lessons examples include

- Lesson 11, Explore, Step 2, Scale, Proportion, and Quantity Callout: "We ask students to look back through time as a way to examine evidence that helps us answer the question - How long have people and dogs worked together? Examining evidence along a time scale helps students understand dates as a specific sequence of events. By focusing on scale here, we allow students to "zoom out" and look at history beyond their own to understand whether something we see now also existed in the past. From earlier lessons, students figured out that today, people often

rely on dogs for help and companionship. In this final lesson set, we ask students to shift the time scale of their analysis to determine if similar people/dog relationships were common in the past." Scale, Proportion, and Quantity Callout: "Looking farther into the past requires us to explore evidence along several time scales and to very long time periods - from tens of years, to hundreds, and even to thousands of years. In Lessons 12 and 13, students will extend the time scale to hundreds of thousands of years as they make sense of what Earth's environments were like long ago." (Lesson 11, Teacher Guide) While students are using the timeline, it is being used to answer a teacher-generated factual question about how long humans and dogs have co-existed, not to figure out something about an observable phenomenon or natural object.

- Lesson 12, Connect, Step 5, Scale, Proportion, and Quantity Callout: "Visualizing the distance it would take to represent dinosaurs on our class timeline can help students understand the vastness of Earth's history and how humans and dogs started working together relatively recently even though it was 1-3 units ago years old (14,000-30,000 years ago). You can support students in thinking about long and short time scales by imagining their own personal history (~8 years) compared to dogs-humans 1-3 units ago years old (14,000-30,000), to humans alone 30 units ago years old (300,000) to dinosaurs (1,000,000). For students, a day, a week, or their lifetime might be a short time scale, but for Earth, 3 units (30,000 years) is a short time scale compared to millions or more years." (Lesson 12, Teacher Guide) Students were not using or creating this timeline to figure out something about an explainable phenomenon. Rather, the purpose of the timeline is to answer a teacher-generated factual question about how long humans and dogs have co-existed.

- Lesson 13, Explore, Step 3: "Listen for students to make the connection that the length of the timeline represents that we only have fossil evidence that these animals lived and that unlike humans and dogs, our evidence for these animals ends before the present day, so they are no longer around. You may need to confirm for students that there are no photographs of mammoths in existence, and that no one alive has ever seen one, though there are cave paintings of them from long ago. The most recent evidence we have of mammoths is the teeth found in North Dakota." (Lesson 13, Teacher Guide)

SC: Stability and Change

Claimed Element: SC-E1 Change is measured in terms of differences over time and may occur at different rates

This CCC is claimed as intentionally developed in the Unit Front Matter. The Matrix claims the element of SC-E1 in Lessons 2, 3, and 4. Evidence was found in all claimed lessons, examples include

- Lesson 2, Explore, Step 4: "As you read the book aloud, pause after each interval of time and ask students how the puppies and their needs have changed. Add student observations to the Timeline of Needs and Changes chart for the wolf puppies (see slide I), using words and taping on images. Record both physical characteristics (how they look) and behaviors (how they act). For the domesticated puppy, if an idea is already represented on the timeline, prompt students to point out the same image or description, and consider placing a checkmark next to it to show we have more evidence from the text to support what we observed in the video. Add new information we get from the text, too." (Lesson 2, Teacher Guide)

- Lesson 3, Synthesize, Step 4: "Start by asking students what similarities they notice when comparing the group models. For example, point to the stages (white boxes) and ask students to discuss how many there are across all the canine types, and to compare the names given to each stage...The first life stage, Newborn, can be used as an example since all models began with this stage. Remind students that we agreed newborn is a living thing just born...Continue the work from lesson 2 by drawing the four life stages (white boxes). Once consensus is reached for the names of the

life stages, record those terms on the model. Repeat this process by then comparing what happens between stages (green boxes) across the canine types. For example, focus on what each group included between the Newborn and Young Adult stages across all canine types. Again, highlight words or ideas that seem similar between each stage. The final life process, Aging and Dying, can be used as an example since all models end with this life process. Remind students that we also have a new term, development, that may help describe some of the changes we notice between stages. (Lesson 3, Teacher Guide)

- Lesson 4, Synthesize, Step 3: "Work with students to annotate class consensus model with similarities (e.g., the main life stages and processes are similar across organisms) and to note differences (e.g., lifespan, way they are born, etc.). Use check marks to note similarities and cross off/edit parts of the model to note differences." (Lesson 4, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

I.C. Integrating the Three Dimensions

EXTENSIVE

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

The reviewers found **extensive** evidence that student sensemaking of phenomena requires student performances that integrate elements of the SEPs, CCCs, and DCIs. In the unit, students are expected to engage in many activities that require them to use grade-appropriate elements of the three dimensions simultaneously. The three dimensions are not used in isolation. In most activities in the unit, students are expected to figure out something that requires the use of the three dimensions, working together at grade level.

Throughout the unit, students engage in three-dimensional tasks to help explain phenomena.

- Lesson 4, Synthesize, Step 3: "Motivate using a model. Display slide I. Celebrate the patterns that students have noticed looking at our class chart. Restate that we are wondering if other animals, though very different, may share some of the same life stages experienced by canines…Point out the main stages we already labeled on our class consensus model: newborn, young adult, adult, and senior. Ask students to look at our class chart and consider whether we can apply the same stages to our other animals…Update our model to include other animals. Display slide I. Ask students how we could revise our consensus model (from Lesson 3) to show what we figured out about our other animals. Ideas to look and listen for: Add our animals to the model at each stage. Add the same life stages for animals. Keep our arrows the same because those are the same for all the animals. Add different ways animals are born. Add different lifespans. Add different size they might grow up to be. Work with students to annotate class consensus model with similarities (e.g., the main life stages and processes are similar across organisms) and to note differences (e.g., lifespan, way they are born, etc.). Use check marks to note similarities and cross off/edit parts of the model to note differences. Once annotated, ask students whether this model still only represents canines. Listen for students to suggest that it now represents more animals. Suggest that maybe our consensus model now represents all animals' life cycles." (Lesson 4, Teacher Guide) **CCC PAT-E1 Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products, DCI 3-LS1.B.1 Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles, SEP MOD-E4 Develop and/or use models to describe and/or predict phenomena.**

- Lesson 6, Explore, Step 2 students integrate the use of the elements when they analyze patterns in retrieving behavior among puppies in a dog family to explain how dogs can have behaviors that they did not learn in the three dimensions: **CCC PAT-E3 Patterns can be used as evidence to support an explanation, DCI LS3.A-E1 Many characteristics of organisms are inherited from their parents, SEP CEDS-E2 Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.**
- Lesson 7, Synthesize, Step 4: Students participate in a discussion where they use evidence (Practice) to support claims about how learning causes (CCC) changes in dog behavior (DCI). "We also know that Alaskan Malamutes are born with certain information that affects their instincts and natural behaviors, like wanting to run and pull. What evidence do we have that learning to be a sled dog could influence behavioral traits, too? They have to learn to work as a team. They have to learn to wear a harness and not get tangled up. They learn certain words and what to do. What evidence did we see that these are new behaviors they have to learn (and they wouldn't know how to do these things without training? Where did we find that evidence?" (Lesson 7, Teacher Guide) **CCC CE-E1 Cause and effect relationships are routinely identified, tested, and used to explain change, DCI 3-LS3.B.2 Variation of Traits: The environment also affects the traits that an organism develops, SEP CEDS-E2 Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.**
- Lesson 10, Connect, Step 2: students integrate the use of the elements when they work in groups to share what they've learned about their new animal in the three dimensions: **CCC PAT-E1 Similarities and differences in patterns can be used to sort and classify natural phenomena, DCI LS3.A-E1 Many characteristics of organisms are inherited from their parents, SEP CEDS-E2 Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.**

As students work toward 3-dimensional learning goals, the Following Student Sensemaking teacher checklists allow the teacher to track 3-dimensional learning over time. For example,

- Following Student Sensemaking Lessons 2-4 reminds teachers of the overall goal for the lesson set (Assessment Statement 1: 3-LS1-1. **Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death**. By Lesson 4, students should have met this assessment statement. You will formally check your class' progress in Lesson 3 with a key formative assessment moment and in Lesson 4 in a summative assessment moment." Then lists 3-dimensional learning goal waypoints for the lesson set: "Evidence of Sensemaking: Checklist of Listen/Look-Fors (*see examples below the table). Use handouts, small-group discussions, and whole-class discussions. Lesson 2: **Use evidence of similarities and differences between wolf and dog puppies to explain how puppies change to become more like adults**. Lesson 3: **Uncover patterns to develop a model that explains how different canines undergo similar developmental processes and stages as part of their life cycle**. Lesson 4: **Develop a model to describe that while animals have unique and diverse life cycles, they all follow the same pattern**."(Following Student Sensemaking Lessons 2-4).
- Following Student Sensemaking Lessons 5-9 reminds teachers of the overall goal for the lesson set Assessment Statement 2: **Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.** (3-LS3-1) Using students' lesson-level work in Lessons 5-7, attempt to collect evidence about this assessment statement for each student by the end of Lesson 7 so that you can use the information you've gathered to support students in the Lesson 8 key formative opportunity. Students have an opportunity to use feedback about this assessment statement (related to inheritance of traits) in Lesson 9 prior to the summative assessment opportunity in Lesson 10. Evidence of Sensemaking Checklist of listen-fors and look-fors (see examples on the following pages); use handouts, small

group discussions, and whole class discussions. Lesson 5: **Analyze and interpret data to provide evidence that related dogs inherit similar patterns of traits from their parents.** Lesson 6: **Analyze and interpret patterns in dogs' instinctual behaviors to provide evidence that puppy siblings inherit information from parents that influences behavioral traits**. Lesson 7: **Use evidence to support the explanation that a dog's traits can be influenced by their environment, like learning new jobs**. Lesson 9: **Use observations and patterns as evidence to support an explanation that variations in wolf traits can result in an advantage to survival**" (Following Student Sensemaking Lessons 5-9)

Criterion-Based Suggestions for Improvement: N/A

I.D. Unit Coherence

EXTENSIVE

Lessons fit together to target a set of performance expectations.

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

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

The reviewers found **extensive** evidence that the lessons fit together coherently to target a set of performance expectations because most lessons build on prior lessons by acknowledging questions raised in those lessons, cultivating new questions that build on what students figured out, and/or cultivating new questions from related phenomena, problems, and/or prior student experiences. The lessons help students develop toward proficiency in a targeted set of performance expectations. While the transition between Lesson Sets 2 and 3 does not clearly build on student questions from the previous lessons, Lesson Set 3 (Lessons 11–14) is coherent and supports student sensemaking through a logical progression of questions and activities.

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.

These examples demonstrate how each lesson builds upon the previous one, and call-backs to the anchor phenomenon and students' questions are incorporated to give purpose to later lessons.

Students ask and answer their questions from the Driving Questions Board in lessons 1, 2, 3, 5, 6, 7, 8, 9, 11, and 13; for example,

- Lesson 1, Synthesize, Step 7: "Display slide X and share that now they will ask questions they want to investigate to understand this phenomenon better. Explain that they are going to share all their questions to create the class' [DQB], which will become their mission to answer as they investigate the phenomenon further. Push students for questions that can be investigated and prepare for brainstorming ideas for investigation by asking, How could we figure that out in our classroom? What other information could we use to help us answer that?" (Lesson 1, Teacher Guide)

- Lesson 3, Navigate, Step 1: "Motivate the need for investigating canines' lives more closely. Point to the arrows on the slide between "newborn" and "adult" and connect to questions from the [DQB] related to the growth and development of all canines. Using students' questions, co-establish that today we want to figure out something like what adult canines do that puppies cannot do (and why)?" (Lesson 3, Teacher Guide)
- Lesson 6, Navigate, Step 7: "As a class, watch the Interview with a Dog Expert - Part 2 video to explore what jobs the puppies might have. After watching the video, ask students to turn and talk with a partner about the prompts on the slide and invite students to add their questions about what the puppies might learn through training to the [DQB]." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize, Step 5: "Ask students to identify questions from the DQB that we can now answer. Move the questions from the DQB to Our Growing Ideas chart as one or two students share what the class figured out to answer the question. If it still feels unanswered, keep it on the DQB for further investigation." (Lesson 7, Teacher Guide)
- Lesson 8, Explore, Step 5: "display slide H and look at the [DQB] together. Bring students' attention to questions they had about traits, variations, and behaviors of wild canines. Say something like, We know domesticated dogs have traits that help them do particular jobs. Do you think wild canines also have trait variations that help them do their job of surviving in the wild? Accept all ideas. Suggest that we start investigating some wild canines and the trait variations they have." (Lesson 8, Teacher Guide)
- Lesson 11, Synthesize, Step 3: "As students share their uncertainties, mark these on the Comparing Our Models chart using a question mark, or add them to the 'Differences' side, and then mark with a question mark. Explain that uncertainty leads to questions, which then motivates us to be scientists and investigate further to figure something out. Add to the (DQB). Display slide T and provide think time for students to think about questions they want to add to the DQB. Students can work on their own or with a partner to generate questions. Keep the "Notice and Wonder" chart and the "Comparing Our Models" chart visible for students. Also, remind students to look back at their initial models to help think about questions." (Lesson 11, Teacher Guide)

The Navigate routine, present at the start and end of each lesson, recalls the previous lesson's endpoint and the next step identified at the end of that lesson, to ensure a consistent thread of learning.

- Lesson 3, Navigate, Step 1: "Recall what we figured out and motivate the new lesson. Display slide A. Point to the images on the slide and [DQB] and invite students to turn and talk to a partner about what we investigated together last time that led us to ask so many questions. Have a few students share their ideas with the class." (Lesson 1, Teacher Guide)
- Lesson 3, Navigate, Step 6: "Motivate looking for example life cycles of other animals using community knowledge. Display slide M. Look back at the Driving Questions Board. Point out that students wanted to figure out about lots of other animals changing in their lives. Explain that you might have a way that we can observe places where that might be happening. Determine how we can use these images and stories next class period. Pause and ask students how we could use these stories and pictures from our community to help us figure out Why do dogs look and act the way that they do. Listen for students to suggest that we could gather more observations of animals in our community to help us decide whether other animals have life cycles like canines. Tell students that we can do this next class period." (Lesson 3, Teacher Guide)
- Lesson 6, Navigate, Step 1: "Recall our ideas about inherited traits and what we are now wondering about. Display slide A. Have students silently review what we figured out in our last class, and then turn and talk with a partner about what and how we figured out those ideas. Have students briefly share what they discussed, and then remind students that we left the last class wondering about how animals act and why they act the way they do." (Lesson 6, Teacher Guide)

- Lesson 7, Navigate, Step 1: "Take stock of what we were thinking last time. Ask a few students to remind the class what they were thinking last time about how the puppies could learn to be therapy dogs. Students may have added new questions to the DQB at the end of the last class, too. Read those questions now as a reminder of what we were interested in investigating." (Lesson 7, Teacher Guide)
- Lesson 7, Navigate, Step 6: "Consider where to go next. Display slide N and take a moment to acknowledge all the new ideas figured out on Our Growing Ideas chart and Consensus Model. Use the prompts on the slide to briefly discuss next steps. Give students a moment to turn and talk with a partner before sharing ideas with the whole group. Decide together that we are feeling pretty good about why many domesticated dogs look and act the way they do, but we may still want more evidence for additional domesticated dogs. Acknowledge that there are lots of breeds and they all look very different, so are there other traits and variations we may want to explore before explaining how domesticated dogs look and act? Plan for next time to do a little more exploring and then explaining about domesticated dogs." (Lesson 7, Teacher Guide)

While there is evidence that within the lesson sets, topics build on each other, the transition between Lesson Sets 2 and 3 could be strengthened to support coherence.

- Lesson 10, Navigate, Step 5: "Ask students how long ago they think humans and dogs developed this special relationship. Give students a moment to turn and talk about when and how dogs and people began working together. As needed, support students to recognize that we are not talking about the time it takes to train a dog, but for how long we think humans and dogs have worked together throughout history." (Lesson 10. Teacher Guide) The shift from individuals' traits and changes over their lifetime (life cycle) to the teacher-generated question about how long humans and dogs have worked together through history could be confusing to students.
- Lesson 12, Navigate, Step 1: "If your students have not brought up the idea of fossils, tell them that you heard them say they wanted evidence from longer ago than our photographs provided. Then introduce the idea that you know there are things called fossils that people sometimes find in rocks that can show parts of plants or animals from very long ago before there were photographs or even cave paintings. Then invite them to explore fossils more deeply." (Lesson 12, Teacher Guide) This step suggests that the students may not have considered the idea of fossils; therefore, the teacher would provide students with this information, introducing them to the phenomenon of fossils.

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

The lessons help students develop toward proficiency in a targeted set of performance expectations. The unit targets five Performance Expectations.

- **3-LS1-1.** Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. Students work toward this PE in the first lesson set.
  - Lesson 3 provides a Key Formative assessment moment as students generalize a life cycle model for many species of canines.
  - Lesson 4 provides a summative assessment moment as students make predictions to show their familiarity with modeling life cycles. Lesson 4 Student Assessment 1 New Animal Prediction: "1. Based on the patterns we observed across many different animals, draw and label a model that describes how this animal might grow and develop. Make sure to label the stages of a life cycle for this newly discovered animal. 2. 2. Based on what we learned about other animals' life cycles, predict what changes we could observe as the newly discovered animals grow from newborn to adult. What differences in looks and behaviors do you predict we would observe? Finish the sentence to complete your prediction. I predict that some changes we would observe from newborns to adults would be...3. What evidence do you have to support your prediction? The evidence that supports my prediction is..." (Lesson 4, Teacher Guide)

- **3-LS3-1:** Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. Students work toward this PE in the second lesson set.
  - Lesson 5, Explore, Step 2: "Fill in the Traits of Labrador and Poodle Posters to build the data set representations. Distribute multiple copies of the Parent and Puppy Trait Cards to each table group. Show slide K and hang the Traits of Labrador and Traits of Poodle posters in a place visible to all students. Invite students to co-construct the bar graphs based on their observations of the Parent and Puppy Trait Cards. Ask students to identify different features of the graphs to draw their attention to the labels and how they can aid in graphing the data. As students share what they notice, begin filling in the bar graph on the class chart to represent the data. After modeling how to fill in the graph, prompt students to use their prior bar graph experiences in math class to complete the bar graphs and make interpretations about the data." (Lesson 5, Teacher Guide)
- **3-LS3-2:** Use evidence to support the explanation that traits can be influenced by the environment.
  - Lesson 7 Sled Dog Explanation: "Duke and Jonah are two Malamutes from the same litter of puppies (they have the same parents) who behaved in the same ways when they were puppies…Duke and Jonah have different trait variations because…Two pieces of information from the sled dog video that support my idea are…" (Lesson 7, Teacher Guide)
  - Lesson 7, Synthesize, Step 4: "Facilitate a Building Understandings Discussion. Display slide I, which continues from the previous discussion. Convene students in a Scientists Circle. Pose the question about how practicing to become a sled dog would change the dog's traits. When you read the word environment, pause to co-construct the meaning of the term. Ask students what their environment includes at school. Ask students to notice the environments in each of the photos on the slide. How would the dog's environment be different if it practices to be a sled dog or becomes a pet instead? Is the training that sled dogs get part of their environment? We also know that Alaskan Malamutes are born with certain information that affects their instincts and natural behaviors, like wanting to run and pull. What evidence do we have that learning to be a sled dog could influence traits? How would you compare the environment that guide dogs experience to the environment of sled dogs?" (Lesson 7, Teacher Guide)
- **3-LS4-1:** Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.
  - Lesson 13 Student Assessment 1 Describing Mammoths From Evidence: "Describe for someone else what you figured out about wooly mammoths based on the fossils we investigated. 1. What were wooly mammoths like? Use words and/or pictures in your description. 2. What was the world like when and where the wooly mammoths lived? Use words and/or pictures in your description. 3. What can we use as evidence to know what woolly mammoths and their environments were like?" (Lesson 13, Student Assessment)
  - Lesson 14, Explore, Step 2: "Allow time for partners to analyze and interpret the fossil images. Circulate to support students as they work. They do not need to visit every image; they have room on their handout to record thinking about 4 fossils (at least one of them a plant). Consider asking the following questions to provide feedback to students while encouraging the use of both linguistic and nonlinguistic (images, gestures) resources: What traits do you notice? Can you show us? Do any of these fossils from the past look like animals or plants that are alive today? How is this fossil plant or animal similar to or different from the ones you know today? What kind of environment do you think this animal or plant lived in back then? Can you show us what evidence supports your idea?" (Lesson 14, Teacher Guide)

- **3-LS4-2:** Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. Students work toward this PE during lesson set 2 as they investigate variation among wolves in a Key Formative assessment and among arctic foxes or rabbits in a summative assessment.
  - Lesson 9, Explore, Step 4: "Elevate the idea that we have figured out that wolves with black fur variation survive better because they can resist disease if there is an outbreak of that virus. But the article also said that even though the original wolves released in the park mostly had gray fur, the number of wolves with black fur born in the park is increasing compared to gray wolves over the years. Ask students why they think that might be happening. Accept all answers and elevate any disagreements. Disagreement is an important clue that we need more information. Suggest that we look at some data about the number of wolves with black and gray fur over time to help us explain what might be happening." (Lesson 9, Teacher Guide)

Criterion-Based Suggestions for Improvement:

- Ensure "[a]ll the lesson themes and content are sequenced coherently and explicitly from the student's perspective." (Detailed Guidance, p. 15)
  - Consider strengthening the transition between Lesson Sets 2 and 3 so that students can see how the lessons are logically linked.

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 make sense of the phenomena using only the life science domain.

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

The phenomenon driving the learning can be fully addressed within the Life Science domain. For example,

- Lesson 1, Synthesize, Step 7: "Co-establish with students an initial unit driving question, something similar to, Why do dogs look and act the way that they do? Check to see if this bigger question makes sense to them and document any additions or changes they think needs to be made. Feel free to use terms and phrasing that reflects how your students and class have been talking about the phenomena. Write this unit question, or a similar question that your class develops, at the top of the DQB. Right at the very end of this lesson, you will work with students to broaden this question to, Why do animals look and act the way that they do?" (Lesson 1, Teacher Guide) This question is fully addressed by LS3.A Inheritance of traits and LS3. B Variation of Traits.

- Lesson 4, Synthesize, Step 3: "Work with students to annotate class consensus model with similarities (e.g., the main life stages and processes are similar across organisms) and to note differences (e.g., lifespan, way they are born, etc.). Use check marks to note similarities and cross off/edit parts of the model to note differences. Once annotated, ask students whether this model still only represents canines. Listen for students to suggest that it now represents more animals. Suggest that maybe our consensus model now represents all animals' life cycles." (Lesson 4, Teacher Guide) The phenomenon of animals changing and growing in predictable ways through a life cycle is fully addressed in LS1.B Growth and Development of Organisms
- Lesson 9, Navigate, Step 7: "Stay in the Scientists Circle. Celebrate that it sounds like we figured out some new ideas about how variations in traits among wolves may affect survival and reproduction. Display the class' consensus model. Point to the part of the model where the class concluded that the way a dog looks and acts changes as it develops, these changes are influenced by inherited and learned traits, and helps pet dogs do a job. Display slide Q and give students a moment to think about model revisions. Then, elicit suggestions for updating the model, working toward something like the example below. One key idea to pull out is that if black wolves can survive disease outbreaks, they are more likely to pass on information to have black wolf pups. To show this idea, draw a couple of "generations" onto the model to show passing on of information from parents to offspring, which is what happens for the black wolves of Yellowstone. An example image from the 3.3 Charts and Models deck will appear here in the final layout. Motivate applying our model to all animals. Say something like, We have evidence these ideas help us explain phenomena about pet dogs and wild canines, but we were able to apply our life cycle model to all animals in lesson 4. We haven't tried to apply our new updates to include other animals. Do we think any of the ideas we figured out might apply to them too? Accept all ideas at this point. Share that you are going to update the class' Our Growing Ideas chart with the students' ideas that they shared in this discussion and will bring it back for them to review at the start of the next science class." (Lesson 9, Teacher Guide) The phenomenon of some traits aiding survival is fully addressed by LS4.B Natural Selection.
- Lesson 13, Synthesize, Step 5: "Revise our consensus model through a Consensus Discussion. Display slide H. Gather students in a Scientist's Circle around the consensus model. Point to the Fossil Timeline chart. Use the first prompt on the slide to elicit student ideas to explain which parts of the life cycle might have been disrupted since the wooly mammoth is no longer alive today. After students share a few ideas, ask how we can revise our model to explain why some animals are no longer found today." (Lesson 13, Teacher Guide) The phenomenon of wooly mammoths and other animals being extinct is fully addressed by LS4.A Evidence of Common Ancestry and Diversity.

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

- Answering the question, "Why do animals look and act the way they do?" can be fully addressed through the life science domain.

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 that are used in the unit and support students to see the connections between content areas.

The materials explicitly state the mathematics and ELA standards used in the unit to support students in seeing connections between content areas. The document titled "Traits and Variations SEP-DCI-CCC-ELA-MATH-Matrix" includes a table that lists all the ELA and Math standards claimed to be supported by the lessons throughout the unit.

ELA

CCSS-ELA-LITERACY.L.3.4B Determine the meaning of the new word formed when a known affix is added to a known word (e.g., agreeable/disagreeable, comfortable/uncomfortable, care/careless, heat/preheat). Claimed as explicitly used in Lesson 1, evidence located in Lesson 1.

- Lesson 1, Explore, Step 2, Literacy Supports Callout Box: "Remind students to use words they already know, like "born" and add a prefix like "new" to make a new word, "newborn". This supports students in L.3.4B to determine meaning of new words when a known affix is added to a known word." (Lesson 1, Teacher Guide)

CCSS-ELA-LITERACY.L.3.1G Form and use comparative and superlative adjectives and adverbs, and choose between them depending on what is to be modified.Claimed as explicitly used in Lesson 5, evidence located in Lesson 5.

- Lesson 5, Navigate, Step 1, Literacy Supports Callout: Support students' oral language by modeling and encouraging students to use comparative and superlative adjectives in their discussion of adult dog traits. Students can add -er, -est, or "more" to common adjectives to communicate differences between dog traits (L.3.1G)." (Lesson 5, Teacher Guide)

CCSS-ELA-LITERACY.L.3.5 Demonstrate understanding of word relationships and nuances in word meanings. Claimed as explicitly used in Lesson 6, evidence located in Lesson 6.

- Lesson 6, Explore, Step 3, Literacy Supports Callout: "As students discuss physical and behavioral traits, they are building an understanding of the ways that relationships between words and meanings can change when new words are paired together. Support students in understanding that the word "trait" takes on a different meaning when it is paired with "physical" than when it is paired with "behavioral." Encourage students to share examples of behavioral physical traits they are familiar with as they demonstrate an understanding of relationships between words and nuances in word meanings as you add these terms to your class Word Wall (L.3.5)." (Lesson 6, Teacher Guide)

CCSS-ELA-LITERACY.L.3.1A Explain the function of nouns, pronouns, verbs, adjectives, and adverbs in general and their functions in particular sentences. Claimed as explicitly used in Lesson 7, evidence located in Lesson 7.

- Lesson 7, Explore, Step 2, Literacy Supports Callout: "As students match the jobs and traits they can use familiar adjectives (i.e., description words) to figure out which verbs (i.e., action words) have a linked relationship. For example, students might recognize that dogs with strong muscles might match the action of pulling or protecting which could require strength. Encourage students to use their knowledge of language and word meanings to help them make predictions about the best matches between jobs and dogs (L.3.1A). (Lesson 7, Teacher Guide)

CCSS-ELA-LITERACY L.3.1H Use coordinating and subordinating conjunctions. Claimed as explicitly used in Lesson 7, evidence located in Lesson 7.

- Lesson 7, Synthesize, Step 4, Literacy Supports Callout: "As students co-construct an explanation together, support students to use linking words and phrases (e.g., because, also, another, and, more, but) to make connections among their explanations and evidence to support it. This supports students in sharing coherent explanations, as well as connecting with L.3.1H. Using linking words and phrases encourages students to speak using coordinating and subordinating conjunctions." (Lesson 7, Teacher Guide)

CCSS-ELA-LITERACY.L.3.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening. Claimed as explicitly used in Lesson 14, evidence located in Lesson 14.

- Lesson 14, Synthesize, Step 3, Literacy Supports Callout: "The ability to generate inferences is an important skill for reading and listening comprehension. Support students in developing the knowledge of this linguistic process and applying that knowledge to connect ideas from students' investigations and prior knowledge with information provided in science texts and data. This work supports L.3.3 and helps students make sense of fossils and organisms that lived long ago." (Lesson 14, Teacher Guide)

CCSS.ELA-LITERACY.RI.3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea. Claimed as explicitly used in Lessons 3, 4, and 9. Evidence was located in all claimed lessons.

- Lesson 3, Explore, Literacy Supports: "As the class reads the text together, pause to use prompts to support students in determining the main idea of a text. Push students to identify the main idea using key details, images, or other text clues and explain how these key parts of the text support important ideas in the text (RI.3.2)" (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize, Literacy Supports: "As students work between their data chart and revising their model, they will practice describing the relationship between scientific ideas from the website and on their class data chart. Additionally, students are prompted to use time-based and sequential language in their explanations of animal life cycles and all of this work supports RI.3.2." (Lesson 4, Teacher Guide)
- Lesson 9, Connect, Literacy Supports: "As you read, pause to use prompts to support students in determining the main idea of a text. Push students to summarize the text and support the main idea using key details, images, or other text clues and explain how these key parts of the text support the main idea (RI.3.2)." (Lesson 9, Teacher Guide)

CCSS-ELA-LITERACY.RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. Claimed as explicitly used in Lessons 2, 9, 11, and 13. Evidence was located in all claimed lessons.

- Lesson 2, Explore, Literacy Supports: "Reading the text (A Tale of Two Puppies: The First Eight Weeks of Life) making sense of the information in the text, and answering questions about the text provides an opportunity for students to describe and use language that pertains to a sequence of events from the text (RI.3.3) and use

information gained from illustrations and words in a text to demonstrate understanding of what is read (RI.3.7)." (Lesson 2, Teacher Guide)

- Lesson 9, Explore, Literacy Supports: "This portion of the text describes cause and effect relationships that students can bring with them to make sense of the data in the Synthesize. To support students' reading of the text, cue them to look for keywords that relate to cause and effect (e.g., if/then, because, since, so, cause). Use the prompts to the left to help students reason about the text with a cause and effect lens (RI.3.3, RI.3.8)." (Lesson 9, Teacher Guide)
- Lesson 11, Explore, Literacy Supports: "As students examine images and information across the older evidence, they are describing the relationship between a series of historical events. Support students in using time-based and sequential language as they compare and make sense of different timelines. For example, you might ask if there's something about the art that seems to change as we go back in time, or something about how dogs are represented today compared to the past (RI.3.3)" (Lesson 11, Teacher Guide)
- Lesson 13, Connect, Literacy Supports: "As you pause to check for understanding and ask students questions about the text, ensure that they are referring to words and images in the text. Students should be able to summarize ideas in the text to explain how paleontologists use fossils to understand ancient environments (RI.3.3)." (Lesson 13, Teacher Guide)

CCSS-ELA-LITERACY.RI.3.5 Use text features and search tools (e.g., key words, Calloutes, hyperlinks) to locate information relevant to a given topic efficiently. Claimed as explicitly used in Lesson 3. Evidence was located in all claimed lessons.

- Lesson 3, Explore, Literacy Supports: "As students locate information on the infographic cards, they use text features like headings, tables, symbols (i.e., arrows), and timelines to efficiently locate information in the text that supports sensemaking. This work connects with RI.3.5." (Lesson 3, Teacher Guide)

CCSS-ELA-LITERACY.RI.3.7 Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). Claimed as explicitly used in Lessons 2, 4, 10, and 12. Evidence was located in all claimed lessons.

- Lesson 2, Explore, Literacy Supports: "Reading the text (A Tale of Two Puppies: The First Eight Weeks of Life) making sense of the information in the text, and answering questions about the text provides an opportunity for students to describe and use language that pertains to a sequence of events from the text (RI.3.3) and use information gained from illustrations and words in a text to demonstrate understanding of what is read (RI.3.7)." (Lesson 2, Teacher Guide)
- Lesson 4, Explore, Literacy Supports: "When students read and record information from the website, they practice using information gained from illustrations and the words in a text to demonstrate understanding of the text (RI.3.7)." (Lesson 4, Teacher Guide)
- Lesson 10, Connect, Literacy Supports: "When students read and discuss ideas about their new animals in the text, they practice using information gained from illustrations in a text to demonstrate understanding of the text (RI.3.7). Prompt students to use images of the parents and offspring in the text to make new noticings and to see if ideas from their list help them explain what they notice. This will support students in learning that images have meaning in a text and can be used as evidence as they figure out science ideas." (Lesson 10, Teacher Guide)
- Lesson 12, Connect, Literacy Supports: "Students use information gained from photographs and words in the text to answer questions about how the scientists use evidence to explain how dogs and humans worked together. As students engage in this work, they gain practice with RI.3.7." (Lesson 12, Teacher Guide)

CCSS-ELA-LITERACY.RI.3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence). Claimed as explicitly used in Lesson 9. Evidence was located in all claimed lessons.

- Lesson 9, Explore, Literacy Supports: "This portion of the text describes cause and effect relationships that students can bring with them to make sense of the data in the Synthesize. To support students' reading of the text, cue them to look for keywords that relate to cause and effect (e.g., if/then, because, since, so, cause). Use the prompts to the left to help students reason about the text with a cause and effect lens (RI.3.3, RI.3.8)." (Lesson 9, Teacher Guide)

CCSS-ELA-LITERACY.W.3.5 With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing. Claimed as explicitly used in Lesson 8. Evidence was located in all claimed lessons.

- Lesson 8, Synthesize, Literacy Supports: "Peer review and feedback offers students the opportunity to develop and strengthen their written explanation by revising and editing it. This work supports W.3.5 and students gain practice writing clear scientific explanations that are supported with evidence." (Lesson 8, Teacher Guide)

CCSS-ELA-LITERACY.SL.3.1B 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 explicitly used in Lessons 1 and 11. Evidence was located in all claimed lessons.

- Lesson 1, Synthesize, Literacy Supports: "In Lesson 1, as we share our initial explanations and voice our questions, it is helpful to check in on class agreements and encourage our community to follow the 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). This will support students in practicing SL.3.1B as they follow agreed-upon rules for discussions and further cultivate a safe community for learning science together." (Lesson 1, Teacher Guide)
- Lesson 11, Synthesize, Literacy Supports: "In this lesson, as we share our initial models and voice our questions, it is helpful to check in on class agreements and encourage our community to follow the 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). This will support students in practicing SL.3.1B as they follow agreed-upon rules for discussions and further cultivate a safe community for learning science together." (Lesson 11, Teacher Guide)

CCSS-ELA-LITERACY.SL.3.2 Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally. Claimed as explicitly used in Lesson 10. Evidence was located in all claimed lessons.

- Lesson 10, Synthesize, Literacy Supports: "Allow students to share specific details from the text about their animals during the Consensus Discussion. For example, they might share a special color change that occurs during development or describe a unique piece of information about their animal (diet influences if a poison frog is poisonous or not). Use questioning strategies to help them summarize a main idea from those special details (SL.3.2), which will help bring the class back to revising Our Growing Ideas chart based on the new evidence we have." (Lesson 10, Teacher Guide)

CCSS-ELA-LITERACY.SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. Claimed as explicitly used in Lesson 7. Evidence was located in all claimed lessons.

- Lesson 7, Navigate, Literacy Supports: "In addition to helping students connect what they are investigating in science to their lives outside of school, encouraging students to share their prior experiences is one way they can gain experience organizing their oral language in preparation for presenting their ideas to others. Encourage them to share descriptive details and speak clearly as they share their prior experiences with the topic (SL.3.4)." (Lesson 7, Teacher Guide)

Mathematics

CCSS-MATH-Practice.MP1 Make sense of problems and persevere in solving them. Claimed in Lesson 11. Evidence was found in lesson 11. Examples include:

- Lesson 11, Explore, Step 2: "Display slide E and explain how scientists and other people who investigate the past use timelines to figure out how long ago different things occurred or the age of artifacts they find. Invite students to point out how a timeline is similar to the number lines they have seen in math." Students make sense of a timeline creation problem.

CCSS-MATH-Practice.MP4 Model with mathematics. Claimed in Lessons 5, 11, and 12. Evidence was found in Lessons 5, 11, and 12. Examples include:

- Lesson 5 slide deck slide K: "As a class, organize the trait data into graphs. What traits did we observe in the Lab parents and their puppies? What traits did we observe in the Poodle parents and their puppies?" Students use bar graphs to model the presence of certain traits among different members of a dog family.
- Lesson 11, Explore, Step 2: "Orient students to the scale of the next timeline representation by showing them one unifix cube and telling them it represents 100 years, or most of the time on Timeline for People and Dogs. Ask students how many unifix cubes they would need to represent 1000 years. Then hold up the string that has 10 unifix cubes in two alternating colors every 5 cubes strung onto it and choral count by 100 years for each unifix cube to confirm students' ideas that 10 unifix cubes represent 1000 years. Label the leftmost cube on the timeline with the paper tent labeled "1000 years ago." Secure the timeline to the wall, or lay it on the floor in the middle of the scientists circle. Collaborate with students to decide what should be labeled on the timeline and where the labels should be placed to support their gaining a clear understanding of the spatial representation of time on the timeline." Students model the passage of time with a scaled timeline.
- Lesson 12, Explore, Step 3: "Ask students how using a timeline could help us. Listen for at least some students to say that it would help us understand how long ago or how far back in time these fossils were from, since our question is about how long ago dogs and humans started working together." Students model the passage of time with a scaled timeline.

CCSS-MATH-Practice.MP5 Use appropriate tools strategically. Claimed in Lessons 9, 12, 13, and 14. Evidence was found in Lessons 9, 12, 13, and 14. Examples include:

- Lesson 9, Explore, Step 5: students use unifix cubes to represent relative amounts of two colors of wolves "Ask students to use their experiences with tables in math class to look at the data table and share what types of information it shows, such as the year and the number of wolves with gray fur compared to the number of wolves with black fur by using unifix cubes to model the relative amount of wolves for each year"
- Lesson 12 Connect, Step 5 Math Supports Callout: "A millions place value mat can support students in using place value as a tool to conceptualize and compare different time periods, from 8 years ago (when they were born) to 1/10th of a unit years ago years old (1,000 years) ago to 3 units ago years old (30,000 years ago) (dogs), to 30 units ago years old (300,000 years ago) (humans), to 6500 units ago (65,000,000 years ago) (dinosaurs)." The lesson notes that 'millions' is a concept beyond the grade band.
- Lesson 13, Explore, Step 3: Students use a timeline as a tool to visualize amounts of time. "Add to the Fossil Timeline chart by co-constructing additional timelines for the wooly mammoth similar to how you did this before for humans and dogs. First, invite students to identify how long ago or how many units correspond to each piece of evidence we have for the wooly mammoth. Mark the appropriate places on the timeline, then color in the interval to represent the time period that we have evidence that the wooly mammoth lived on Earth."

- Lesson 14, Explore, Step 2: Math Supports sidebar: "A millions place value mat (see the Place Value Mat handout) can support students in using place value as a tool to conceptualize and compare different time periods, from 3 units ago years old (30,000 years ago: dogs), to 30 units ago years old (300,000 years ago: humans), to 5,000 units ago (50,000,000 years ago: the fossils from Fossil Butte in this lesson)."

CCSS-MATH-Practice.MP6 Attend to precision. Claimed in Lessons 3 and 11. Evidence was found in Lessons 3, 11, and 12. Examples include:

- Lesson 3 students grapple with the concept of puppies having a weight at zero months old. Explore, Step 2 Math Support Callout: "Students will likely notice the dogs have a weight when they are 0 months old while exploring the infographics. Explain that when the puppies are born, they have been alive for 0 months but will weigh more than 0 pounds, which supports students in being precise with their measurements of age and weight as they later compare different types of canines." (Teacher Guide, Lesson 3)
- Lesson 11 students work together to be precise about placing dates on timelines. Explore Step 2: "As a class, work together to annotate the timeline to visualize these relative differences in time. Project slide F and use sticky notes on the screen, or use a document camera to project a copy of the Timeline for People and Dogs handout to annotate it with personal events. Work with students to calculate how many "years ago" some of the events on the timeline occurred and add these annotations to the timeline." (Teacher Guide, Lesson 11)
- Lesson 12 students co-create a longer timeline and consider how to be precise about scale: Explore Step 3 Math Supports Callout: "Students use a scaled timeline, or number line, where each unit (i.e., piece of paper, tile, or tickmark) represents 10,000 years. The scaled timeline is a tool to help students conceptualize how long ago some of the evidence comes from in relation to other evidence and the present (MP5). Students' analysis and interpretation of their models is supported on slide G where students consider what the length of the time spans tells us about the history of dogs and humans (MP4)." (Teacher Guide, Lesson 12)

CCSS-MATH-Practice.MP7 Look for and make use of structure. Claimed in Lesson 9. Evidence was found in Lesson 9. Examples include:

- Lesson 9, Explore, Step 5: "Introduce graphs as a tool to visualize data. Display slide M. This graph represents data they may be familiar with from Unit 3.2. Remind students the purpose of looking at this data is to figure out if one fur color gives an advantage to wolves for surviving and reproducing. By looking at data, we can see if one fur color is more common than the other over time." (Teacher Guide, Lesson 9) Students create a graph and use it to seek patterns of change in wolf fur colors over time.

CCSS-MATH-3.NF.A.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. Claimed in Lesson 9. Evidence was found in Lesson 9. Examples include:

- Lesson 9, Explore, Step 5, Math Supports Callout: "manipulatives like 10 unifix cubes can represent the whole group of 100 wolves, with cubes showing proportional, relative amounts (e.g. 6 gray = 6/10 or 60%; 4 other = 4/10 or 40%). As the frequency changes, the number of total cubes remains the same, but the distribution will change" (Lesson 9, Teacher Guide)

CCSS-MATH-3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).* Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.** (*Excludes compound units such as cm3 and finding the geometric volume of a container. **Excludes multiplicative comparison problems (problems involving notions of "times as much").) Claimed in Lesson 3. Evidence was found in Lesson 3. Examples include:

- Lesson 3, Explore, Step 2 Math Supports Callout: "Students will use subtraction to calculate height (in inches) and weight (in pounds) differences to answer the one-step question, 'How much have I grown?' while completing the A Canine's Life Handout." Students are solving problems including units of measure, but are not making or estimating the measurements themselves.

CCSS-MATH-3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets. Claimed in Lesson 9. Evidence was found in Lesson 9. Examples include:

- Lesson 9, Explore, Step 5: "Explain that we will work together as a group to build a special kind of graph called a scaled pictograph. Divide students into small groups to have 8 groups total and pass out one copy of Wolf Data Sheet to each student. Assign each student in a group a year. Each student should complete two data strips for their year, one for each fur color. Show students where to get the materials needed for cutting and coloring their data strips. Point out the importance of talking as a group and coming to an agreement before coloring and cutting the data strip. Allow time for students to complete their data strips and then complete the group graph. Circulate between groups to offer guidance as necessary. As groups finish, ask them to add their data strip to the appropriate location on the group graph." (Teacher Guide, Lesson 9) Students use the graph to explore how wolf numbers change over time.
- Lesson 9, Synthesize, Step 6: "Help students visualize the general change over time of increases in the number of wolves with black fur and decreases in the number of wolves with gray fur. You can do this by asking student volunteers to come up and use their fingers to trace the pattern they see in the wolf population for different fur colors using the sample graph in Relative Frequency of Fur Color Over Time Graph or a graph from a group. You could also ask all students to trace an imaginary line in the air to show what is happening to the number of wolves with black fur, and then what happens to the number of wolves with gray fur. You can follow up by marking the lines on the sample graph in Relative Frequency of Fur Color Over Time Graph to make visualizing the trend more accessible for all students." (Teacher Guide, Lesson 9) Students co-create a scaled picture graph showing different wolf fur colors over time, though they do not draw it themselves, and they do not create a separate scaled bar graph.

Criterion-Based Suggestions for Improvement: N/A

CATEGORY II

NGSS Instructional Supports

II.A. Relevance and Authenticity

EXTENSIVE

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

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

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

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

The reviewers found **extensive** evidence that the materials engage students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world, because throughout the unit, students experience phenomena or design problems as directly as possible. The materials include suggestions for how to connect instruction to students' homes, neighborhoods, communities, and/or cultures, where appropriate. The materials do provide opportunities for students to connect their explanation of a phenomenon and/or their design solution to questions from their own experiences.

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

Several lessons throughout the unit include videos or books that support the students in experiencing the phenomena as directly as possible. For example,

- Lesson 1, Explore, Step 2: "Make further observations of newborns. Display slide D. Point out that the photos helped us observe some things about how these puppies look, but not about how they act. Videos can help us observe more about them. Play the Newborns Group A and Newborns Group B videos (probably more than once) and give students time to notice and wonder with a partner. Invite students to share aloud and chart their noticings on the Notice and Wonder chart." (Lesson 1, Teacher Guide)
- Lesson 2, Explore, Step 2: "Transition to watching a video. Acknowledge that we have made some helpful predictions about what we think happens as a puppy grows into an adult, but we are not sure if that will be the same for domesticated and wild canines. Recall that we had other ideas about how we could investigate this more, and tell students you have a video we can watch of domesticated puppies over several weeks to make more observations." (Lesson 2, Teacher Guide)
- Lesson 6, Explore, Step 3: "Share with students that you have a video of a puppy from a different breed doing the same retrieving and umbrella test as we observed for the Labradors. As a class, watch the Puppy Retrieving Test video for the retrieving and on slide O the Puppy Umbrella Test video. It is the same puppy in both videos." (Lesson 6, Teacher Guide)
- Lesson 7, Explore, Step 3: "Motivate looking at videos of dogs learning jobs. Using students' ideas about how dogs might learn jobs (e.g., dog training and dog trainers), share with them that you have two videos that show dogs learning two of the jobs - guide dog and sled dog dogs. Ask students to remind us (using their job cards if needed) what a guide dog and sled dog do in their communities." (Lesson 7, Teacher Guide)

- Lesson 9, Explore, Step 3: "Observe more traits using a video. Display slide F. Explain that sometimes it can be hard to observe behaviors by looking at pictures or reading text. Scientists try to make observations using many different sources, so we will watch a short video to add to our observations. Share with students that this is a video of wolves in Yellowstone National Park. Explain that a video camera was used to record the wolves without any people around. This allows scientists to observe how the wolves look and act in the wild. Point out the two questions on the slide." (Lesson 9, Teacher Guide)
- Lesson 10, Connect, Step 2: "Organize students into groups. Display slide E. Point out that there are several types of animals for us to investigate by gathering evidence from a book that you happen to have about animal families. Ask students if any of the animals on the slide are one of their special animals. If so, we can find out more about their special animals. If none of the animals pictured are their special animal, remind them that we have a wide variety of animals to investigate using the book, and they can choose one that's most interesting to them." (Lesson 10, Teacher Guide)
- Lesson 12, Connect, Step 2: "Distribute Comparing Fossils Infographic and a highlighter to each pair of students and show slide C. Have partners analyze the infographic What are Fossils by discussing the questions on the slide. While students discuss, direct the partners to highlight passages they would use as evidence for the slide prompts. Once students have had enough time to analyze the infographic, show slide D and have students share what they found about fossils." (Lesson 12, Teacher Guide)
- Lesson 14, Explore, Step 2: "Share with students that fossils are found all over the world, but that in the U.S., we have some very special places where many fossils are found, and all the fossils we will explore today are from this one location. Display slide E. Point out Wyoming and your own community on the map. If time and experiences permit, invite students to share if they have visited Wyoming before and what it is like there (i.e., mountains or flat area, forests or grasslands, etc.). Explain that Fossil Butte (pronounced BYOOT) National Monument is a public land that anyone can visit and many fossils are found here and are protected. Remind students that we are wondering how fossils can help us figure out what this place was like long ago. Ask students to observe the photos and turn and talk to share their descriptions of this place today." (Lesson 14, Teacher Guide)

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

Suggestions for connecting with students' lives beyond the classroom are featured throughout the lessons in this unit. For example,

- Lesson 1, Connect, Step 9: "Think about personal experiences with animals that are special to us. Display slide DD. Give students time to think about animals that are special to them or ones they find fascinating." (Lesson 1, Teacher Guide)
- Lesson 2, Explore, Community Connections: "Some of your students may be familiar with village dogs or 'feral' or free-ranging dogs. Discussing the terms 'domesticated' and 'wild' will allow you to identify that some dogs might fall somewhere in between the two kinds we named, and that's OK. You can use this moment to talk about how some things do not always fit neatly into categories and might be better represented on a continuum between more or less wild and domesticated." (Lesson 2, Teacher Guide)
- Lesson 3, Navigate, Step 6: "Introduce the Sharing Community Examples-Lifecycles handout. Go over the Sharing Community Examples-Lifecycles handout with students and explain how they can use it to document stories and/or observations in their communities. Tell students that you are excited to hear their home stories." (Lesson 3, Teacher Guide)

- Lesson 4, Navigate, Community Connections: "Some students in your class may not have pet dogs. Instead, they may have a different kind of pet (e.g., cat, lizard, fish) and/or livelihood connected to animals (e.g., ranching, farming). This lesson is an opportunity to elevate their experiences with these other kinds of animals and observations they have made. Use their observations and experiences as a source of information and evidence the class can work with." (Lesson 4, Teacher Guide)
- Lesson 7, Explore, Community Connections: "If you or a student has access to a person who has service dogs or trains service dogs or other dogs for specific jobs, this lesson is a great opportunity to connect with community members to hear firsthand how learning/training happens. Invite them to speak to the class and/or collect questions from students and interview them, bringing back their responses to students." (Lesson 7, Teacher Guide)
- Lesson 8, Explore, Step 2 Community Connections leverages student experiences with card games; "Students may have experiences with sports trading cards or trading card games (TCG's). For example, baseball and hockey sports player cards include statistics and TCG game characters have cards with information and descriptions of certain powers, etc. Leverage your students' prior experiences with trading cards as you orient them to the dog breed cards and prepare to sort and classify based on characteristics and traits." (Lesson 8, Teacher Guide)
- Lesson 10, Synthesize, Community Connections: "This lesson is a great opportunity to connect to students' interests and experiences with other animals and bring in the rich and diverse sources of knowledge from students' families. Allow students time to work on and/or take home the Special Animal Survival Trait community connection page, and then share their ideas about their Special Animal with classmates, such as in a gallery tour." (Lesson 10, Teacher Guide)
- Lesson 11, Explore, Step 2, Broadening Access: "For this lesson, we will consider how far back people and dogs have lived and worked together. This then motivates us to look back in time to find out more about the types of animals alive today, the ones alive a long time ago, and that some of those are no longer living today. As students have a range of experiences with historical events, particularly as it pertains to when certain animals lived in the past, supporting them to actively listen to other ideas and perspectives will benefit the class as they develop models during this lesson. Encourage contributions from a broad range of perspectives to include knowledge about past dog-human interactions from a variety of cultures." (Lesson 11, Teacher Guide)
- Lesson 12, Connect, Step 2, Community Connections: "Facilitate a conversation about laws and guidelines regarding the removal of artifacts on public or private lands and the principles of 'Leave no trace'. It is important that students understand fossils and ancient artifacts are under special protection and should not be removed from where they are found. More information and resources are provided in the unit front matter." (Lesson 12, Teacher Guide)
- Lesson 13, Navigate, Step 1, Broadening Access: "Communities around the world have important norms and cultural traditions about observing ancestral art and digging and removing cultural artifacts such as remains and fossils. It is important to validate student identities and honor their traditions by recognizing that some students may choose not to participate in the activity due to cultural norms and beliefs concerning the viewing of ancestral art, bones, fossils, and other ancient artifacts. It is important to connect with families in advance about what is appropriate for their child's learning...Remind students that when we view fossils, we should approach them with an attitude of respect and gratitude, acknowledging that these once-living organisms can teach us important things about what life was like on Earth long ago." (Lesson 13, Teacher Guide)
- Lesson 14, Explore, Step 2: "Introduce a new location. Share with students that fossils are found all over the world, but that in the U.S., we have some very special places where many fossils are found, and all the fossils we will explore today are from this one location. Display slide E. Point out Wyoming and your own community on the map. If time and experiences permit, invite students to share if they have visited Wyoming before and what it is like there (i.e., mountains or flat area, forests or grasslands, etc.)." (Lesson 14, Teacher Guide)

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

Students are provided opportunities to connect their explanation of a phenomenon to their own experiences. For example,

- Lesson 1, Connect, Step 1: "Write and draw about the chosen animal. Keep slide DD displayed and distribute 1 copy of My Special Animal to each student. Ask students to draw their animal and to write in their language of choice about what makes the animal special to them, including identifying something about the way it looks or behaves that they find interesting." (Lesson 1, Teacher Guide)
- Lesson 2, Navigate, Step 2, Community Connections: "Some of the students may be familiar with village dogs, or "feral," or free-ranging dogs. Discussing the terms "domesticated" and "wild" will allow you to identify that some dogs might fall somewhere in between the 2 kinds we named, and that is OK. You can use this moment to talk about how some things do not always fit neatly into categories and might be better represented on a continuum between more or less wild and domesticated." (Lesson 2, Teacher Guide)
- Lesson 3, Connect, Step 5, Community Connections: "To help students maintain interest, it's important to connect what students figure out about the canine life cycle back to the animal they consider special (see Lesson 1). Asking students to make predictions based on what they figured out in this lesson helps to center the storyline around the student's own line of inquiry and generates excitement and motivation for the next lesson." (Lesson 3, Teacher Guide)
- Lesson 6, Connect, Community Connections: "During this Connect, students hear from an expert about specific dog instincts that might help make them successful service dogs. Many students will have personal and/or community experiences with service dogs or others like police K-9s that will be critical knowledge for the class to draw on as they make sense of how behaviors help dogs be successful at different jobs." (Lesson 7 Teacher Guide)
- Lesson 8, Explore, Community Connections: "Students may have experiences with sports trading cards or trading card games (TCG's). For example, baseball and hockey sports player cards include statistics and TCG game characters have cards with information and descriptions of certain powers, etc. Leverage your students' prior experiences with trading cards as you orient them to the dog breed cards and prepare to sort and classify based on characteristics and traits." (Lesson 8, Teacher Guide)
- Lesson 9, Connect, Step 2: "Share our experiences. Display slide C. Introduce National Parks as places people can visit to experience nature that is far away from cities. Ask students to share what they know about National Parks, including things they may have read about or seen in movies, places they (or people they know) may have visited, and any other information they want to share related to National Parks or experiences in nature." (Lesson 9, Teacher Guide)
- Lesson 13, Navigate, Step 7: "Ask questions about other extinct animals and plants. Display slide M. Point to the word "extinct" on the Word Wall and use the first prompt on the slide to ask students to share any experiences or stories they have with other animals or plants that used to live on Earth but are no longer found anywhere. Students may have experiences to share about animals or plants of the present day that are facing extinction." (Lesson 13, 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 give students opportunities to negotiate new understandings by clarifying their own ideas and comparing them to those that their peers encountered in the learning experience(s). The materials offer opportunities for students to justify or build upon their ideas and support students in reflecting on others' ideas, as well as helping students change or reconsider their own ideas.

The teacher has support to facilitate students expressing, clarifying, and/or justifying their ideas. Examples include:

- Students justify their ideas as they support claims with evidence. Elements of the Engaging in Argument from Evidence practice are a major focus of this unit; see I.B SEPs above for additional evidence.
- Throughout the unit, teachers are given prompts to use to elicit student ideas, in every lesson, that are located in tables with headings "Prompts to Use", "Ideas to Look and Listen For," and "Follow-up Response". For example:
  - Lesson 2, Explore, Step 2: "Prompts to use...How are the adults different from the older puppies? Ideas to Look and Listen For...They're just bigger. Maybe the adults can run faster, see better, bark louder? They don't need their parents. The wolves can live on their own. Possible Follow-up Responses...What makes you think that? What questions do you have about that?" (Lesson 2, Teacher Guide)
  - Lesson 7, Explore, Step 2: "Prompts to use...If they have helpful traits for a job, can they just do the job right away? Ideas to Look and Listen For...No, they have to learn it. Yes, maybe because it's instinct. Follow-up Response...Do we think all golden retrievers [kind of dog] can do the lifeguard job [kind of job]? Why or why not?" (Lesson 7, Teacher Guide)
  - Lesson 13, Explore, Step 3: "Prompts to use...Looking at our timeline, what do you think the environment might have been like long ago when dogs and humans started working together? Ideas to Look and Listen For...It was probably cold. There were plants. We said it was cold for the mammoths so it must have been cold for the humans and dogs, too. The dogs had fur, too, so maybe it was cold for them. It was at the same time, so the environment was the same. Possible Follow-up Responses...What evidence from the fossils support this idea?" (Lesson 13, Teacher Guide)

Students represent their reasoning with written words, pictures, data charts, and models in several lessons. For example,

- Lesson 1, Synthesize, Step 3: "Develop an individual initial model. Use slide I to review what modeling is if your students are unfamiliar with this practice. Display slide J and distribute the Initial Model handout and read the directions and prompts aloud. Give students time to explain how the newborns and adults they observed look and behave differently. Remind students that "how" questions ask for the ways something happens, so they should describe details about the ways newborns and adults are different. If they have ideas about reasons why that happens, they can explain those, too." (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 6: "Set the purpose of modeling. Display slide L for reference. Reestablish that models help us explain how or why something happens, and developing models can help us figure out what we still do not know. Now, we want to develop a model to help us describe what we have figured out so far and can help us try to explain why a newborn canine becomes an adult that looks and acts the way it does." (Lesson 2, Teacher Guide)

- Lesson 3, Explore, Assessment Opportunity: "During the task A, Canine's Life, students work in groups to obtain information from research cards to construct a representation of the life stages and processes for their assigned canine. The 52 Ratings Table 3rd Grade, Dogs (Trait Variations), August 2024 representation becomes a model that helps students explain how a canine changes during its lifetime." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize, Step 5: "Introduce a new phenomenon. Display Slide K. Tell students that they will have the opportunity to use what they have learned about the life stages of other animals to make predictions about a newly discovered animal. Distribute New Animal Predictions and read through the scenario and questions. Ask students if they have any questions about the scenario or prompts. Give students 15 minutes to work individually on questions 1-3. Tell students they can refer back to their previous work, the Class Consensus Model, and Our Growing Ideas chart as evidence. As students work, you can challenge their thinking with questions like: How does that data/evidence support your claim? Did you consider the patterns true for other animals?" (Lesson 4, Teacher Guide)
- Lesson 9, Explore, Step 3: "Make observations about wolf traits using data cards. Display slide E. Introduce the Wolf Cards as a tool that we can use to help us figure out some information about the traits of wild canines. Preview with students what kinds of information they will find in these new texts. Also, set up the class data chart, Wolf Traits and Variations chart." (Lesson 9. Teacher Guide)
- Lesson 11, Synthesize, Step 3: "Develop an individual initial model. Display slide R. Tell students that they will individually create a model that answers the question, How have people and dogs been working together over time? Distribute Dogs Working With People Through History to each student. Read the directions from the slide or the more detailed instructions on the handout. For the first step, students choose a point on the timeline from "Long Ago" that they will compare to "Today", which represents everything students know about how people work with dogs from previous lessons. For the second step, students create a model to describe how people and dogs worked together today and long ago. Encourage students to use a combination of drawings, symbols, words, and numbers as part of their model." (Lesson 11, Teacher Guide)

The Class Our Growing Ideas chart illustrates how the class's overall understanding is changing and growing. This chart is updated based on student discussions of their investigations, and/or referred back to, in Lessons 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, and 14. For example:

- Lesson 4, Synthesize, Step 4: "Place Our Growing Ideas chart next to the revised An Animal's Life model and Our Animal Life Stages chart. Add the lesson question to the "Our Questions" column of the chart: How do other animals change over their lifetime? Invite students to help you write, sketch, or add images to record the class ideas on the chart. Record ideas we figure out through a Consensus Discussion. Use the prompts on the slide J and below to elicit student ideas that synthesize what we have figured out about the stages of life experienced by all animals. Wait to record student ideas onto the chart until multiple students have responded to a prompt so that you can synthesize an idea. As students share ideas, ask the class if we are all in agreement before you synthesize ideas on the Our Growing Ideas chart." (Lesson 4, Teacher Guide)
- Lesson 10, Synthesize, Step 3: "After students have articulated the patterns they notice, revise or annotate Our Growing Ideas chart with language to help generalize the idea beyond just canines if the idea helps explain other kinds of animals, too. Use a Consensus Discussion to facilitate this revision to ideas. Explain to students that the goal of this Consensus Discussion is to agree on what we have figured out so far from the data. The term consensus means to agree together. Tell students that it will be important for them to share their ideas along with the evidence that supports them and think carefully about the ideas and evidence others share, so we can decide if we agree or not. Wait to revise ideas until multiple students have responded so that you can synthesize their ideas for the revision to be made. Ask the class if we are all in agreement before you revise. If you revise ideas by paraphrasing, check back with students who shared to confirm that you captured what they meant. Invite students to help you write, sketch,

or add images from the Unknown material with identifier: tv.l10.tref reference to record the class ideas on the chart." (Lesson 10, Teacher Guide)

- Lesson 13, Synthesize, Step 5: "Update Our Growing Ideas Chart again. Display slide I. Transition to updating the Our Growing Ideas chart by suggesting we record what we figured out about mammoths. Ask students to identify any of their questions from the [DQB] that they think we have answered and move those sticky notes underneath the lesson question. Wait for several students to share their ideas to the prompts on the slide before adding ideas to the Our Growing Ideas chart. Your chart will reflect the language that your students use. Invite students to help you write, sketch, or add images from the Unknown material with identifier: tv.l13.tref reference to record the class ideas on the chart." (Lesson 13, Teacher Guide)
- An optional "My Growing Ideas" chart allows individual students to track changes in their thinking over time. Lesson 2 Preparation Checklist: "In third grade OpenSciEd units include a class-level Our Growing Ideas chart similar to the units in K-2, which your class will begin in this lesson. However, if students are ready to begin tracking their ideas individually or in combination with a class-level chart, print a My Growing Ideas handout for each student. Use this handout periodically throughout the unit to give students space to individually reflect on the progress of their ideas over time." (Lesson 2, Teacher Guide)

Students receive constructive feedback from both the teacher and peers. For example,

- Lesson 4, Explore, Step 2: "Provide peer review and feedback. Display slide F. When students complete their individual work on their special animal, ask students to trade handouts and read each other's ideas. Using Giving and Receiving Feedback ask students to give their 1-2 feedback ideas to their partner. Consider also having a quick conversation about why feedback is important to our learning (see example below)." (Lesson 4, Teacher Guide)
- Lesson 8, Synthesize, Step 4: "Set the purpose and give directions for peer feedback. Display slide F. Explain that when we're learning how to do anything, getting feedback about what we're doing well and what we can still do better is super helpful. So as we figure out how to construct explanations, it will be helpful to share them with partners and get and give feedback that we can then use to improve our explanations." (Lesson 8, Teacher Guide)
- Lesson 13, Synthesize, Step 6: "Students should partner up, quietly read their partner's explanations, and then discuss with each other to exchange feedback. Leverage sentence starters presented to help multilingual students develop English language skills all the while expressing their ideas to peers. After feedback is complete, students have an opportunity to reflect on what they would add or change about their explanations and ask for help from you. Give students time to make changes to their assessment using a different color." (Lesson 13, Teacher Guide)
- Teachers and students work together to revise ideas on the class Life Cycle model, documenting students' thinking changes over time. For example:
  - Lesson 4, Synthesize, Step 3 Developing and Using Models Callout: "This is an important move to help students experience what it is like to revise a model with new information. Show students that we can annotate a model to note how the model needs to be revised given new evidence. Later in the lesson, you will revisit this "messy" annotated model to make a plan for revising it." (Lesson 4, Teacher Guide)
  - Lesson 9, Navigate, Step 7: "Display the class' consensus model. Point to the part of the model where the class concluded that the way a dog looks and acts changes as it develops, these changes are influenced by inherited and learned traits, and helps pet dogs do a job. Display slide Q and give students a moment to think about model revisions. Then, elicit suggestions for updating the model, working toward something like the example below. One key idea to pull out is that if black wolves can survive disease outbreaks, they are more likely to pass on information to have black wolf pups. To show this idea, draw a couple of "generations" onto the model to show passing on of information from parents to offspring, which is what happens for the black wolves

of Yellowstone. An example image from the 3.3 Charts and Models deck will appear here in the final layout. Motivate applying our model to all animals. Say something like, We have evidence these ideas help us explain phenomena about pet dogs and wild canines, but we were able to apply our life cycle model to all animals in lesson 4. We haven't tried to apply our new updates to include other animals. Do we think any of the ideas we figured out might apply to them too? Accept all ideas at this point" (Lesson 9, Teacher Guide)

- Lesson 13, Synthesize, Step 5: "Revise our consensus model through a Consensus Discussion. Display slide H. Gather students in a Scientist's Circle around the consensus model. Point to the Fossil Timeline chart. Use the first prompt on the slide to elicit student ideas to explain which parts of the life cycle might have been disrupted since the wooly mammoth is no longer alive today. After students share a few ideas, ask how we can revise our model to explain why some animals are no longer found today." (Lesson 13, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

II.C. Building Progressions

EXTENSIVE

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

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

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

The reviewers found **extensive** evidence that the materials identify and build upon students' prior learning in all three dimensions. The materials explicitly identify prior learning expected for all three dimensions, although it is not at the element level. The supports to teachers clearly explain how the prior learning will be built upon. The materials provide explicit support to teachers in clarifying their understanding of potential alternate conceptions that they or their students may hold during the unit.

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

The materials contain the Unit Overview document that features a section titled, "What ideas and experiences will my students bring that can help them in this unit." It contains some of the expected learning that students will come to third grade. For example,

Disciplinary Core Ideas:

LS1.B-E1 Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

- 3.3 Trait Variations Unit Front Matter: "What Ideas and Experiences Will Students Bring That Can Help Them In This Unit? In first grade students will learn that adult plants and animals have young and that sometimes animal parents and the young engage in behaviors to help the young survive (1-LS1-2). Note that plant life cycles are taken up in Unit 3.2: Why do plants only grow well in certain places, and how can we protect them?"
- 3.3 Trait Variations About the Science: "Across the unit, reproduction continues to surface as a critical process in which information is passed from parents to offspring, which influences how offspring look and act and the observable variation in physical and behavioral traits, as well as ultimately ensuring that this kind of animal does not

go extinct. Leverage what students bring from first grade - that adult animals can have young and that adults and young engage in behaviors to survive - to help build this understanding that offspring may need help from parents at first (first grade science idea), but grow and develop to become more independent and able to survive on their own."

LS3.A-E1 Many characteristics of organisms are inherited from their parents.

- 3.3 Trait Variations Unit Front Matter: "What Ideas and Experiences Will Students Bring That Can Help Them In This Unit? Formally, students will learn about traits in first grade as they investigate why young plants and animals are very much alike, but not exactly the same, as their parents (1-LS3-1). In the OpenSciEd program, this learning experience occurs in Unit 1.4: How do the ways plants and animals look and act help them live?. In first grade students only make noticings of the traits and compare them between parents and offspring but they do not explain why there are some similarities and differences. This will happen in 3rd grade. Students do not develop understanding of 'genes' until middle school."
- 3.3 Trait Variations About the Science: "In first grade students make observations between parent plants and animals and their offspring to conclude that they look very similar but not identical. While students are observing 'traits' to draw conclusions, they do not use this terminology. You will introduce this term to students in Lesson 5 as a scientific word to describe things they have already been observing about living things."

LS3.A-E-2 Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.

- 3.3 Trait Variations About the Science: "In first grade, students observe similarities and differences between parents and offspring but do not explain how or why offspring look similar to parents, and also slightly different. They do lay foundational ideas for "kinship" that related plants and animals look similar to each other. How and why this occurs is new for 3rd grade. In 3rd grade students develop an understanding of "inherited information" passing from parents to offspring that influences how offspring look and act. Students expand on first grade ideas by moving beyond observable physical traits to observable behavioral traits."

LS3.B-E1 Different organisms vary in how they look and function because they have different inherited information.

- 3.3 Trait Variations About the Science: "Similar to inheritance, students will learn in first grade that individuals of the same kind of plant and animal share similarities but also vary in different ways. In first grade, students don't explain how or why there is variation, whereas in 3rd grade students start to lay foundational ideas about how this works."

LS3.B-E2 The environment also affects the traits that an organism develops.

- 3.3 Trait Variations About the Science: "In first grade, students observe similarities and differences between parents and offspring but do not explain how or why offspring look similar to parents, and also slightly different. They do lay foundational ideas for "kinship" that related plants and animals look similar to each other. How and why this occurs is new for 3rd grade. In 3rd grade students develop an understanding of "inherited information" passing from parents to offspring that influences how offspring look and act. Students expand on first grade ideas by moving beyond observable physical traits to observable behavioral traits."

LS4.A-E1 Some kinds of plants and animals that once lived on Earth are no longer found anywhere.

- Materials do not identify how prior learning will be built upon within this DCI.

LS4.A-E2 Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.

- 3.3 Trait Variations Unit Front Matter: "What Ideas and Experiences Will Students Bring That Can Help Them In This Unit?: During second grade they will learn more about the many different kinds of living things that exist in places on land and in water (2-LS4-1). These prior experiences and ideas will be helpful to leverage in Lessons 13 and 14 as students use fossil evidence of plants and animals long ago to make sense of what the environment may have been like."

LS4.B-E1 Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.

- 3.3 Trait Variations Unit Front Matter: "What Ideas and Experiences Will Students Bring That Can Help Them In This Unit? In science class, students learn about plants and animals meeting their needs for food and water (and light for plants) during kindergarten (K-LS1-1)." "In the context of wild canines, differences in traits are critical to survival and, ultimately, reproduction in order to pass along information to new generations. Students will not have prior formal learning of these ideas from K-2."

Science and Engineering Practices:

Developing and Using Models - claimed as Intentionally Developed.

- 3.3 Trait Variations Unit Front Matter: "Students engaged with the practice of modeling in Units 3.1 and 3.2. Developing and Using Models will be further developed in Unit 3.4: Why do living things live where they do and what should we do when it changes? when students use system models to explain how plants and animals in a system interact with each other and respond to change."
- The materials do not identify element-level expectations for prior learning for any claimed MOD element.

Analyzing and Interpreting Data - claimed as Intentionally Developed.

- 3.3 Trait Variations Unit Front Matter: "Students engaged with the practice of Analyzing and Interpreting Data in Units 3.1 and 3.2, and it will be further developed in Unit 3.4 when students investigate data on animal population sizes over time, before and after an environmental change."
- The materials do not identify element-level expectations for prior learning for any claimed DATA element.

Constructing Explanations and Designing Solutions - Claimed as Intentionally Developed

- 3.3 Trait Variations Unit Front Matter: "What Ideas and Experiences Will Students Bring That Can Help Them In This Unit?: In K-2, students start to develop their skill with constructing scientific explanations by using their own observations as evidence to explain phenomena. Observations are an important source of evidence and your students will bring to this unit their prior experiences of observing carefully and attempting to explain what they encounter. Your students may not realize that a variety of pieces of evidence are important to examine to be confident in an explanation. It's OK to pose tentative explanations until more evidence is gathered. They may also struggle with writing scientific explanations that emphasize how or why something happens and references evidence to support the ideas they share."
- 3.3 Trait Variations Unit Front Matter: "The designing solutions aspect of this practice is emphasized in Units 3.1, 3.2, and 3.4, with the focus of this unit on explaining phenomena. Students will also have opportunities to practice constructing explanations (in addition to designing solutions) in Unit 3.4."
- The materials do not identify element-level expectations for prior learning for any claimed CEDS element.

Crosscutting Concepts:

Patterns - claimed as Intentionally Developed

- 3.3 Trait Variations Unit Front Matter: "The crosscutting concept of Patterns is also intentionally developed in Units 3.1, 3.2, and students will have an opportunity to practice using Patterns in Unit 3.4."

Similarities and differences in patterns can be used to sort and classify natural phenomena. (PAT-E1)

- 3.3 Trait Variations Unit Front Matter: "What Ideas and Experiences Will Students Bring That Can Help Them In This Unit?: This unit includes many learning experiences where students will use similarities and differences to sort and classify. Sorting and classifying should come readily to third grade students as they likely have many prior experiences inside and outside school engaging in this kind of thinking."

Patterns of change can be used to make predictions. (PAT-E2)

- 3.3 Trait Variations Unit Front Matter: "What Ideas and Experiences Will Students Bring That Can Help Them In This Unit? From K-2, students will also understand that they can use patterns as evidence, too, which can be helpful to their thinking in this unit as they use patterns to make predictions and to support explanations."

Patterns can be used as evidence to support an explanation. (PAT-E3) - claimed as used periodically to support the overall development of the Practice

- "3.3 Trait Variations Unit Front Matter: What Ideas and Experiences Will Students Bring That Can Help Them In This Unit?: "From K-2, students will also understand that they can use patterns as evidence, too, which can be helpful to their thinking in this unit as they use patterns to make predictions and to support explanations."

Cause and Effect - claimed as Intentionally Developed.

Cause and effect relationships are routinely identified and used to explain change (CE-E1).

- 3.3 Trait Variations Unit Front Matter: "The crosscutting concept of Cause and Effect is developed in each third grade unit so students have opportunities to identify, test, and use cause and effect relationships in several different contexts across the year."

Scale, Proportion and Quantity - claimed as Intentionally Developed.

- 3.3 Trait Variations Unit Front Matter: "The crosscutting concept of Scale, Proportion, and Quantity was also developed in Unit 3.1 and practiced in Unit 3.2."
- The materials do not identify prior learning expectations for this element of the Practice.

Stability and Change - claimed as Opportunity to Practice

- The materials do not identify prior learning expectations for specific elements.

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

The materials contain a Unit Overview document that includes a chart providing a detailed description of the DCIs, SEPs, and CCCs intentionally developed in the unit. The table also describes at the element level the work students do in the unit to develop those practices, concepts, and science ideas. For example,

- DCI LS1.B: "This DCI is the focus of the first lesson set (Lessons 1-4) and the backbone for the entire unit. In Lessons 2-3 students investigate life stages and processes in canines, culminating in a model to describe commonalities in canine life cycles. Students broaden this model in Lesson 4 to describe commonalities in animal life cycles, but also investigate unique differences, too. This DCI is about much more than "life cycles". The idea that reproduction is essential to the existence of every kind of organism is a foundational idea in life sciences. Thus, this idea is revisited across the unit. Students start making sense of it in Lessons 3 and 4 as part of the life cycle, but then investigate reproduction as the process in which information is passed from parent to offspring (inheritance in Lessons 5-8). Students use this idea to explain patterns in wolf populations over time (Lesson 9) and to explain why some animals are no longer found today (Lesson 13). Note that plant life cycles are taken up in Unit 3.2: Why do plants only grow well in certain places, and how can we protect them?" (Unit Overview)
- DCI: LS3.A: "Students' initial ideas of inheritance surface in Lesson 1 as they try to explain why canines look and act a certain way. Inheritance of traits and environmental influence on them becomes the focus of Lesson Set 2 (Lessons 5-10). Students bring initial ideas from their own experiences that offspring look similar to parents and siblings. They develop a simple model in Lesson 5 to help them make sense of how information is inherited from parents, and that different offspring receive different combinations of information, thus resulting in slightly different trait variations. Students expand beyond physical traits to behaviors in Lesson 6 and investigate how learning influences behaviors in Lesson 7. Students' considerations in Lessons 7 and 8 about how dogs' traits (inherited and learned) support them in doing certain jobs help students notice that dogs' characteristics involve both inheritance and environment. Students broaden all of these ideas to other animals in Lesson 10. Note that inheritance in plants is taken up in Unit 3.4: Why do living things live where they do and what should we do when it changes?" (Unit Overview)
- DCI LS3.B: "Canines provide an authentic context for developing ideas of variation, in both physical and behavioral traits. Students note variations in physical and behavioral traits throughout the first several lessons, but focus specifically on physical trait variations and investigate where they come from in Lesson 5. They expand their investigation to behavioral trait variations in Lesson 6. Students will gather evidence in both lessons to figure out that while certain dog breeds tend to have a particular look and sometimes similar instinctual behaviors (i.e., herding, pulling), there is still variation in these traits. Lesson 8 will help layer on how a change to a dog's environment, like learning to be a guide dog or sled dog, ultimately can influence the dog's traits. Students broaden ideas of variation to other animals in Lesson 10." (Unit Overview)
- DCI LS4.A: "Canines also provide an authentic context for exploring fossil evidence of organisms and environments long ago. Students investigate these ideas in the final lesson set (Lessons 11-14). In Lesson 12, students figure out that people and dogs formed a special relationship 14,000-30,000 years ago. Lesson 13 has students investigate an animal that was alive during that time period but is no longer found today, and students also use fossil evidence to identify what the environment was like for that animal. Lesson 14 culminates in students analyzing and interpreting two data sets of both animal and plant fossils from long ago to provide evidence about the types of organisms and their environments found at that time and in those places." (Unit Overview)
- DCI LS4.B: "Students ask questions about this idea after investigating coyote sizes across the country in Lesson 8. Then Lesson 9 provides an opportunity for students to develop this idea in the context of wolf populations in Yellowstone, drawing on students' emerging understandings of inheritance and variation of traits (Lessons 5-8), and applying it to a real case in Yellowstone where certain wolves have an advantageous trait for survival and reproduction. In Lesson 10, students read about non-canine animals and consider how their trait variations can also

help them survive, find mates, and/or reproduce. However, the entire class may not explicitly investigate examples of trait variations that provide advantages in finding mates because at this grade level and in this unit with its focus on life cycles, successfully reproducing implies that one was also able to find a mate." (Unit Overview)

- SEP: Developing and Using Models: "This likely will not be the first time students have used the practice of modeling, but this practice is intentionally developed in the first lesson set and then used throughout the unit. Students develop initial models in Lesson 1 to attempt to make sense of the phenomenon of newborn puppies looking similar but adult dogs looking so different, and the class works together in Lesson 2 to use a model to begin to describe why a newborn canine becomes an adult that looks and acts like it does. In Lesson 3, the class reads a text about how scientists use models to explain, and they revise their model to describe what they've figured out about canine life cycles. By Lesson 4, students are ready to expand their model to explain other animals (not only canines), and from then on, the class consensus model becomes a central artifact to update as students figure out ideas about inheritance. Students also reflect on the limitations of their model in Lessons 3, 4, and 10. Students continue to use the model as they make sense of their ideas, especially in Lesson 13 when they consider why some animals are no longer found on Earth. Students' development through this practice is supported by formative assessment opportunities in Lessons 2 and 11, and key formative opportunities in Lessons 3 and 4, including peer feedback and self-reflection in Lesson 4." (Unit Overview)
- SEP: Analyzing and Interpreting Data: "This unit explicitly supports students in analyzing and interpreting trait data and fossil evidence data, which students observe first and then organize to identify patterns. Students represent data bar graphs (e.g. Lesson 5), tables (e.g. Lesson 6), pictographs (Lesson 9), and timelines (Lessons 11, 12, and 13), and use logical reasoning to make sense of phenomena. The teacher and materials often explicitly support and scaffold this work, but students also have opportunities to analyze and interpret data more independently especially at the ends of the second (trait data) and third (fossil data) lesson sets. Students' development through this practice is supported by multiple formative assessment opportunities across the unit, a key formative and peer feedback opportunity in Lesson 13, and summative and self-reflection opportunities in Lesson 14." (Unit Overview)
- SEP: Constructing Explanations and Designing Solutions: "Students use evidence from their investigations to construct explanations for a variety of phenomena in the unit. Explanations may occur orally, in writing, and/or in drawing explanatory models. Development of this practice is explicitly supported when the class builds a checklist tool in Lesson 7 to use to support explanations they construct individually in later lessons. The class establishes that explanations give a how or why account (cause) of a phenomenon and are based on evidence, and then students have opportunities to give and receive peer feedback about their explanations, also (eg, Lesson 8). Students' development through this practice is supported by formative assessment opportunities in Lessons 7 and 9, a key formative opportunity in Lesson 8, and a summative opportunity in Lesson 10." (Unit Overview)
- CCC: Patterns: "Students have multiple opportunities in this unit to make observations of life changes in animals and animal traits and then work as a class to identify patterns across their observations. The word "pattern" is defined explicitly with students to help them talk about how they are observing something that happens again and again. In Lessons 1-4, students use patterns to help them identify underlying similarities in the life cycles of animals. After starting to notice patterns of traits and/or variations in traits in the first Lesson set, students explicitly look for patterns in the trait variations of parents and offspring in Lessons 5-10. Finally, in Lesson 14, students identify patterns to help them interpret fossil evidence to describe what an environment was like long ago." (Unit Overview)
- CCC: Cause and Effect: "Students use cause and effect to explain why canines and other animals have the trait variations they do (Lesson 5), to identify how learning can affect an animal's trait variations (Lesson 7) and to identify trait variations among wild animals that give them an advantage in surviving (Lessons 9 and 10). Students' development of this crosscutting concept is supported by formative assessment opportunities in Lessons 7 and 9 and a summative in Lesson 10." (Unit Overview)

- CCC: Scale, Proportion and Quantity: "Scale is critical to students' sensemaking in the last lesson set of the unit as they make sense of fossil evidence in relation to animals and places today and those long ago. Two scaled timeline representations are used in Lessons 11 and 12-14 to support students in understanding the immense scale of time for fossil records compared to the scale of time for their own personal history. Students' development of this crosscutting concept is supported by formative assessment opportunities in Lessons 11 and 12, a key formative and peer feedback moment in Lesson 13, and a self-reflection and summative assessment opportunity in Lesson 14." (Unit Overview)

There is also a document titled "About the Science." It provides information to help teachers gain an overview of the unit concepts as a whole. The document breaks down the science ideas into sections that students will learn throughout the unit. It also includes adult learning resources for teachers to access so they will build a better understanding of their knowledge for the unit.

- This document states: "This unit will help students develop science ideas about life cycles, inheritance of traits and variation in traits, traits and survival, and fossil evidence of living things and their environments long ago. From life experiences and their prior science learning in first grade (1-LS1-2, 1-LS3-1), your students may bring to their learning ideas about adult animals having offspring and that the adults and their offspring engage in behaviors to help the offspring survive. Students may also bring with them the idea that young plants and animal offspring look very much like their parents but are not identical to them. In 3rd grade, students build on these ideas to describe life cycles and the essential role of reproduction to passing on information to offspring. The information passed along influences how the offspring develops and how they look and behave, including traits that help them survive. Ultimately the passing on of information from parents to offspring and generation to generation ensures that a kind of animal does not go extinct. Evidence of fossils tell us that some kinds of plants and animals are no longer around, thus unsuccessful in reproducing and passing along information for their kind of living thing. Below is more guidance on the science ideas you will help students develop in the phenomena context for this unit - the way animals look and act over their lives. Some of the information below, which is noted, is intended to support your learning of the science as an adult learner, and is not expected to be learned by your 3rd grade students." (About the Science)
- "What are recommended adult-level learning resources for the science concepts in this unit? The following resources are recommended to help build your understanding of the phenomena and Performance Expectations bundle for this unit. The level of understanding presented in these resources goes beyond what would be expected of your students' learning. National Research Council. (2012). A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Washington, DC: The National Academies Press. Download for free: https://nap.nationalacademies.org/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts Read about LS1.B Growth and Development of Organisms on pages 145-147. Read about LS3.A Inheritance of Traits and LS3.B Variation in Traits on pages 158-162. Read about LS4.A Evidence of Common Ancestry and Diversity and LS4.B Natural Selection on pages 162-164. Chapters in Duncan, Krajcik, and Rivet (Eds.), Disciplinary Core Ideas: Reshaping Teaching and Learning. Arlington, VA: NSTA Press would be helpful to build understanding of disciplinary core ideas." (About the Science)

Criterion-Based Suggestions for Improvement:

- Ensure "[t]he materials explicitly state the expected level of prior proficiency students should have with individual elements of all three dimensions for the core learning of the materials." [Detailed Guidance, p. 24]
- Ensure "[a] progression of learning toward the targeted elements of all three dimensions is clearly described for teachers for each section of the materials." [Detailed Guidance, p. 25]

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 use scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support their three-dimensional learning. Teachers are supported in guiding students to authentically develop scientifically accurate language, and grade-level appropriate math is used. However, some scientific inaccuracies are presented to students.

Teachers are supported to guide students to develop scientifically accurate language authentically. For example,

- Lesson 1, Connect, Step 1: "Science Content Note for Teacher: In this first lesson and throughout the unit, students will explore a variety of canines. Pet dogs are one species of canine with many breeds, while wolves are different species, as are fox and coyote. The term "canine" is an accurate word to describe both pet dog breeds and other canine species, like wolves, foxes, and coyotes, that students will encounter in this unit, but it is OK to use the term "dog" with students in this first lesson, as dog might be a familiar term for your students and helpful to surface their ideas using a word they recognize. This is the reason student-facing materials use "dog" instead of "canine" in this lesson. It is not expected that you use "canine" with students in the first lesson. In Lesson 2, you will develop with students an understanding of the terms "canine", "domesticated canine (dog)", and "wild canine", so that students can start to distinguish between pet dogs and wild canine species. Students will develop their understanding of "breed" in Lessons 5 and 6. If students bring any of these terms to the discussions in this first lesson, probe their understanding of the words and consider adding questions about them to the DQB, but avoid defining them or adding them to the Word Wall until all students have the opportunity for further investigation."
- 3.3 Trait Variations Unit About the Science: "While students are observing 'traits' to draw conclusions, they do not use this terminology. You will introduce this term to students in Lesson 5 as a scientific word to describe things they have already been observing about living things."
- Lesson 5, Navigate, Step 1 Teaching Tip: "Trait variations are the potential differences in traits that exist between individuals or types of animals. Students may refer to 'trait variations' as 'traits' or 'traits of that dog'. Students do not need to be able to articulate the distinction between traits and trait variations, but you should be as accurate as possible when referring to trait variations vs. traits to help students begin to understand the difference." (Teacher Guide, Lesson 5)
- Lesson 9, Explore, Step 4: "As students begin to wonder about variations among the fur of the wolves in Yellowstone, they may call back to the Red Wolves they were introduced to in Lesson 1. Bear in mind that Red Wolves (Canis rufus) and Gray Wolves (Canus lupus, which can also look black) are two different species. It is important that students compare variations between individuals of the same species (although that word is not used with students in this unit), so focus students' discussions in this lesson on the wolves in Yellowstone, which are all Gray Wolves. (Teacher Guide, Lesson 9) While this sidebar is provided for teachers, the prompts to use in Lesson 9 sometimes have language that is less precise when in the Teacher Guide Explore and Synthesize sections, where Gray Wolves are referred to as: Gray Wolves and Black Wolves, black wolves and gray wolves, and wolves with gray fur, wolves with black fur.
- As the class consensus model is updated in Lessons 4, 5, and 10 to include other animals, some information is revised, but the "newborn" information remains the same: "Cannot see. Cannot hear. Doesn't move much. Needs food, warmth, protection from parents." This is not true of all newborn animals, including several specifically referenced in Lessons 4 and 10.

  - Lesson 4 Animal Changes Over Time website: "Baby Green Sea Turtles hatch and they are ready to take care of themselves…From the moment they hatch, baby Ball Pythons take care of themselves…Baby Seven-Spotted Ladybugs take care of themselves and do not depend on their parents. They start to find bugs, called aphids, to eat as soon as they hatch."
  - Lesson 10 Book Amazing Animal Traits Parents and Offspring: "After they hatch, these frogs live on their own. The offspring will survive by using their instincts…After they hatch, these lizards live on their own. These offspring will survive by using their instincts." By lesson 10, the sample class consensus model has been relabeled to be about "animals" instead of "canines", so the Newborn information is not accurate.

Grade-appropriate math is used when constructing timelines. For example,

- Lesson 12 Preparation Checklist: "Important Note: Please note that the age of fossils in this unit are represented as "units ago years old" where one unit is equal to about 10,000 years. The actual years are listed in parentheses in teacher-facing documents and in the later part of Preparing the Fossil Timeline. Please note that numbers in the hundreds of thousands are out of gradeband for math standards. However, if using the actual numbers is in the best interest and abilities of your students please do so." (Lesson 12, Teacher Guide)
- Lesson 12, Synthesize, Step 4 Teaching Tip: "The discourse around when dogs first started living and working with humans is still being debated. There is a strong consensus that fossils found about 14,000 years ago (1-2 units ago) can be classified as dogs. But there is still debate on whether fossils found between 14,000-33,500 (1-3 units ago) years ago can be classified as dogs, since it is unclear when exactly these canines had been completely domesticated and when they were biologically distinguishable from wolves or other wild canines. Including this portion of the discussion is helpful for kids to see the limits of fossils as evidence." (Lesson 12, Teacher Guide)
- The possibility of comparing human to dog inheritance is raised and explained for the teacher in the 3.3 Trait Variations unit 'About the Science' document: "The unit has been designed to avoid investigation of traits and variation among humans as that is beyond the scope of this grade band. However, students will likely make these connections at different points. When discussing trait variation, students may draw similarities between the way puppies look like their parents and the way some children look like their biological parents. It is important if these ideas come up to use inclusive language; remember that not all students in your classroom may be living with, or even know, either of their biological parents. You can recognize that human families are created in a variety of ways that are not just biological and use this to acknowledge the validity of all kinds of human families. This is an opportunity to normalize that families may look many different ways. If you have a student who may not know or live with their biological parents, do not single them out in this conversation. If students would like to share, they will offer that information up themselves in this context." (About the Science)

Criterion-Based Suggestions for Improvement:

- Ensure "the student-facing materials have precise, grade-appropriate wording to help students scaffold their understanding of concepts in all three dimensions, avoiding creating misconceptions" (Detailed Guidance, p. 26)
  - Consider revising the updates for the class consensus model to ensure consistency and accuracy. For example, when the class consensus model is updated in Lessons 4, 5, and 10, prompt teachers to include information about the newborn stage of other animals as well.

II.E. Differentiated Instruction

ADEQUATE

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 **adequate** evidence for teachers to support differentiated instruction. The materials provide guidance for teachers to support multiple modality expressions and multiple means of engagement. While the materials provide strategies for teachers to support multilingual learners, the support for students who have met the performance expectations was often not connected to the elements of three-dimensional learning.

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.

Teachers are frequently reminded to look and listen for student ideas being expressed in multiple modalities, including speaking in English or another language, gesturing, or drawing. For example,

- Lesson 1, Connect, Broadening Access: "Recruit interest by encouraging students to share their thinking in a variety of ways, and validate all the ways we communicate our ideas, such as with gestures or body movements, pointing at images, and using words from multiple languages." (Lesson 1, Teacher Guide)
- Lesson 2, Explore, Step 3: "What do domesticated puppies need during their first week of life and how are they different from adults? Use words and/or your bodies to share your ideas." (Lesson 3, Teacher Guide)
- Lesson 3, Explore, Broadening Access: "To guide information processing and visualization during and after the gallery tour, consider providing multiple means of expression, such as allowing students to share similarities orally, through writing, or through gestures such as pointing. If you feel that some of your students might be overwhelmed by looking at all of the diagrams at once, you can assign a range of diagrams for students to focus on. If students need language support constructing their findings, consider providing sentence stems like: One similarity I found was _____, I observed that most canines _____, Something interesting I noticed was _____." (Lesson 3, Teacher Guide)
- Lesson 4, Navigate, Broadening Access: "When asking students to share ideas, keep in mind that sharing ideas can include words and/or gestures. For example, as students recall what we did in the previous lesson to answer our question about canine life cycles, students may use hand gestures to indicate working in a group or hold up their model to indicate creating a model. Consider elevating these gestures by explicitly recognizing them during the discussion, in order to communicate their equal value, and thus encouraging multiple communication modalities." (Lesson 4, Teacher Guide)
- Lesson 5, Navigate, Step 5, Broadening Access: "As students are sharing their ideas, look for their understanding in what they explain in discussion, as well as gestures, symbols and movements they may use. When adding those

ideas to the class chart, use drawings in addition to words to represent student ideas to support emerging readers and multilingual learners. If applicable, you might encourage your multilingual students to add ideas across named languages (e.g., Spanish, Mandarin, Arabic) to the chart if it would support their sensemaking throughout the lesson." (Lesson 5, Teacher Guide)

- Lesson 6, Synthesize, Broadening Access: "To enhance students' language learning and language use opportunities throughout this Synthesize, consider using the Classroom Agreements handout. The handout provides discussion phrases that students can use to support their sensemaking work. The phrases, along with supporting materials like the data table, will help students fully explain their ideas, attune to and make sense of their peers' ideas, and build off ideas shared by classmates. Also, encourage the use of gestures or everyday language that students prefer." (Lesson 6, Teacher Guide)
- Following the Student Sensemaking checklists for Lessons 2-4, 5-9, and 11-14 reminds teachers to look for multiple ways for students to communicate their ideas. Each includes a column for teacher notes titled "Notes about what students say, write, draw, gesture, do," and each includes possible sample evidence across modalities. For example,
  - Following Sensemaking Lessons 2-4: "Throughout each lesson, keep track of students' sensemaking, remembering that students often use multiple means of communication at the same time to express their ideas. You can use the example table below, a seating chart, your class list, etc., to record how each student is making sense of the science ideas and practices that are the focus of this lesson set." (Lessons 2-4)

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

- Lesson 1, Explore, Broadening Access: "It is important to organize activities in ways that create opportunities to support student engagement by emphasizing socially safe activity structures (e.g., small-group or partner work before a whole-class discussion). This is especially beneficial to multilingual students. For this reason, partner talk or small-group talk should precede whole-group discussion whenever possible to give students an opportunity to share their ideas with peers before going public with the whole class." (Lesson 1, Teacher Guide)
- Lesson 2, Explore, Broadening Access: "As you record ideas on the charts, include visual representations of the ideas (e.g., drawings, photos, icons such as those provided in the Timeline Chart Images reference). This will benefit multilingual students, as well as all students, in understanding the ideas captured on the chart." (Lesson 2, Teacher Guide)
- Lesson 5, Navigate, Broadening Access: "As students are sharing their ideas, look for their understanding in what they explain in discussion, as well as gestures, symbols and movements they may use. When adding those ideas to the class chart, use drawings in addition to words to represent student ideas to support emerging readers and multilingual learners. If applicable, you might encourage your multilingual students to add ideas across named languages (e.g., Spanish, Mandarin, Arabic) to chart if it would support their sensemaking throughout the lesson." (Lesson 5, Teacher Guide)
- Lesson 11, Navigate, Broadening Access: "It is important to organize activities in ways that create opportunities to support student engagement by emphasizing socially safe activity structures (e.g., small-group or partner work before a whole-class discussion). This is especially beneficial to multilingual students. As in previous lessons, partner talk or small-group talk should precede whole-group discussion whenever possible to give students an opportunity to share their ideas with peers before going public with the whole class as well as the space to use their linguistic and nonlinguistic resources to express their ideas (and learn from other students' uses of these resources too)." (Lesson 11, Teacher Guide)

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

- Lesson 1, Explore, Broadening Access: "If you have a student with a visual impairment, consider the following modifications to the activities: enlarge the photos to a full slide and/or include verbal descriptions with each image that highlight salient features of the canine (e.g., eyes closed, solid black fur with pink nose or black and brown fur with black nose, rounded ears, etc.). Additionally, check with your special education services at your school for additional modifications." (Lesson 1, Teacher Guide)
- Lesson 2, Explore, Broadening Access: "When you get to page X in the book, play audio recordings of a wolf pup howling to provide multiple means of engagement that will enhance the experience for all students but especially those with visual impairments. For example, you could use this Wolf Pup Week 3 Early Howl video or this Wolf Pup Week 4 Howling video." (Lesson 2, Teacher Guide)
- Lesson 4, Explore, Step 2, Broadening Access: "To remove a barrier for students who have a color vision deficiency, make sure to refer to animals primarily by the animal name (e.g., frog) and not the color of the sticky note (e.g., green). Doing so ensures that all students have access to the data being analyzed as the class discusses observations and patterns." (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize, Step 4, Broadening Access: "Connect back to students' prior uses of cause and effect during this discussion to help them identify the relationship between parent dogs' trait variations and those of their puppies to help students explain why the puppies have those trait variations." (Lesson 5, Teacher Guide)
- Lesson 9, Explore, Broadening Access: "As students share their ideas, encourage alternative forms of communication including hand gestures or head nods. It may be helpful to teach your students a few signs from American Sign Language (ASL) so that they may share understanding when thoughts are shared with gestures. ASL is a visual language with a long history, complex rules, and rich culture. Therefore, be mindful of accuracy when sharing this language with your students. In addition to the physical signs, ASL is directional. This means that the direction of your hands and their movements is a key part of the language and should also be addressed when teaching the signs. Two terms that may be helpful to teach are "same" to indicate when a student agrees with an idea shared by a fellow student and "disagree" to indicate when a student disagrees. This site can act as a resource: https://www.lifeprint.com/asl101/pages-signs/a/agree.htm." (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize, Broadening Access: "Students with color vision deficiencies and/or visual impairments may need additional support to make observations of the photos. Include key descriptive words with the images, such as "solid black fur" or "black and white spotted fur," and "ears dropped down" or "ears standing up" to verbally describe the key traits of the offspring and parents." (Lesson 10, Teacher Guide)
- Lesson 12, Synthesize, Step 4, Broadening Access: "To help all students access the class timeline, use color-blind-friendly colors and add labels. Instead of referencing bars by color (e.g., blue bar), reference them by the label (e.g., human fossils)." (Lesson 12, Teacher Guide)

Learners reading below grade level

- Lesson 3, Explore, Step 2 Broadening Access: "To guide information processing and visualization during and after the gallery tour, consider providing multiple means of expression, such as allowing students to share similarities orally, through writing, or through gestures such as pointing. If you feel that some of your students might be overwhelmed by looking at all of the diagrams at once, you can assign a range of diagrams for students to focus on. If students need language support constructing their findings, consider providing sentence stems like: One similarity I found was _____, I observed that most canines _____, Something interesting I noticed was _____." (Lesson 3, Teacher Guide)

- Lesson 4, Explore, Step 2: "Distribute a copy of the An Animal's Life Notes handout to each student, help students orient to the website Animal Changes Over Time Website. Review the steps of the handout and ask students if they have any questions. Although each student will record notes on their own handout, give them the opportunity to work with a partner or small group while reading about the same animal on the website, if helpful." (Lesson 4, Teacher Guide)
- Lesson 6, Synthesize, Step 6 Broadening Access: "To provide multiple options for perception and comprehension, leverage the multiple representations the class created to support students' sensemaking. These representations include written ideas on the Our Growing Ideas chart, visual representations on the class model, and timeline charts from previous activities." (Lesson 6, Teacher Guide)
- Lesson 9, Connect, Step 2 Literacy Supports: "As you read, pause to use prompts to support students in determining the main idea of a text. Push students to summarize the text and support the main idea using key details, images, or other text clues and explain how these key parts of the text support the main idea (RI.3.2)." (Lesson 9, Teacher Guide)
- Lesson 10, Connect, Step 2: "Preview the text. Have students practice locating their animal in the book and scanning the pages for their section, but not yet reading it. Remind students of the question we are investigating: Why do animals look and act the way that they do? Ask them to consider strategies they can use to read the text to answer this question, and also use Our Growing Ideas to guide us." (Lesson 10, Teacher Guide)

Critical information is often read aloud by the teacher or with the support of a partner. For example:

- Lesson 4, Explore, Step 2: "Distribute a copy of the An Animal's Life Notes handout to each student, help students orient to the website Animal Changes Over Time Website. Review the steps of the handout and ask students if they have any questions. Although each student will record notes on their own handout, give them the opportunity to work with a partner or small group while reading about the same animal on the website, if helpful. Remind students of the question we are investigating: What are the changes that happen to other newborn animals as they become adults? Ask them to consider strategies they can use to read the new infographics. Ideas to look and listen for: We can look at the pictures. We can look for words that are big or in bold. We can read the captions under the pictures. We can look for titles or headings. We can look for symbols, like arrows or stars" (Lesson 4, Teacher Guide)
- Lesson 7, Explore, Step 2: "Read the card together and discuss (1) what the job requires and (2) clues about the way the dog needs to look or act - their traits - to be the right fit for a lifeguard dog. Listen for ideas like: Looks (physical traits): Has to weigh around 65 pounds, maybe needs webbed feet to swim. Acts (behavioral traits): Loves water, likes to fetch, calm, easygoing, does not panic. Examine the Dog Job Cards. After orienting students to the lifeguard job card, pass out a set of Dog Job cards (part of Dog Job and Dog Trait Cards) to each pair of students. Display slide C and give students time to read together about the other jobs and the way dogs need to look or act for the job. During this time, keep supporting students to use the language of 'traits' as they talk about certain physical traits or behavioral traits required for the job." (Lesson 7, Teacher Guide)
- Lesson 10, Synthesize, Step 4: "Preview the assessment context. Using slide K1 and/or slide K2, introduce students to the assessment task context. Color images of the assessments are also provided at the end of the slide deck. You may want to read the task together using these slides. Toggle between slide J (sentence starters) and color images as needed for your students. Remember the options described in the materials preparation guidance that can help you tailor this assessment for your students." (Lesson 10, Teacher Guide)
- Lesson 14, Explore, Step 5: "Complete an individual analysis and interpretation of fossil evidence. Display slide K. Preview the instructions with students and distribute the La Brea Tar Pits Fossils assessment to each student. Read the assessment items aloud as needed, and work together to locate 50,000 years ago (5 units) on the timeline. Remind students to use any class-developed charts that are helpful to them, and offer sentence starters, if needed." (Lesson 14, Teacher Guide)

Embedded instructions in Lesson guides offer tips for ensuring access to information for readers at varying levels. For example:

- Lesson 2, Explore, Step 4: "Explain to students that one useful strategy for gathering evidence from text is to know the question we are trying to answer before we start reading. Ask students to recall the question we are trying to figure out (some version of What is happening between being a newborn and being an adult?), and emphasize that they have identified our purpose for reading the book. Before reading, direct students to be listening, looking, or otherwise observing for the different ways puppies change over time. Consider emphasizing how identifying a purpose for reading in science can be a helpful strategy for reading science, just like it can be used to find the main idea and key details of text in English Language Arts time." (Lesson 2, Teacher Guide)
- Lesson 3, Explore, Step 2: "Point out that the infographics contain lots of information with pictures, diagrams, and words. Remind and encourage students to use the headings, pictures, and diagrams (e.g., timelines) to quickly locate information and patterns about their canine." (Lesson 3, Teacher Guide)
- Lesson 10, Connect, Step 2: 'Preview the text. Have students practice locating their animal in the book and scanning the pages for their section, but not yet reading it. Remind students of the question we are investigating: Why do animals look and act the way that they do? Ask them to consider strategies they can use to read the text to answer this question, and also use Our Growing Ideas to guide us. Listen for ideas" (Lesson 10, Teacher Guide)

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

The materials explicitly clarify how they anticipate the needs of students who might struggle with any of the three dimensions in the assessment portion of the lesson.

- Lesson 1, Lesson Assessment Guidance: "If a student struggles to think of a question, have the student revisit the wonderings the class generated earlier in the lesson. Ask if there was something challenging about the activity that made the student wonder something. Alternatively, ask them to reflect on their experiences with dogs in their lives, things they have noticed firsthand or secondhand, and if they have ever been curious about the way dogs look or behave." (Lesson 1, Teacher Guide)
- Lesson 2, Lesson Assessment Guidance: "If a student is struggling to make comparisons, have the students focus on 1 or 2 changes that occur (e.g. what they eat) and revisit the timeline looking for evidence of how that change(s) happen(s) for both puppies. Then ask if those changes were similar and at the same time, or different." (Lesson 2, Teacher Guide)
- Lesson 3, Lesson Assessment Guidance: "Refer to Lesson 3 Instructional Guidance for additional guidance to support students struggling with summarizing information and/or identifying patterns." Synthesize, Step 4: "When students struggle with this, point out that our consensus model only shows the similarities, but that our infographics and our diagrams also tell us about the differences (such as "how big the canine grows" or "how long each canine lives"). Explain that if we want to know more about the differences between different kinds of canines, then we may need a different model. Using the second prompt on slide J, ask the class to share or summarize what they figured out about modeling...Establish that as another limitation of our current model: is it focused only on canines. Ask students what we could do to be able to further revise our model to explain more animals, and decide together that figuring out the life cycles of our special animals would be helpful." (Lesson 3, Teacher Guide)
- Lesson 4, Lesson Assessment Guidance: "If a student is struggling to make a prediction about what would happen to a population if there were no more births, ask students to point on the Animal's Life Cycle model and talk through the stages. Remind students that animals exist now (since we just discovered them). So talk through the rest of their lives. Then ask them to consider what happens after they die. Use the model to emphasize direction. If we have no

more births, that is the start of the cycle. So we can assume that the rest of the cycle will continue unimpeded, but once that cycle ends, a new cycle will not begin." (Lesson 4, Teacher Guide)

- Lesson 9, Lesson Assessment Guidance: "If a student struggles to use evidence to support their explanation, ask them to show or describe the evidence we collected during the lesson. You can ask questions such as, What does our graph tell us about the number of wolves with a particular fur color? What did we learn from scientists about fur color and matching traits when we read the article? What source helped us decide which matching trait was more important for survival? It may also be helpful to look through the evidence with your student and possibly articulate your thinking as you model how you would use evidence in an explanation. Continue to use the Following Student Sensemaking." (Lesson 9, Teacher Guide)
- Lesson 12, Synthesize, Assessment Opportunity: "If you notice students struggling to identify significant ideas, ask students to review the years and Scientist's Interpretations found on the cards. Refer to the Assessment Guidance at the beginning of the lesson." (Lesson 12, Teacher Guide)
- Lesson 13 Teacher Assessment Tool Lesson 13 Instructional Guidance: "If you Notice...Students struggle to interpret fossil evidence to explain what the environment may have been like long ago when and where mammoths lived. Possible Next Steps...Look at a new photograph of an African elephant today that shows at least three traits. Find a photograph that shows its tusks, teeth, and fuzzy hair. Talk through the traits of the elephant. Then, revisit the wooly mammoth cards that show the tusk, teeth, and fur. Have students identify similar traits between the elephant today and the mammoth long ago (e.g., tusks) but also different traits (e.g., fur). Explain that elephants today live in tropical areas (connecting back to what students learned about tropical climates in the Unit 3.2: Why do plants only grow well in certain places, and how can we protect them?. Then, have them describe what kind of climate a very hairy elephant might live in today? Finally, return to interpreting the thick fur of the wooly mammoth long ago." (Lesson 13, Teacher Guide)

iii. Extensions for students with high interest or who have already met the performance expectations to develop deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts.

There is evidence that differentiation strategies are explicitly recommended for students who have a high interest. However, extension opportunities are not consistently connected to elements of the three-dimensional learning in which students are engaged. For example,

- Lesson 3, Explore, Step 2 Broadening Access: "As an extension opportunity, ask students how many 5-pound reams of paper they would need to hold to represent final weights, prompting them to divide final weights by 5 (part of 3.OA.C.7)." (Lesson 3, Teacher Guide) Students dividing by 5 does not directly relate to a SEP, DCI, or CCC.
- Lesson 4, Explore, Step 2: "Extension opportunity: To deepen student engagement with life cycles, consider extending the resources in this lesson to observations of a live life cycle using mealworms (darkling beetles). How you approach this extension will depend on time and availability of materials; see the Optional Mealworms Extension for detailed instructions. If you cannot complete a live insect observation, consider watching videos as a supplement. Use the live insects or the video to help construct a generalized model for animal life cycles." (Lesson 4, Teacher Guide)
- Lesson 5, Lesson Materials and Preparation: "Optional extension: For students who are very interested in dogs and/or for students who could use extra practice identifying physical traits in dogs, you can provide the Newborn, Puppy, and Adult Cards for students to sort and discuss (a larger set than were used in earlier lessons). See the Puppy-Adult Matching Extension Instructions reference for directions and prompts." (Lesson 5, Teacher Guide)
- Lesson 8, Explore, Teaching Tip: "Optional extension: If your students demonstrate high interest in dog breeds and/or they could use additional practice connecting trait variations to jobs dogs do, the History of Dog Breed Articles

reference is available. There are several articles and options for how you might use them with students are described in that reference." (Lesson 8, Teaching Guide) Having students research the History of Dog Breed Articles is not an extension of their science learning.

- Lesson 9, Explore, Teaching Tip: "Extension: This article provides an opportunity for students to do more with developing reading strategies for informational texts. To extend students' learning, consider printing 1 copy of OpenSciEd Press: Update on the Wolves in Yellowstone National Park for each pair of students. Provide them a highlighter or colored pencils to annotate the text as they read in partners. Before they begin to read, Ask students to share strategies they can use to find answers to their questions, and listen for ideas, such as highlighting or underlining information about fur color, looking for quotations to figure out what scientists say in the article, looking for specific words like traits, fur color, job, finding words that tell us about cause and effect like since, so, if/then, because. Give students time to read in partners and practice these strategies with the text." (Lesson 9, Teacher Guide) Having students read text at a different Lexile level is not an extension of their science learning. This is a differentiated reading strategy.
- Lesson 9, Navigate, Teaching Tip: "Optional Extensions: Wild canines may be a high interest area for your students generally or specific students. To extend their learning, consider one of the following: Connect with an organization like the International Wolf Center Virtual Learning Program, who offer free zoom sessions for classrooms with their wolf experts. Bring in additional photographs of foxes and coyotes to make observations of different variations in their traits, too." (Lesson 9, Teacher Guide) This opportunity enables students to further explore the phenomenon of traits varying among and between species. While these suggestions may be applicable to students with high interest, they do not delve deeper into specific DCI, CCC, or SEPs for students who have already demonstrated an understanding of the performance expectations.
- Lesson 14, Explore, Step 2 Teaching Tip: "The fossil images and information used in the gallery tour are mostly from the National Parks Service; if students are interested in learning more, share their website for students to explore, which includes many more images and information: Fossil Butte National Monument." This extension provides additional pictures of the same phenomenon (Fossil Butte), but does not enable students to interact with the DCI, CCC, or Practice more deeply.

Criterion-Based Suggestions for Improvement:

- To increase the rating on this criterion, ensure that extensions are included for "[s]tudents who have already met the performance expectation(s) or who have high interest in the subject matter and are ready to develop deeper understanding in any of the three dimensions." (Detailed Guidance, p. 28)
  - Consider labeling which dimension(s) an extension is intended to develop.

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 connected learning experiences over time by providing sufficient supports for students to make explicit links between their sensemaking of phenomena and learning in all three dimensions over time.

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 provide guidance and support for teachers to recognize what students figure out in a lesson, what questions remain unanswered, and what new questions could be addressed in the next investigation. Each lesson begins and ends with a Navigate section that includes teachers in supporting students with engagement across lessons.

- Lesson 2, Navigate, Step 1: "Recall where we left off. Display slide A. Point to the images on the slide and [DQB], and invite students to turn and talk to a partner about what we investigated together last time that led us to ask so many questions. Have a few students share their ideas with the class." (Lesson 2, Teacher Guide)
- Lesson 2, Navigate, Step 8: "Revisit our initial explanation. Display slide P and review the question on our initial explanation from Lesson 1, Why does a newborn canine become an adult that looks and acts the way it does? Ask students to show a thumb up, down, or sideways: Can we explain the answer to this question yet? Expect mostly noes or maybes. Acknowledge that we do have more evidence of how canines look and act similar as puppies but look and act differently as adults. However, we need more information to keep figuring this out." (Lesson 2, Teacher Guide)
- Lesson 4, Navigate, Step 1: "Transition from canines to other animals. Display slide A. Remind students we spent some time also thinking about animals special to us. We thought that if we investigate some kinds of animals - canines - we might figure out some new ideas that would help us understand many animals, including those special to us. Ask students to turn and talk about how investigating many animals and the changes that happen as they become adults could help them understand life cycles of all animals." (Lesson 4, Teacher Guide)
- Lesson 4, Navigate, Step 6: "Reflect on the revised model. Display slide M. Use the model to celebrate all the great new ideas we figured out about many animals to add to what we've been investigating about canines. Also, celebrate the great model revision work we did as a class. Share that sometimes when scientists get new information, they revise models, which is what we just did! But in the process of revising it, it got kind of messy. We started trying to describe more and more details about the many animals in one model." (Lesson 4, Teacher Guide)
- Lesson 8, Navigate, Step 6: "Ask questions about trait variations in coyotes and other wild canines. Display slide O and facilitate the sharing of questions about the differences in coyote traits into a broader wondering about whether wild canines have those trait variations for the same reasons that all the domesticated canines have their trait variations - they inherit them from their parents, and those trait variations help them do their jobs well. Remind

them that we said that wild canines' jobs have to do with surviving and raising their pups in the wild. Lead them to wonder about other wild canines and if they have similar kinds of variations in their traits." (Lesson 8, Teacher Guide)

- Lesson 11, Navigate, Step 4: "Congratulate students on coming up with so many questions and ideas for investigation that might help. Tell students that you'll try to find some of the evidence they mentioned for next time." (Lesson 11, Teacher Guide)
- Lesson 12, Explore, Step 3, Analyzing and Interpreting Data Callout: "This is an opportunity to support analytical and interpretive reasoning by helping students turn a simple data set into a number line to better reveal patterns in the data and suggest relationships between the history of humans and dogs." (Lesson 12, Teacher Guide)
- Lesson 14, Explore, Step 2: "If your class will not be proceeding immediately to the Synthesize, consider collecting students' Fossils Gallery Tour handouts as a formative assessment and providing written feedback or setting up mini conferences with students before the next class period to check in as needed. See the lesson assessment guidance for suggestions about what to look for in students' work." (Lesson 14, Teacher Guide)

Throughout the unit, the "Our Growing Ideas" poster tracks the learning progression as one idea builds upon the next. Teachers are given tips for rewording student questions to add to the poster or linking existing student questions. For example,

- Lesson 6, Synthesize, Step 6: "Update Our Growing Ideas chart. Display slide U. Transition to updating the Our Growing Ideas chart by adding the lesson question to the "Our Questions" column of the chart: Why can dogs do things they did not learn from their parents or people? Ask students to identify any of their questions from the [DQB] that they think we have answered, and move those sticky notes underneath the lesson question. Wait for several students to share their ideas to the prompts on the slide before adding ideas to the Our Growing Ideas chart." (Lesson 6, Teacher Guide)
- Lesson 8, Navigate, Step 1: "Use Our Growing Ideas chart to check in. See slide A and refer to your class chart. Ask students to turn and share with their partners what we investigated and figured out last time. After a few moments of talk time, ask for a few volunteers to share what their partner said." (Lesson 8, Teacher Guide)
- Lesson 9, Navigate, Step 7: "Motivate applying our model to all animals. Say something like, We have evidence these ideas help us explain phenomena about pet dogs and wild canines, but we were able to apply our life cycle model to all animals in lesson 4. We haven't tried to apply our new updates to include other animals. Do we think any of the ideas we figured out might apply to them too? Accept all ideas at this point. Share that you are going to update the class' Our Growing Ideas chart with the students' ideas that they shared in this discussion and will bring it back for them to review at the start of the next science class." (Lesson 9, Teacher Guide)

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

Throughout the unit, lessons include Callout Boxes to highlight for teachers whose students are using and developing SEPs and CCCs, and to guide teachers in supporting students as they progress.

- Lesson 3, Synthesize, Patterns Callout: "As the class works toward representing a canine life cycle model, support students in using the lens of patterns to notice underlying similarities across the canines even if there are small differences for each kind." (Lesson 3, Teacher Guide)
- Lesson 4, Navigate, Developing and Using Models Callout: "Use this moment to show students how revising models as new information and evidence is gathered is an important aspect of science. As we work to explain our phenomenon better, our model should change to capture the new ideas we figure out." (Lesson 4, Teacher Guide)

- Lesson 6, Synthesize, Analyzing and Interpreting Data Callout: "During this Consensus Discussion, students continue to use logical reasoning to analyze data from across lessons about how the behaviors of the Labrador puppies have changed from birth to eight weeks old to explain how dogs can have behaviors they did not learn." (Lesson 6, Teacher Guide)
- Lesson 8, Synthesize, Constructing Explanations and Designing Solutions Callout: "An important element of this practice is to use evidence (such as observations or patterns) to construct an explanation. On the Poodle Explanation assessment, students construct an explanation using observations and descriptions for how certain dog traits were intentionally chosen by humans to help various breeds accomplish certain jobs. In this lesson, students will give and receive peer feedback to support the construction of their explanation, and then in Lesson 10 they will have another opportunity to independently construct an explanation about animal trait variations." (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize, Step 6 Cause and Effect Callout: "As students identify amounts of fur color over time, be sure to elevate the use of cause and effect as a tool to make sense of the data. Return to the cause-and-effect relationships students predicted before they observed the data. For example, prompt students by asking, "if this is true now, do we think this will be true in the future? What would we expect to happen to the amount of gray wolves if there were no more sickness outbreaks? What would we expect to happen to the amount of gray wolves if the sickness outbreak continued for several years?" (Lesson 9, Teacher Guide) This teacher move supports students in using the CCC of cause and effect with the Practice of analyzing data, in service to the DCI of traits affecting survival.
- Lesson 10, Synthesize, Step 3, Teaching Tip Callout: "Consensus Discussion: A Consensus Discussion is different from other kinds of discussions because the purpose of the discussion is to converge on an idea or explanation that the whole class agrees upon. In this discussion, your classroom community is pushing toward a shared explanation that can be supported by evidence. Your role is to help students see where they agree and resolve disagreements where possible." (Lesson 10, Teacher Guide)
- Lesson 11, Synthesize, Step 3 Asking Questions and Defining Problems Callout: "Your students have asked questions about phenomena earlier in this unit, and in prior units, which you can leverage now. If your students are struggling, guide them to focus on what we cannot tell about the relationship between people and dogs from the images alone. If your students are having difficulty writing questions, and not specific to this phenomenon, refer back to the sentence stems from Lesson 1, slide Y." (Lesson 11, Teacher Guide) This teacher move combines support for a Practice (Asking questions and defining problems) used to leverage a DCI (dog characteristics related to their environment) through the lens of a CCC (an observable phenomenon happening over a very long time period).
- Lesson 14, Explore, Step 2, Community Connections: "The gallery tour images include the following extinct animals, which students might be especially interested in if their special animal seems similar: fish (herring, perch, paddlefish, and stingray), dragonfly, turtle, salamander, and a crocodile-like reptile. Students will also get to analyze and interpret additional fossils in the summative assessment in this lesson, which may be similar to others' special animals: saber-toothed cat, giant ground sloth, and ancient bison." (Lesson 14, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

II.G. Scaffolded differentiation over time

ADEQUATE

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

The reviewers found **adequate** evidence that supports are provided to help students engage in the practices, but there is not gradual adjustment in the level of independence in the students' use of the elements of the unit's focal SEPs: Developing and Using Models, Analyzing and Interpreting Data, and Constructing Explanations and Designing Solutions. Elements for each SEP are identified in the Unit Overview. These pieces of evidence were selected because they show how the class as a whole is progressing by steps from introduction to independent use of selected elements of the identified focal SEPs. Scaffolds are introduced in the early lessons and are not consistently removed later in the unit for some SEP elements as students become more independent in their use of the SEP.

MOD: Developing and Using Models

MOD:E4: Develop and/or use models to describe and/or predict phenomena. Students receive similar amounts of support and scaffolding when updating their consensus models in Lessons 1-9. Scaffolding is not explicitly reduced over time.

- Lesson 1, Synthesize, Step 3: "Develop an individual initial model. Use slide I to review what modeling is if your students are unfamiliar with this practice. Display slide J and distribute the Initial Model handout and read the directions and prompts aloud. Give students time to explain how the newborns and adults they observed look and behave differently. Remind students that "how" questions ask for the ways something happens, so they should describe details about the ways newborns and adults are different. If they have ideas about reasons why that happens, they can explain those, too." (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 6: "Propose a structure for this model. Display slide M and remind students that we have been investigating these different steps or stages in a canine's life. Suggest that we first describe what happens in each stage and then put them together to show the changes happening over time. Explain that we can work together to describe the stages if we have one piece of paper for each: newborn, young adult, and adult and we can share the work of drawing/writing ideas in marker on each page. If needed, remind students that we heard the term "young adult" at the end of the book." (Lesson 2, Teacher Guide) However, this is more support than Lesson 1.
- Lesson 3, Synthesize, Step 4: "Add to the class consensus model from Lesson 2. Display the consensus model from Lesson 2. Continue the work from lesson 2 by drawing the four life stages (white boxes). Once consensus is reached for the names of the life stages, record those terms on the model. Repeat this process by then comparing what happens between stages (green boxes) across the canine types. For example, focus on what each group included between the Newborn and Young Adult stages across all canine types. Again, highlight words or ideas that seem similar between each stage. The final life process, Aging and Dying, can be used as an example since all models end with this life process. Remind students that we also have a new term, development, that may help describe some of the changes we notice between stages. Add this term to the Word Wall." (Lesson 3, Teacher Guide) While students are developing their consensus model, they are doing so with the same amount of support that was provided in Lesson 2.
- Lesson 4, Synthesize, Step 4: "Work with students to annotate class consensus model with similarities (e.g., the main life stages and processes are similar across organisms) and to note differences (e.g., lifespan, way they are born, etc.).

Use check marks to note similarities and cross off/edit parts of the model to note differences. Once annotated, ask students whether this model still only represents canines. Listen for students to suggest that it now represents more animals. Suggest that maybe our consensus model now represents all animals' life cycles." (Lesson 4, Teacher Guide) While students are developing their consensus model, they are doing so with the same amount of support that was provided in Lessons 2-3.

- Lesson 5, Synthesize, Step 4: "Develop a new model for Dog trait inheritance. Show slide P and co-construct the model as a class using the following prompts. Add to the model using students' suggestions and students' words. As they make suggestions, add them to the model. Use the sample chart shown here as a guide for one effective way to organize the information students will be sharing." (Lesson 5, Teacher Guide) While students develop a new model, they do so with the same level of support provided in Lessons 2-4.
- Lesson 6, Synthesize, Step 4: "Because this is a Consensus Discussion, make sure the class is in agreement before revising the model. After students have surfaced their ideas and agreed on ideas they have evidence to support, say something like, It sounds like we are saying that animals don't just inherit the information for the way that they look - their physical traits - but can also inherit information for the way that they act - their instinctive behaviors. Revise the Class Consensus Model to reflect what we have figured out about instincts." (Lesson 6, Teacher Guide) While students are developing their consensus model, they are doing so with the same amount of support that was provided in Lessons 2-5.
- Lesson 7, Synthesize, Step 5: "Point to the part of the model where the class concluded that the way a dog looks and acts changes as it develops and helps the dog do a job. Ask students what we should add to our Consensus Model so it includes how learning affects the way a dog looks and acts. Give students time to think or partner talk, then elicit suggestions for updating the model." (Lesson 7, Teacher Guide) While students are adjusting their consensus model, they are doing so with the same amount of support that was provided in Lessons 2-6.
- Lesson 8, Synthesize, Step 3: "Construct an explanation for poodles. Show slide E and distribute a Poodle Explanation assessment to each student. Explain the directions on the assessment and point out how the Poodle card is similar to the other Dog Breed card students sorted earlier in this lesson. Remind students that they can (and should) refer to the What does an explanation need? chart, Our Growing Ideas chart, and class consensus model to support their explanations." (Lesson 8, Teacher Guide)
- Lesson 9, Navigate, Step 7: "Update the class model. Stay in the Scientists Circle. Celebrate that it sounds like we figured out some new ideas about how variations in traits among wolves may affect survival and reproduction. Display the class' consensus model. Point to the part of the model where the class concluded that the way a dog looks and acts changes as it develops, these changes are influenced by inherited and learned traits, and helps pet dogs do a job. Display slide Q and give students a moment to think about model revisions. Then, elicit suggestions for updating the model, working toward something like the example below. One key idea to pull out is that if black wolves can survive disease outbreaks, they are more likely to pass on information to have black wolf pups. To show this idea, draw a couple of "generations" onto the model to show passing on of information from parents to offspring, which is what happens for the black wolves of Yellowstone." (Lesson 9, Teacher Guide) While students update their consensus model, they do so with the same level of support that was provided in Lessons 1-7.
- Lesson 10, Synthesize, Step 3: "Update our model to include other animals. Have students turn and talk with a partner to consider how we should revise our model, then elicit suggestions from students for how we might update the Class Consensus Model to show that many of the new ideas we figured out explain more than dogs or canines. Listen for students to suggest places where "dogs" or "canines" appear, we could change to "animals" or "many kinds of animals". Make sure the class is in agreement before revising the model. Consider inviting a student to revise the model following the suggestions agreed upon by the class." (Lesson 10, Teacher Guide)

- Lesson 11, Synthesize, Step 3: "Develop an individual initial model. Display slide R. Tell students that they will individually create a model that answers the question, How have people and dogs been working together over time? Distribute Dogs Working With People Through History to each student. Read the directions from the slide or the more detailed instructions on the handout. For the first step, students choose a point on the timeline from "Long Ago" that they will compare to "Today", which represents everything students know about how people work with dogs from previous lessons. For the second step, students create a model to describe how people and dogs worked together today and long ago. Encourage students to use a combination of drawings, symbols, words, and numbers as part of their model." (Lesson 11, Teacher Guide) This is the first lesson in the last lesson set; therefore, allowing students to create the initial model alone is the appropriate amount of scaffolding needed.
- Lesson 13, Synthesize, Step 5: "Revise our consensus model through a Consensus Discussion. Display slide H. Gather students in a Scientist's Circle around the consensus model. Point to the Fossil Timeline chart. Use the first prompt on the slide to elicit student ideas to explain which parts of the life cycle might have been disrupted since the wooly mammoth is no longer alive today. After students share a few ideas, ask how we can revise our model to explain why some animals are no longer found today." (Lesson 13, Teacher Guide) Supports not present in Lesson 11 are added back in this lesson.

DATA: Analyzing and Interpreting Data

DATA: E1:Represent data in tables and/or various graphical displays (bar graphs, pictographs, and/or pie charts) to reveal patterns that indicate relationships. Scaffolding is not explicitly reduced over time.

- Lesson 3, Explore, Step 2: "Create a table to compare canine lifespans. Display slide D. Guide the class to create a representation as an example by saying, Let's find out which of our canines lives the longest! On blank chart paper draw a two-column table (see slide D), labeling the first column "Canine Type" and the second column "Lifespan". Explain that scientists might use a representation called a table to organize information about how long each canine lives. Ask one student from each group to share information about the lifespan of their canine. Record the canine type and lifespan information on the data table, and point out that canine's age starts at 0 months when they are born. Then ask students which canine lives the longest. They will likely notice that the canines have a range of lifespans. Some students may also notice that pet canines tend to live longer than wild canines. Be sure that a consensus is reached. Point out that the table made it easier to quickly compare information about different canines." (Lesson 3, Teacher Guide)
- Lesson 4, Explore, Step 2: "Add data to our class chart. Display slide G. Point out the class chart, Our Animal Life Stages. Ask students if the current chart captures all that we have figured out. Remind students that one way scientists share information is through data charts. Because the student investigated similar animals you can place them in groups based on the animal they took notes on. Tell students we will all add our information to a shared chart to organize and combine the information. Once students are in groups based on animal, show students how to add their data to the chart by first adding 7 sticky notes with "canine" written on them together. Elicit suggestions from students where we should place the canine sticky notes, and add them to the chart." (Lesson 4, Teacher Guide) However, the teacher is assisting students in creating a data chart, similar to Lesson 3.
- Lesson 5, Explore, Step 2: "Invite students to co-construct the bar graphs based on their observations of the Parent and Puppy Trait Cards. Ask students to identify different features of the graphs to draw their attention to the labels and how they can aid in graphing the data. As students share what they notice, begin filling in the bar graph on the class chart to represent the data. After modeling how to fill in the graph, prompt students to use their prior bar graph experiences in math class to complete the bar graphs and make interpretations about the data. Use the

following questions to guide their reasoning." (Lesson 5, Teacher Guide) However, the teacher is assisting students in creating a data chart, similar to Lessons 3-4.

- Lesson 6, Explore, Step 2: "Make observations of the Labrador puppies' retrieving. Display slide F. Distribute the Behavior Data Table handout to each student and explain that we are going to make observations of puppies retrieving. The handout is a data table that we will use to keep track of our observations and includes the behaviors we noticed in our first video, along with a few others that we will observe. Briefly, as a class, come to a consensus for how we will describe the behavior of each puppy we observe (check mark or "X" in the box)." (Lesson 6, Teacher Guide) However, the teacher is assisting the students in completing the data table, which is the same scaffolding as Lessons 3-5.
- Lesson 9, Explore, Step 3: "Add observations to our class chart. Display slide G. Point out the class chart, Wild Canine Traits. Remind students that scientists often share information through data charts, therefore, we will add our observations to a chart. Although each small group examined all of the wolf cards, different groups may have noticed different traits. Elevate the importance of multiple perspectives in gaining a more complete understanding." (Lesson 9, Teacher Guide) While students are making observations and recording them on a class chart, scaffolding is not being reduced over time.
- Lesson 11, Synthesize, Step 3: 'Develop an individual initial model. Display slide R. Tell students that they will individually create a model that answers the question, How have people and dogs been working together over time? Distribute Dogs Working With People Through History to each student. Read the directions from the slide or the more detailed instructions on the handout. For the first step, students choose a point on the timeline from "Long Ago" that they will compare to "Today", which represents everything students know about how people work with dogs from previous lessons. For the second step, students create a model to describe how people and dogs worked together today and long ago." (Lesson 11, Teacher Guide) While students create a timeline as a whole class, this is more scaffolding than in Lesson 9, where students work in small groups to represent data.
- Lesson 12, Explore, Step 3: "Organize data to visualize the differences in how long dogs and humans have been on Earth. Organize students into pairs to complete their timelines. Show slide F. On Dog-Human Fossil Timelines students will find separate timelines for dogs and humans. Read the instructions together and direct student pairs to mark points along the timelines for where they have fossil evidence for humans and dogs. Once they mark these points, students can use colored pencils to shade in the length of time that we have evidence for the presence of dogs and humans." (Lesson 12, Teacher Guide) While students look for patterns in their timeline in small groups, this is more scaffolding than Lesson 11, where students look for patterns and describe them independently.
- Lesson 13, Explore, Step 2: "Organize fossil evidence. Display slide D. Say, to help us figure out when these animals lived, let's organize our fossil evidence by their age. Prompt students to work in small groups to first place the set of cards in order from youngest to oldest at their table. Once students are confident that they have placed the cards from youngest to oldest. Complete the process for analyzing evidence of ancient animals parallels the process for analyzing human-dog fossil evidence from the previous lesson. Remind students that one unit represents 10,000 years on the scaled timeline. Have students use the timeline on Ancient Animal Fossil Record Timeline to mark the units ago the fossil cards were found and then shade in the region." (Lesson 13, Teacher Guide)

DATA:E2: Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.

- Lesson 5, Explore, Step 3: "Analyze the Trait Data for the Poodle/Labrador puppies. Show slide N and distribute Labrador and Poodle Puppy Data. Explain to students that while you don't have pictures of the offspring of the brown Lab and the brown Poodle, you do have data they can use to figure out what they would look like. Direct students to work in small groups to analyze the Traits of Parents and Puppies of a Mixed Breed graph, using the three prompts to guide their analysis. As you circulate, listen and record student thinking in the Following Student Sensemaking

(Lessons 5-9). Form a scientist circle to share our thinking. After students have had enough time to analyze the graphs and record their thinking, invite students to bring their materials and form a Scientist Circle. Show slide O, and have a sensemaking discussion around the data." (Lesson 5, Teacher Guide)

- Lesson 6, Explore, Step 3: "Describe patterns in our data. Display slide H. Explain to students that we need to observe patterns in our data to make sense of our observations. Then, have pairs share their responses to the questions on the slide. Use the class discussion as an opportunity to surface students' ideas about the similarities and differences in the puppies' behaviors." (Lesson 6, Teacher Guide) While students share their observations with a partner and then with the whole group, this process is similar to the scaffolding used in Lesson 5.
- Lesson 9, Synthesize, Step 6: "After students have completed their group graph. Have students create a prediction of which way we could add an arrow to show the change over time for each wolf using Wolf data analysis predictions." (Lesson 9, Teacher Guide) Here, students independently analyze a pictograph chart to seek patterns that will let them make predictions. Their independent analysis to look for patterns is a reduction of scaffolding from lesson 6, where the analysis happened as a whole class.
- Lesson 10, Connect, Step 2: "Establish the goal of the group work. Emphasize that the goal of our work is to work in groups and then share what we find out with each other to look for patterns in similarities and differences. Remind students that patterns mean something repeats again and again. Explain that they will research one kind of animal, but ultimately, we want to see what patterns exist across the animals, if any. Arrange students into groups with the same animal to research. Have students keep their copy of Our Growing Ideas Checklist with them. Have students write the animal they are researching on the handout. Distribute 1 copy of Amazing Animal Traits: Parents and Offspring to each group." (Lesson 10, Teacher Guide) While students share their observations with a partner and then with the whole group, this scaffolding is the same as in Lesson 6.
- Lesson 11, Explore, Step 2: "Explore older evidence. Display slide M and explain that these images are even older than the ones from before. Hand out tent cards with these images from Printable Tent Cards to pairs of students and ask them to discuss the prompts on the slide. After about 5 minutes, display slide N and ask the class to share what they notice and wonder about the people and animals in the images. Draw a line below the previous noticings and wonderings, and continue to add new ideas on the Notice and Wonder chart. Refer to Guidance for Interpreting Ancient Images for further guidance on interpreting the images. (See the note in the lesson's Preparation Checklist regarding cultural norms concerning ancestral artifacts)." (Lesson 11, Teacher Guide) While students share their observations with a partner and then with the whole group, this follows the same scaffolding as Lessons 5, 6, 9, and 10.
- Lesson 12, Explore, Step 3: "Analyze and interpret data in table groups. Once students have had enough time to construct their Fossil Timelines, show slide G and have table groups analyze and interpret the fossil data by discussing the slide prompts." Synthesize Step 4: "Facilitate a Building Understandings Discussion. Show slide H and have a discussion where the class analyzes and interprets the Fossil Timeline together." (Lesson 12, Teacher Guide) While students are creating a number line timeline in small groups, then analyzing it together as a whole class to create a whole-class timeline, this represents a return of scaffolding, as students are no longer analyzing timeline data independently
- Lesson 13 Teacher Instructional Guidance Tool Wooly Mammoth Assessment: "If you notice…Students struggle to interpret fossil evidence to explain what the environment may have been like long ago when and where mammoths lived. Possible Next Steps…Look at a new photograph of an African elephant today that shows at least three traits. Find a photograph that shows its tusks, teeth, and fuzzy hair. Talk through the traits of the elephant. Then, revisit the wooly mammoth cards that show the tusk, teeth, and fur. Have students identify similar traits between the elephant today and the mammoth long ago (e.g., tusks) but also different traits (e.g., fur). Explain that elephants today live in tropical areas (connecting back to what students learned about tropical climates in the Unit 3.2: Why do plants only grow well in certain places, and how can we protect them?. Then, have them describe what

kind of climate a very hairy elephant might live in today? Finally, return to interpreting the thick fur of the wooly mammoth long ago." While students are analyzing a timeline as a whole class, they receive the same scaffolding as in Lesson 12.

- Lesson 14, Explore, Step 2: "Allow time for partners to analyze and interpret the fossil images. Circulate to support students as they work. They do not need to visit every image; they have room on their handout to record thinking about 4 fossils (at least one of them a plant). Consider asking the following questions to provide feedback to students while encouraging the use of both linguistic and nonlinguistic (images, gestures) resources: What traits do you notice? Can you show us? Do any of these fossils from the past look like animals or plants that are alive today? How is this fossil plant or animal similar to or different from the ones you know today? What kind of environment do you think this animal or plant lived in back then? Can you show us what evidence supports your idea? Prepare to discuss interpretations. Remind students to answer the questions on the back side of their handouts, and then gather the class back together to share their interpretations." (Lesson 14, Teacher Guide)

CEDS: Constructing Explanations and Designing Solutions

CEDs: E2: Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation

- Lesson 1, Synthesize, Step 6: "Write or draw explanations. The students can write their ideas and/or draw them. Cue students who want to draw their ideas to use labels and words to help communicate their ideas more completely. If the term 'model' has been discussed with students, now would be a good time to review it as another way we explain how or why something happens. Give students about 10 minutes to work on their explanations (or models). As they do so, circulate around to each group to listen in or look at their explanations" (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 5: "Discuss differences and similarities. Use the prompts that follow and guide students to support explanations with evidence of what they saw and heard in the video and text. When commenting on similarities, expect students to point out that both domesticated and wolf puppies need their parents to keep them alive when they are newborn and then start to need their parents less as they get older." (Lesson 2, Teacher Guide) The teacher supports students in using evidence to construct their explanations.
- Lesson 6, Synthesize, Step 5: "Then, return to the first prompt again (Why did the expert select Haven and Elvis as parents for the litter?). Have students turn and talk with a partner about how they would answer this question, using what they know about traits that puppies can inherit as evidence to support their explanation. Invite a few student pairs to share their explanations with the class. Tell students that they have figured out a lot of ideas and suggest that they take some time to update their model." (Lesson 6, Teacher Guide) While students use prompts as a class to support their explanations, this is the same scaffolding used in Lesson 2.
- Lesson 8, Synthesize, Step 4: "Facilitate a Building Understandings Discussion. Display slide I, which continues from the previous discussion. Convene students in a Scientists Circle. Pose the question about how practicing to become a sled dog would change the way a dog looks and acts during its life." (Lesson 8, Teacher Guide) Students are given a question and asked to create an explanation with the class.
- Lesson 9, Synthesize, Step 6: "Determine a cause-and-effect relationship. Ask students to consider what could be causing the patterns we see in our graph. Prompt them to think back to our cause-and-effect relationships on our Wolf Traits chart." (Lesson 9, Teacher Guide) While students are prompted to use previous evidence to construct an explanation, they are receiving the same teacher support as in Lessons 2 and 6.

- Lesson 10, Synthesize, Step 4: "Discuss scientific explanations. Share that explanations will answer a question. Pointing to the [DQB], remind students that the big question we are investigating is Why do animals look and act the way they do? And they have some new ideas and evidence to work with to develop an explanation to this question." (Lesson 10, Teacher Edition) This represents a backward step in scaffolding, as students are using the same tools to do the same kind of task as in Lesson 8. Sentence frames, not present in the Lesson 8 task, are reintroduced in Lesson 10.

Criterion-Based Suggestions for Improvement:

- To increase the rating of this criterion, ensure that "[s]caffolding is explicitly reduced over time for the use of nearly all SEP elements stated as targeted learning objectives." (Detailed Guidance, p. 33)
  - Re-evaluate scaffolding around MOD-E4, DATA-E1, and DATA-E2 to ensure that students are progressing in the use of this SEP.
  - Provide varied opportunities for students to demonstrate elements of the SEPs other than during a whole-class, teacher-led discussion.

CATEGORY III

Monitoring NGSS Student Progress

III.A. Monitoring 3D Student Performance

EXTENSIVE

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

The reviewers found **extensive** evidence that the use of student artifacts shows direct, observable evidence of using all three dimensions at a grade-appropriate level. Tasks require students to integrate all three dimensions as part of their learning performance, applying them to explain why animals look and act the way they do. Assessments are similar in style and context to student learning activities. The focus is on using students' sensemaking of the phenomenon to uncover student understanding of all three dimensions.

Lessons 10 and 14 contain summative assessments that require students to apply their knowledge and demonstrate an understanding of the concepts presented. Students complete these tasks independently, and the resulting artifacts can be collected and evaluated to determine student mastery of the learning objectives.

- Lesson 10 Student Assessment 2 Explanation about Bunnies: "Why does Daisy look like her parents, but also a little different?... How could changing fur color at the right time help the snowshoe hare survive? Use evidence to support your explanation."
- Lesson 14, Explore, Step 5: "Display slide J and orient students to the new location of California. Share with students that there is a place in southern California called the La Brea Tar Pits. ("Brea" is the Spanish word for the substance found in the tar pits.) Explain that long ago, animals and plants were caught in the thick, sticky ponds of a substance called asphalt (not actually tar) and turned into fossils. Point out that the area around the La Brea Tar Pits today is the busy city of Los Angeles, but what was it like long ago when those animals were fossilized? Propose that students analyze and interpret data from some of the fossils to figure that out." (Lesson 14, Teacher Guide)

Throughout the unit, several student performances produce artifacts that integrate the three dimensions in service of sense-making or problem-solving.

- Following Student Sensemaking Lessons 2 - 4 gives teachers a format to collect informal evidence about students' use of 3 integrated dimensions: "Checklist of Listen/Look-Fors") Use handouts, small-group discussions, and whole-class discussions. Lesson 2: **Use a model describing evidence of similarities and differences between wolf and dog puppies to explain the ways puppies change to become more like adults.** Lesson 3: **Uncover patterns to develop a model that explains how different canines undergo similar developmental processes and stages as part of their life cycle**. Lesson 4: **Develop a model to describe that while animals have unique and diverse life cycles, they all follow the same pattern**." (Following Sensemaking Tool Lessons 2-4).
- Following Student Sensemaking Lessons 5-9 gives teachers a format to collect informal evidence about students' use of 3 integrated dimensions: "Checklist of Listen/Look-Fors") Use handouts, small-group discussions, and whole-class discussions. Lesson 5: **Analyze and interpret data to provide evidence that related dogs inherit similar patterns of traits from their parents.** Lesson 6: **Analyze and interpret patterns in dogs' instinctual behaviors to provide evidence that puppy siblings inherit information from parents that influences behavioral traits**. Lesson 7: **Use evidence to support the explanation that a dog's traits can be influenced by their environment, like learning new jobs**. Lesson 9: **Use observations and patterns as evidence to support an explanation that variations in wolf traits can result in an advantage to survival**." (Following Sensemaking Tool Lessons 5-9)

- Following Student Sensemaking Lessons 11-14 gives teachers a format to collect informal evidence about students' use of 3 integrated dimensions: "Checklist of Listen/Look-Fors") Use handouts, small-group discussions, and whole-class discussions. Lesson 11: **Examine historical evidence across long time periods to develop a model describing how people and dogs have lived together today and in the past**. Lesson 12: **Analyze and interpret fossil data to determine how long humans and dogs have been working together**. Lesson 13: **Analyze and interpret fossil data to determine when wooly mammoths lived on Earth and what their environments were like.** Lesson 14: **Analyze and interpret fossil data to describe the type of organisms in a place long ago and make sense of what the place was like given the evidence.**" (Following Sensemaking Tool Lessons 11-14)

Throughout the unit, students routinely produce artifacts that demonstrate the use of grade-appropriate elements of SEPs, CCCs, and DCIs, which are targeted as learning objectives. For example,

- Lesson 4, Synthesize, Step 5: "Tell students that they will have the opportunity to use what they have learned about the life stages of other animals to make predictions about a newly discovered animal. Distribute New Animal Predictions and read through the scenario and questions. Ask students if they have any questions about the scenario or prompts. Give students 15 minutes to work individually on questions 1-3. Tell students they can refer back to their previous work, the Class Consensus Model, and Our Growing Ideas chart as evidence. As students work, you can challenge their thinking with questions like: How does that data/evidence support your claim? Did you consider the patterns true for other animals?"
- Lesson 4: Three-Dimensional Goal: **Develop a model to describe that while animals have unique and diverse life cycles, they all follow the same pattern**. **SEP:MOD-E4: Develop and/or use models to describe and/or predict phenomena.DCI: LS1.B Growth and Development of Organisms CCC:PAT-E2: Patterns of change can be used to make predictions.**
- Lesson 11, Synthesize, Step 3: "Students use the Dogs Working With People Through History handout that students complete on their own to share initial models, as well as ideas shared by the class when discussing the uncertainties they have in their models after comparing them with two classmates." (Lesson 11, Teacher Guide)
- Lesson 11: Three-Dimensional Goal: **Examine historical evidence across long time periods to develop a model describing how people and dogs have lived together today and in the past**. **SEP:MOD-E4: Develop and/or use models to describe and/or predict phenomena DCI: LS4.A Evidence of Common Ancestry and Diversity CCC:SPQ-E1: Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long time periods.**

Criterion-Based Suggestions for Improvement: N/A

III.B. Formative

EXTENSIVE

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

The reviewers found **extensive** evidence that the materials provided opportunities, which are called out as formative, and most of those opportunities include support for next steps. Evidence of varied support for student thinking across the three dimensions was located, and most of the formative assessment processes attend to multiple aspects of student equity.

Materials include explicit, frequent, and varied support for formative assessment processes. Formative assessment opportunities are highlighted for each lesson, with connections to all three dimensions indicated in separate colors. These include a "How can I use the information I gather from this assessment?" section in the assessment instructions at the beginning of each lesson, often in a clear if-then format. For example,

- Lesson 3, Teacher Guide Assessment Guidance: "If a group of students is struggling to get started on their canine's life stages and processes, take time to demonstrate how to read and find the pertinent information from the Canine Infographics infographic. Demonstrate how to locate their canine using the infographic heading and images. Demonstrate how they might take one piece of information from the text and summarize it on their A Canine's Life handout." (Lesson 3, Teacher Guide)
- Lesson 9, Teacher Guide Assessment Guidance: "If a student struggles to use evidence to support their explanation, ask them to show or describe the evidence we collected during the lesson. You can ask questions such as, What does our graph tell us about the number of wolves with a particular fur color? What did we learn from scientists about fur color and matching traits when we read the article? What source helped us decide which matching trait was more important for survival? It may also be helpful to look through the evidence with your student and possibly articulate your thinking as you model how you would use evidence in an explanation." (Lesson 9, Teacher Guide)

Key formative assessments are labeled separately from other formative assessment opportunities, and include more specific support in the Assessment Overview document, as well as more support in the Teacher Guide for that lesson and in the associated Following Student Sensemaking documents. For example,

- Lesson 5, Explore, Assessment Opportunity, "This analysis provides the teacher an opportunity to formatively assess learning goal 5.A. As students demonstrate their data analysis of the patterns observed in the Traits of Parents and Puppies of a mixed breed, ask them to explain whether the data supports or refutes their developing understanding of inheritance. If you notice students struggling to identify significant patterns, ask students to review the Traits of Parents and Puppies for Labrador and Poodle graphs. Refer to the Assessment Guidance at the beginning of the lesson." (Lesson 5, Teacher Guide)
- Lesson 6, Explore, Assessment Opportunity: "This is the first opportunity to collectively assess Learning Goal 6. Use the turn and talk discussion to gauge whether students are analyzing patterns in retrieving behavior among puppies in a dog family to explain how dogs can have behaviors that they did not learn. The Following Student Sensemaking (Lessons 5-9) tool is a helpful tool for documenting students' ideas...This is the second opportunity to collectively assess Learning Goal 6. Use the class discussion to gauge whether students are analyzing patterns in dog behavior within a dog family to predict how a related dog will behave." (Lesson 6, Teacher Guide)
- Lesson 10, Connect, Assessment Opportunity: "This is your first opportunity to assess learning goal 10.A. While students are working in their research groups, circulate to groups to listen to their discussions. Keep Following Student Sensemaking (Lessons 5-9) and Poodle Explanation Instructional Guidance on a clipboard to jot down evidence of student understanding. You can cue students to share what they are figuring out from pictures and text

about the new animal. Also, review students' Our Growing Ideas Checklist handout as they check off ideas. Probe their reasoning for checking off certain ideas." Synthesize, Step 3, Assessment Box: "This is your second opportunity to assess learning goal 10.A. During discussions, keep Following Student Sensemaking (Lessons 5-9) and Poodle Explanation Instructional Guidance on a clipboard to jot down evidence of student understanding as they suggest ways to revise Our Growing Ideas and/or class model." (Lesson 10, Teacher Guide)

- Lesson 12, Synthesize, Assessment Opportunity: "Formative assessment: This discussion provides the teacher an opportunity to formatively assess learning goal 12. Students can demonstrate their understanding that fossils provide evidence for the types of animals that have lived on Earth. Ask students to use the Dog and Human Fossil Cards to provide evidence to support the construction of the Fossil Timeline. If you notice students struggling to identify significant ideas, ask students to review the years and Scientist's Interpretations found on the cards." (Lesson 12, Teacher Guide)
- Lesson 13, Explore, Step 2: "Formative assessment: This is the second opportunity to individually assess learning goal 13 specifically in the context of when ancient animals lived on Earth. Use the timeline conversations to assess whether students are using mathematics to analyze the range of time we observe evidence of the wooly mammoth to describe how long ago wooly mammoths were found on Earth. Following Student Sensemaking (Lessons 11-14) is a helpful tool for documenting students' ideas. Refer to the Assessment Guidance at the beginning of the lesson." (Lesson 13, Teacher Guide)
- Following Student Sensemaking, individual documents are provided for Lessons 2-4, 5-7, 8-10, and 11-14, each of which offers checklists to help teachers track individual students' progress toward key formative learning goals. These are 3-dimensional, as shown through color-coding of the checklist:
  - Following Student Sensemaking Lessons 5-9 gives teachers a format to collect informal evidence about students' use of 3 integrated dimensions: "Checklist of Listen/Look-Fors") Use handouts, small-group discussions, and whole-class discussions. Lesson 5: **Analyze and interpret data to provide evidence that related dogs inherit similar patterns of traits from their parents.** Lesson 6: **Analyze and interpret patterns in dogs' instinctual behaviors to provide evidence that puppy siblings inherit information from parents that influences behavioral traits**. Lesson 7: **Use evidence to support the explanation that a dog's traits can be influenced by their environment, like learning new jobs**. Lesson 9: **Use observations and patterns as evidence to support an explanation that variations in wolf traits can result in an advantage to survival**." (Following Sensemaking Tool Lessons 5-9)
  - The "What to Look and Listen For" column in each lesson's Lesson Assessment Guidance is also color-coded to emphasize elements from each dimension. Lesson 5: Where Can I Check For Understanding: "Where to check for understanding: In the Explore, when students work in groups to analyze the trait pattern data for the Labrador and Poodle offspring using Labrador and Poodle Puppy Data. What to look and listen for: Look for signs that students **describe similarities and differences** between **the trait data sets**. Students should be **using these analyses** to connect that **related dogs' traits share more similarities than with unrelated dogs**. For example, students should explain that Lab puppies have more similar fur length and texture with Lab parents than Poodle parents." (Lesson 5, Teacher Guide)

Teacher action steps correspond to elements from all three dimensions over time, for example:

- Lesson 4, Teacher Assessment Tool Instructional Guidance table: "If You Notice…Students struggle to identify the 4 key life stages of all animals (Question 1) Possible Next Steps…" addresses the DCI element of life cycles and stages and the Practices of using models to explain a phenomenon. "If You Notice…Students struggle to identify evidence to support their ideas (Question 3)…Possible Next Steps…" addresses the SEP element of using evidence to support explanations, and the CCC of using patterns of change to make predictions.

- Lesson 7, How Can I Use this Assessment Information: "If a student struggles to connect learning to a change in environment, have the student describe the daily environment for a dog who is training to become a sled dog compared to the daily environment if this same dog were to become a pet dog. If needed, looking at additional photos together may help." (Lesson 7, Teacher Guide) This supports the SEP and DCI elements.
- Lesson 9, How Can I Use This Assessment Information: "If a student struggles to use evidence to support their explanation, ask them to show or describe the evidence we collected during the lesson. You can ask questions such as, What does our graph tell us about the number of wolves with a particular fur color? What did we learn from scientists about fur color and matching traits when we read the article? What source helped us decide which matching trait was more important for survival? It may also be helpful to look through the evidence with your student and possibly articulate your thinking as you model how you would use evidence in an explanation. "(Lesson 9, Teacher Guide) This supports all three dimensions.
- Lesson 11, How can I Use this Assessment Information: "To support student understanding in interpreting the timeline, draw a connection between this timeline and a number line as students may be more familiar with the number line from math class. On this timeline, moving left takes you further back in time to the years before today. Similarly, on a number line, moving left causes the numbers to decrease." (Lesson 11, Teacher Guide) This supports the SEP and CCC elements.
- Lesson 13, Teacher Assessment Tool Instructional Guidance table: "If you Notice...Students struggle to interpret fossil evidence to explain what the environment may have been like long ago when and where mammoths lived. Possible Next Steps..." addresses the CCC of long versus short timelines, the DCI of fossils providing evidence about long-ago species and habitats, and the Practice of analyzing and interpreting data to make sense of phenomena.

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

- Lesson 1, Synthesize, Broadening Access: "Having students complete their explanation on their own, but with a thought partner, is especially beneficial for multilingual learners, but provides an opportunity for all learners to review their developing thoughts and explanations that allow for self-reflection. This might promote confidence, which ultimately optimizes motivation to engage in discussions." (Lesson 1, Teacher Guide)
- Lesson 2, Explore, Broadening Access: "As you record ideas on the charts, include visual representations of the ideas (e.g., drawings, photos, icons such as those provided in the Timeline Chart Images reference). This will benefit multilingual students, as well as all students, in understanding the ideas captured on the chart." (Lesson 2, Teacher Guide)
- Lesson 4, Explore, Broadening Access: "As students collect information from the website, students can write or draw their ideas in their preferred language modality and discuss them verbally; the template is a scaffold for collecting and sharing information." (Lesson 4, Teacher Guide)
- Lesson 5, Navigate, Broadening Access: "As students are sharing their ideas, look for their understanding in what they explain in discussion, as well as gestures, symbols and movements they may use. When adding those ideas to the class chart, use drawings in addition to words to represent student ideas to support emerging readers and multilingual learners. If applicable, you might encourage your multilingual students to add ideas across named languages (e.g., Spanish, Mandarin, Arabic) to chart if it would support their sensemaking throughout the lesson." (Lesson 5, Teacher Guide)
- Lesson 6, Synthesize, Broadening Access: "To enhance students' language learning and language use opportunities throughout this Synthesize, consider using the Classroom Agreements handout. The handout provides discussion phrases that students can use to support their sensemaking work. The phrases, along with supporting materials like the data table, will help students fully explain their ideas, attune to and make sense of their peers' ideas, and build off

ideas shared by classmates. Also, encourage the use of gestures or everyday language that students prefer." (Lesson 6, Teacher Guide)

- Lesson 12, Explore, Broadening Access: "As students share their noticings, pause and give the other groups a moment to sort their cards so that they can also see the shared pattern. The goal is to surface patterns in the data, so allowing all students to observe how the pattern is seen across the fossil cards will support student sensemaking later in the lesson." (Lesson 12, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

III.C. Scoring Guidance

EXTENSIVE

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

The reviewers found **extensive** evidence 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.

The Lesson Assessment Guidance in each Teacher Guide offers support for planning instruction.

- Learning targets are clearly stated and incorporated into scoring guidance for each of the Teacher Assessment Tool documents. These documents are provided for each of the summative assessments. The other Teacher Assessment Tools list the Performance Expectations addressed in the assessment at the top of the page and include learning targets in a table correlating them to elements of each dimension and specific questions on the assessment.
- Guidance for teachers on interpreting progress is provided in tables within the rubric for each summative assessment in Lessons 10 and 14. Column labels of "Beginning", "Developing", and "Secure" for each question or step in the assessment indicate what a teacher should look for to determine which level best fits a student's work. The Summative Assessment Instructional Guidance outlines students' performance levels and offers guidance for teachers to provide targeted feedback to students during the assessment.
- Lesson 10 has two options for the summative assessment with a common Assessment Statement: 3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. 3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species (cause) may provide advantages in surviving (effects) finding mates, and reproducing.
  - Lesson 10, Option 1, Explanation about Dogs, is an assessment where each student determines which set of parents belongs to Max the dog and then reads about an arctic fox to determine how its changing fur color helps it survive in its environment, using ideas developed across Lessons 2-9. The Teacher Assessment Tool, Dog Explanation Instructional Guidance, contains a color-coded, three-dimensional rubric for teachers to assess students' understanding during this individual performance assessment. Each element used in this assessment is identified in the NGSS Reference Table, and guidance on interpreting student progress

is included. There are row labels (learning targets) and column labels (Beginning, Developing, Secure, Feedback) that contain detailed descriptions of what the students should include for different questions on the assessment. Sample drawings and possible student responses are also included in the key.

  - Lesson 10, Option 2, Explanation about Bunnies, is an assessment where each student determines which set of parents belongs to Daisy the bunny and then reads about a Snowshoe Hare to determine how its changing fur color helps it survive in its environment using ideas developed across Lessons 2-9. The Teacher Assessment Tool, Bunny Explanation Instructional Guidance, contains a color-coded, three-dimensional rubric for teachers to assess students' understanding during this individual performance assessment. Each element used in this assessment is identified in the NGSS Reference Table, and guidance on interpreting student progress is included. There are row labels (learning targets) and column labels (Beginning, Developing, Secure, Feedback) that contain detailed descriptions of what the students should include for different questions on the assessment. Sample drawings and possible student responses are also included in the key.

- The materials include information to support teachers in providing feedback to students in Lesson 10. The Assessment System Overview states: "Also, use the evidence you have gathered on the Following Student Sensemaking (Lessons 5-9) and Poodle Explanation Instructional Guidance to make a summative claim about students' understanding of the assessment statements. See the range of student samples shown in the Dog Explanation Instructional Guidance or Bunny Explanation Instructional Guidance to guide what to look for as you provide feedback and evaluate the ideas students explain." (Assessment System Overview)
- The Assessment System Overview includes Lesson 14 as a summative assessment. It states: "In Lesson 14, use the evidence you gather on the Fossil Self Reflection, plus evidence you have collected from Lessons 11 through 14 using Following Student Sensemaking (Lessons 11-14) to make a summative claim about students' understanding of the assessment statement. See the range of student samples shown in the Scoring Guidance for Fossil Interpretation to guide what to look for as you provide feedback and evaluate the ideas students share." (Assessment System Overview)
- The Lesson 14 Teacher Assessment Tool, Scoring Guidance for Fossil Interpretation, contains a color-coded, three-dimensional rubric for teachers to assess students' understanding during this individual performance assessment. Each element used in this assessment is identified in the NGSS Reference Table, and guidance on interpreting student progress is included. There are row labels (learning targets) and column labels (Beginning, Developing, Secure, Feedback) that contain detailed descriptions of what the students should include for different questions on the assessment.
- Suggestions for feedback are found in the Lesson Assessment Guidance section of the Teacher Guides for each lesson. This includes feedback for summative assessments, as seen in Lesson 14, Lesson Assessment Guidance: "You can use information from the Fossil Self Reflection to inform your feedback to students so that you can provide more targeted feedback on things that students name they are struggling with. Take time to conference with students and/or provide written feedback and additional support as needed before students complete their La Brea Tar Pits Fossils." (Lesson 14, Teacher Guide)
- Teachers are given the choice for students to track their progress on a personal Our Growing Ideas chart, or use the class chart. The Lesson 2 Materials and Preparation information states: "In 3rd grade OpenSciEd, the units include a class-level Our Growing Ideas chart similar to the units in K-2. However, if your students are ready to begin tracking their ideas individually or in combination with a class-level chart, print My Growing Ideas for each student. Use this handout periodically throughout the unit to track the progress of student ideas over time. Consider adding the lesson question to the handout before making copies to reduce the writing burden for students." (Lesson 2, Teacher Guide)

The Lesson Assessment Guidance in each Teacher Guide offers suggestions on how to act on assessment information, and often includes individual feedback suggestions. For example,

- Lesson 3 Instructional Guidance for the Key Formative Assessment: A Canine's Life consists entirely of a chart for planning further instruction. For example, "If you notice...Students struggle to see patterns across the unique differences for each canine...Possible Next Steps...Start with the changes from newborn to more independence. Have each group share how long this phase lasts and the important things happening. As they share, have students listen for when each other is using the same words (e.g., 2 months, growing fast, fur changing color, etc.), and suggest patterns they hear. Also, you might consider listing the similarities on chart paper to demonstrate how to do this for one particular life cycle stage or process. For example, all canines become an adult at around 1-2 years old. Some students may need to visualize the pattern, so you can record words students use to describe and a tally of their use so that a pattern emerges of the most common time frame and changes that are happening. In Lesson 4, students will be expanding to even more animals and even more unique life cycles. If a student struggled with this task for canines, have a one-on-one conversation with them. Ask them what they did well and understood, but also where the activity was challenging. Let them share their experience so that you can adjust your support for the student in Lesson 4." (Lesson 3, Teacher Guide)
- Lesson 7, Assessment Guidance: "The assessment during this lesson is through verbal discussion one-on-one with students, listening to small group conversations, and during whole group discussion. Therefore, having the Following Student Sensemaking (Lessons 5-9) on a clipboard or nearby to jot notes of student sensemaking is critical." (Lesson 7, Teacher Guide)
- Lesson 8, Synthesize, Assessment Opportunity: "These explanations provide an opportunity to formatively assess learning goal 8 with the purpose of providing information to direct your instruction and offering feedback to students that they can respond to. As students demonstrate their understanding for why people often chose poodles for retrieving wild game, ask them to provide evidence to support their claims. Use the Poodle Explanation Instructional Guidance tool to guide your assessment and decide on next steps for students based on their responses. Provide feedback to students on their use of evidence and give students time to reflect on the feedback you provide" (Lesson 8, Teacher Guide)
- Lesson 8, How Can I Use This Assessment Information?: "Pay particular attention to how students are using evidence to support their explanations. Provide feedback on these explanations using guidance from Poodle Explanation Instructional Guidance and give students time to review their feedback before their next written explanation. Use the evidence you have collected on Following Student Sensemaking (Lessons 5-9) to help you decide if there are specific students you would like to check in with before, during, or after their work on the Poodle Explanation assessment." (Lesson 8, Teacher Guide)
- Lesson 10, Assessment Guidance: "Use the formative assessment opportunity to provide feedback to students that will help them be successful on the summative assessment task. For example, if you anticipate students may struggle with the summative assessment task given their discussion in Synthesize, consider doing the Explanation about Canines together first to talk through how to examine the photos as data and use them to write an explanation. Then have students complete the Explanation about Bunnies individually." (Lesson 10, Teacher Guide)
- Lesson 13, Synthesize, Assessment Opportunity: "This is a moment of formative assessment for learning goal 13, and anticipating learning goal 14. A shift in this moment is toward the practice of constructing explanations using the data we examined in the lesson. Use Lesson 13 Instructional Guidance for instructional guidance and to provide feedback to your students. Use Giving and Receiving Feedback if students need support in giving and receiving feedback. Students' assessment handout includes a moment to ask for help from you, but you can also use slide L to get a quick assessment of how students are feeling across the class." (Lesson 13, Teacher Guide)

- Lesson 14 Lesson Assessment Guidance: "The assessment opportunities in this lesson provide multiple ways to gather information about students' progress on interpreting fossil evidence data. Students have had multiple opportunities in Lessons 11-13 and now during the formative moments here in Lesson 14 to interpret fossil evidence in whole groups, small groups, and partners, so your notes on the Following Student Sensemaking (Lessons 11-14) tool can inform your feedback and instruction as the class approaches the end of the unit (see the Lesson 13 Instructional Guidance tool for additional suggestions." (Lesson 14, 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 and items assess student proficiency using accessible and unbiased methods, vocabulary, representations, and examples. However, the materials offer limited suggestions for assessing students through multiple modes of communication and do not explicitly provide options for students to choose how they demonstrate understanding on a key assessment. Additionally, the final summative assessment does not present expectations for student performance using multiple formats; it is only presented to students in a written format.

The assessments contain grade-appropriate text volume and vocabulary. These tasks are also frequently accompanied by graphics or videos to support students in expressing their understanding of the content. For example,

- Lesson 3, Explore, Broadening Access: "To guide information processing and visualization, give students a partially created poster and break them into groups of 4. Give each student a stage they have to write on their poster and 2 sticky notes to write the height and weight of their dog at this stage and one more fact about the stage. Then do a gallery tour and discuss what was the same across dog types." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize, Step 5: "Tell students that they will have the opportunity to use what they have learned about the life stages of other animals to make predictions about a newly discovered animal. Distribute New Animal Predictions and read through the scenario and questions. Ask students if they have any questions about the scenario or prompts. Give students 15 minutes to work individually on questions 1-3. Tell students they can refer back to their previous work, the Class Consensus Model, and Our Growing Ideas chart as evidence. As students work, you can challenge their thinking with questions like: How does that data/evidence support your claim? Did you consider the patterns true for other animals?" and Lesson 4: How Can I Use This Assessment Information?: "To anchor students to the assessment task, students may benefit from imagining the appearance of the newly discovered deep sea animal. Consider a whole-class brainstorm about what the creature may look like. There will likely be disagreement, so you may follow-up by asking them if the appearance would matter? Connect this appearance back to the Stages in Animal's Life chart and ask students to consider whether the appearance of these animals mattered related to the experienced life stages." (Lesson 4, Teacher Guide)
- A visual is provided to students in Lesson 10 before they begin the assessment task. Lesson 10, Synthesize, Step 4: "Preview the assessment context. Using slide K1 and/or slide K2, introduce students to the assessment task context. Color images of the assessments are also provided at the end of the slide deck. You may want to read the task

together using these slides. Toggle between slide J (sentence starters) and color images as needed for your students. Remember the options described in the advance preparation guidance that can help you tailor this assessment for your students." (Lesson 10, Teacher Guide)

- The Lesson 10 Dog Explanation and/or Bunny Explanation Assessment includes several color photographs to help students apply their knowledge to the given scenarios. The photos ensure that students who struggle more with written descriptions can still understand the seasonal change in fur color that they are being asked about.
- Lesson 8, Lesson Materials and Checklist: "Send home the Reminder Letter during or after this lesson. This letter, like the Welcome Letter from Lesson 1, notifies families that students will observe images of ancient artifacts and fossils in Lessons 11-14. To validate important cultural norms and traditions that communities around the world hold around ancestral artifacts, the letter invites families and students to opt out of those lessons if they feel uncomfortable viewing and discussing these images. Since the NGSS expects students to use fossils as evidence of what the world was like long ago, this unit does not provide an alternative path of study to address that performance expectation. If students in your class opt out of those lessons, work with families and your administrator to plan how best to have them use their time while the class finishes the unit." (Lesson 8, Teacher Guide) This lesson informs families about the upcoming lessons focused on fossils and the option to opt out if requested.
- Lesson 13, Synthesize, Step 6: "Display slide J. Pass out 1 copy of Describing Mammoths from Evidence to each student. Read the instructions together and answer any clarifying questions. Preview and talk through possible sentence starters as needed. When ready, give students time to write their individual description." (Lesson 13, Teacher Guide)
- The Lesson 14 La Brea Tar Pit Assessment includes several color photographs to help students apply their knowledge to the given scenarios. The photos ensure that students who struggle more with written descriptions can still understand the types of environments using the color photographs provided.

The materials support success for all students. Examples include,

- Lesson 2, Explore, Broadening Access: "If you think some of the students may feel overwhelmed by viewing all of Older Puppy Matching Cards at once, consider modifying this task by reducing the number of card sets you provide to them." Step 3, Broadening Access: "As you record ideas on the charts, include visual representations of the ideas (e.g., drawings, photos, icons such as those provided in the Timeline Chart Images reference). This will benefit multilingual students, as well as all students, in understanding the ideas captured on the chart." (Lesson 2, Teacher Guide)
- Lesson 4, Explore, Step 2: "Although each student will record notes on their own handout, give them the opportunity to work with a partner or small group while reading about the same animal on the website, if helpful." Synthesize, Step 5, Broadening Access: "Because this is a transfer task to a new situation, students may feel uneasy responding because they fear being wrong or not knowing. Remind students that because this is a new phenomenon for all of us, it is ok to not know exactly how to answer the questions. But they do have the tools to figure out a response. Explain that you are not looking for one right answer, but rather want to understand how they are able to use what we've learned to apply to a new situation. You may also want to include that you hope this is fun." (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize, Teaching Tip: "If a student proposes connections to humans or themselves, such as asking about multiracial families directly or being part of one, you can respond by first celebrating and appreciating the diversity of human families and identities. Second, tell students that how humans get the traits they have is so fascinating and complex that students won't investigate it until high school, and adult scientists are discovering new things about it all the time. This allows you to honor student curiosities and identities while also maintaining the emotional safety and inclusiveness of the classroom." (Lesson 5, Teacher Guide)
- Lesson 7, Explore, Broadening Access: "it is important that students be seated in a way that helps them see and hear all of their classmates. This is why the Scientist Circle seating arrangement is particularly helpful as it allows students

to orient to all their peers and the ways their peers might communicate their thinking. It might also be helpful to revisit classroom agreements." (Lesson 7, Teacher Guide)

- Lesson 9, Connect, Broadening Access: "You may have students who have not yet had an opportunity to learn about or visit a National Park. This may be due to distance from a park, financial restrictions, allergies, belief systems, or lack of interest. In order to value all perspectives and avoid making students feel left out of the class discussion, be prepared to offer other ways for students to connect to National Parks. Consider showing side-by-side pictures of different parks and asking students to pick the one they'd choose to go to and offer them a chance to explain their reasoning." (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize, Broadening Access: "Provide opportunities, as needed, for students to communicate their ideas through words across named languages, pictures, verbally, or using gestures. Consider options for alternative formats of communication, such as creating a short video to demonstrate learning about inheritance and variation of traits, and how traits influence survival. Or letting students orally communicate to you their responses. These options allow for multiple means of action or expression. Encourage students to use the Our Growing Ideas chart to help them think about questions on the assessments." (Lesson 10, Teacher Guide)
- Lesson 14, Lesson Assessment Guidance: "A Place Value Mat may support some students in transition time scales from thousands of years ago (Lessons 11-13) to millions of years ago (this lesson). Plan to use the Fossil Timeline and units your class decided on in Lesson 12 to support this work." (Lesson 14, Teacher Guide)

While the expectations for formative and summative tasks are clearly communicated, and the formative tasks offer a structured variety of modalities for student responses, the summative task materials do not explicitly provide students with a choice of responses across multiple modalities. Examples include,

- Lesson 2, Synthesize, Broadening Access: "To support students in noticing all of the rich ways that their peers might share ideas during a discussion (e.g., using gestures, pointing to an image, talking across different languages, etc.) it is important that students be seated in a way that helps them see and hear all of their classmates. This is why the Scientists Circle seating arrangement is particularly helpful during important discussions, as it allows students to orient to all their peers and the ways their peers might communicate their thinking." (Lesson 2, Teacher Guide)
- Lesson 3, Explore, Broadening Access: "To guide information processing and visualization during and after the gallery tour, consider providing multiple means of expression, such as allowing students to share similarities orally, through writing, or through gestures such as pointing. If you feel that some of your students might be overwhelmed by looking at all of the diagrams at once, you can assign a range of diagrams for students to focus on. If students need language support constructing their findings, consider providing sentence stems like: One similarity I found was _____, I observed that most canines _____, Something interesting I noticed was _____." (Lesson 3, Teacher Guide)
- Lesson 4, Navigate, Broadening Access: "When asking students to share ideas, keep in mind that sharing ideas can include words and/or gestures. For example, as students recall what we did in the previous lesson to answer our question about canine life cycles, students may use hand gestures to indicate working in a group or hold up their model to indicate creating a model. Consider elevating these gestures by explicitly recognizing them during the discussion, in order to communicate their equal value, and thus encouraging multiple communication modalities." Explore, Step 2, Broadening Access: "As students collect information from the website, students can write or draw their ideas in their preferred language modality and discuss them verbally; the template is a scaffold for collecting and sharing information." (Lesson 4, Teacher Guide)
- Lesson 6, Synthesize, Broadening Access: "To provide multiple options for perception and comprehension, leverage the multiple representations the class created to support students' sensemaking. These representations include written ideas on the Our Growing Ideas chart, visual representations on the class model, and timeline charts from previous activities." (Lesson 6, Teacher Guide)

- Lesson 8, Explore, Broadening Access: "Have students keep visible and use the deck of Dog Breed cards as they share ideas, and encourage them to point to ideas on the cards, use gestures or act out ideas, and/or use languages that they are most comfortable with." (Lesson 8, Teacher Guide)
- Lesson 10, Synthesize, Broadening Access: "Provide opportunities, as needed, for students to communicate their ideas through words across named languages, pictures, verbally, or using gestures. Consider options for alternative formats of communication, such as creating a short video to demonstrate learning about inheritance and variation of traits, and how traits influence survival. These options allow for multiple means of action or expression. Encourage students to use the Our Growing Ideas chart to help them think about questions on the assessments." (Lesson 10, Teacher Guide) While this information appears in a Callout near the summative assessment section of the lesson plan, it is not specific to the assessment itself. It does not clarify whether students are explicitly given a choice of modality on the summative task.
- Lesson 13, Synthesize, Broadening Access sidebar: "If necessary, to meet students where they are in improving their writing skills and sustain effort and persistence, have students record their explanations in lieu of, or in combination with, writing or drawing using both everyday and scientific language. Additionally, intentionally group students to support English language use and development (sometimes with peers who know the same languages as them, and other times with peers whose English language development is slightly more advanced)." (Lesson 13, Teacher Guide)
- Lesson 14, Explore, Assessment Opportunity: "Complete an individual analysis and interpretation of fossil evidence. Display slide K. Preview the instructions with students and distribute the La Brea Tar Pits Fossils assessment to each student." (Lesson 14, Teacher Guide) The only modality is written; students do not have a choice of modality with this assessment.

The materials contain evidence of student choice. For example,

- Lesson 10, Teacher Guide Preparation Checklist: "Option #4: Allow students to choose which assessment they would like to complete." (Lesson 10, Teacher Guide) The Lesson includes two summative assessments and provides the teacher with four options for using them, including the option to allow students to choose.
- Lesson 13, Student Assessment 1, Describing Mammoths from Evidence: "1. What were wooly mammoths like? Use words and/or pictures in your description. 2. What was the world like when and where the wooly mammoths lived? Use words and/or pictures in your description." (Lesson 13, Teacher Guide). The assessment task is the same for all students, but the handout allows students to choose words, pictures, or both to show their understanding of the first two of the four tasks.
- Lesson 14, Student Assessment 1, La Brea Tar Pits: "Use evidence: What about the fossil(s) and your own ideas makes you think that's what the environment was like? Write and/or draw your evidence." (Lesson 14, Teacher Guide). The task is for all students, but the handout offers one question that allows students to choose between writing, drawing, or both.

Criterion-Based Suggestions for Improvement:

- Ensure "there is a structured variety in the modalities expected for student responses." [Detailed Guidance, p. 43]
    - Consider opportunities for student choice of modalities in key formative and/or summative assessments to allow students to express their understanding.

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 have assessments within the unit—including pre-, formative, summative, and self-assessments—that together, create an assessment system that measures the intended student learning across the materials. The unit assessments are designed to lead from one to the next, culminating in an assessment of a performance expectation.

Each lesson has a clearly identified Three-Dimensional Learning Goal that is explicitly aligned with the Lesson Assessment Guidance. For example,

- Lesson 3, Teacher Guide Lesson Assessment Guidance: "Where to check for understanding: In the Explore, when students collaboratively uncover patterns in data and use a model to explain templates to describe the major life stages and processes of a canine's life cycle, and when they occur (slide E). Also, when students collaboratively construct a consensus model of the life cycle for a typical canine during the Synthesize (slide J) and then answer the final question on the handout as an exit ticket. What to look and listen for: Students verbally explaining, acting out, gesturing, pointing to, writing, or drawing related to these ideas: **Models explaining** that canines **typically** have a **life cycle that includes the following stages: newborn/puppy, young adult, adult, senior**. **Models explaining** that canines **typically** have a **life cycle that includes the processes between each stage: birth, growth & development, and death**. **Models explaining** that as adults, canines **typically reproduce to create new offspring, and that same life cycle continues for the new offspring.** Typically, canines grow older and eventually, a canine will die." Lesson 3 three-dimensional learning goal: "**Uncover patterns to develop a model that explains how different canines undergo similar developmental processes and stages as part of their life cycle**."
- Lesson 6 Teacher Guide Lesson Assessment Guidance: "Where to check for understanding: In the Explore (slides H and K), as students **describe patterns** between the **behaviors of dog parents and their puppies to explain how dogs can have a behavior they did not learn**. During the Synthesize (slide R), students **describe patterns** in **dogs' instinctive behavior** as **evidence to revise the Class Consensus Model to explain inherited behavior**. What to look and listen for: Students use **evidence** such as: In the videos, the **Labrador puppies had similar retrieving behaviors as their parents without any training**. In the videos, the **Labrador puppies and their parents had similar reactions to an umbrella, an object they had never seen before.** Students use **evidence to revise the Class Consensus Model to explain that: Labradors (adults and puppies) share a larger number of similar behaviors compared to dogs of a different breed**. **Labrador puppies' instincts change as they develop from birth to eight weeks old because of inherited information received from their parents**. Evidence of students' ideas may be expressed in words, drawings, written or spoken descriptions, movement, and/or gestures." Lesson 6 three-dimensional learning goal: "**Analyze and interpret patterns in dogs' instinctual behaviors to provide evidence that puppy siblings inherit information from parents that influences behavioral traits**."
- Lesson 7, Lesson Assessment Guidance, Where to Check for Understanding: "During the Explore when students are explaining if learning the job affects the way the dog looks or acts (slides G and H) during the turn and talks and then whole class discussion, in Synthesize during the Building Understandings Discussion (slide I), and when they work in partners on the Sled Dog Explanation (slide J). What to look and listen for: Evidence of students' ideas may be expressed in words, drawings, written or spoken descriptions, movement, and/or gestures. **Use evidence from the video to explain that learning new jobs affects the way a dog acts or its behaviors. Use evidence from cards to explain** that **dogs have traits that make them well-matched to learn certain jobs** (e.g., like

natural love of water, instinct to retrieve, and webbed feet are traits that are helpful to becoming a lifeguard dog)." Lesson 7 three-dimensional learning goal: "**Use evidence to support the explanation that a dog's traits can be influenced by their environment, like learning new jobs**."

- Lesson 11, Lesson Assessment Guidance, Where to Check for Understanding: "Where to check for understanding: In the synthesize, use the Dogs Working With People Through History handout that students complete on their own to share initial models, as well as ideas shared by the class when discussing the uncertainties they have in their models after comparing them with two classmates.What to look and listen for: Allow students to choose to **write, draw, speak, or represent their ideas using any format that allows them to describe how people and dogs live and work together today, and in the past**." Lesson 11 three-dimensional learning objective: "**Examine historical evidence across long time periods to develop a model describing how people and dogs have lived together today and in the past**."

Pre-Assessment

- The Assessment System Overview document states: "As students engage in these lessons, there are multiple opportunities to gather pre-assessment evidence. This evidence can be used to determine what incoming ideas, experiences, and sensemaking strategies students bring to the unit. All ideas and experiences should be invited into the classroom and be considered as resources to support students' ongoing sensemaking. These opportunities should not be used to assign a score or a grade."
- Two pre-assessment opportunities are claimed for Lesson 1. The Lesson 1 Assessment Guidance states: "Lesson 1 begins the unit. The initial ideas that students share on their Initial Model and when the class creates an Initial Class Explanation chart can inform your plans about how to build and leverage student ideas across the unit. Likewise, the questions they post to the [DQB] can provide insight to what they are thinking about and bringing to the unit. The students will **use observations of newborn, puppy, and adult photos to explain how newborn puppies begin their lives looking so similar but change during their lives to look so different**."
  - Lesson 1, Synthesize, Assessment Opportunity: "Students' initial explanations (or models) provide an opportunity to gather evidence around learning goal 1.A with the purpose of determining support students may need in upcoming lessons around the practices of explanation and modeling, and ideas around patterns of change as living things grow up (life cycles) and patterns and cause and effect related to inheritance and variation of traits. Students will continue to develop these ideas and practices throughout this unit." Lesson 1 Handout 3 Initial Explanation for Changes In Dogs: "Write or draw to explain your ideas about this question about the dog you chose. Why does a newborn _____ become an adult _____ that looks and acts the way it does?" (Lesson 1, Teacher Guide)
  - Lesson 1, Synthesize, Assessment Opportunity: "Pre-assessment: Developing the [DQB] provides an opportunity for gathering evidence for learning goal 1.B with the purpose of determining support students may need in upcoming lessons around the practices of asking questions, and ideas around patterns of change as living things grow up (life cycles) and patterns and cause and effect related to inheritance and variation of traits. Students will continue to develop these ideas and practices throughout this unit. Accept all students' questions. Look to see if students are asking questions related to disciplinary core ideas and crosscutting concepts questions, such as: How and why canines look and/or behave in certain ways (cause and effect). Similarities, differences, and relationships between canines (patterns)." (Lesson 7, Teacher Guide)

Formative Assessment

- At least one formative assessment is included in each lesson. (See III B for a specific analysis of formative assessment).

Summative Assessment

Summative assessment opportunities are identified in lessons 10 and 14. The summative assessments in Lessons 10 and 14 are related to the lesson progression Learning Goals and to grade-level Performance Indicators. For example,

- Lesson 10 Learning Goal: "10.A **Analyze and interpret data to provide evidence** that **animals have traits inherited from parents** (**similarities**) **and that variation of these traits** (**differences**) **exists in a group of similar organisms**." relates to the Performance Expectation:3-LS3-1: Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms."
- Lesson 10, Synthesize, Step 4: "introduce students to the assessment task context. Color images of the assessments are also provided at the end of the slide deck. You may want to read the task together using these slides. Toggle between slide J (sentence starters) and color images as needed for your students. Remember the options described in the materials preparation guidance that can help you tailor this assessment for your students." Assessment Box: "This is an opportunity to assess individual students on learning goals 10.A and 10.B. Use Scoring Guidance for Canine Explanation and/or Scoring Guidance for Bunnies Explanation and the Assessment Guidance at the beginning of the lesson." (Lesson 10, Teacher Guide)
- Lesson 14 Learning Goal: "14. **Analyze and interpret fossil data to describe the type of organisms in a place long ago and make sense of what the place was like given the evidence."** relates to the Performance Expectation: "3-LS4-1**: Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago**."
- Lesson 14, Explore, Step 5: "Students' individual analysis and interpretations on the (La Brea Tar Pits Fossils assessment task provide an opportunity to gather evidence about learning goal 14, with the purpose of summatively assessing students' interpretation of fossil data and use of it to support ideas about what a place was like long ago." (Lesson 14, Teacher Guide)

Self Assessment

- Lessons 4, 10, 13, and 14 are identified as containing self-reflection opportunities. The Assessment System Overview: "These lessons/This lesson provide opportunities to support students in reflecting on their own learning and sensemaking. These opportunities allow students to take ownership of their learning and use their reflections to guide future sensemaking. There are discussion prompts suggested in Lessons 4 and 13 to offer an opportunity for students to check in on their progress toward modeling and constructing explanations using evidence they have collected and science ideas they have developed. Lessons 10 and 14 offer more opportunity for students to write self-reflections and name areas where they might need support." (Assessment System Overview)
- Lesson 4 Slide deck Slide L: "How successful was I at...using patterns we figured out and our model to predict life cycle of a new animal?" (Lesson 4, Teacher Guide). The whole class does a quick thumbs-up, thumbs-down, thumbs-sideways check-in.
- Lesson 10 Student Reflection Animal Explanation: "How successful was I at constructing an explanation for how and why an animal looks or acts a certain way? How successful was I at using trait patterns as my evidence in my explanation?" This aligns with the Lesson Level learning goal of "**Analyze and interpret data to provide evidence that animals have traits inherited from parents** (**similarities**) **and that variation of these traits** (**differences**) **exists in a group of similar organisms**."
- Lesson 13, Slide deck slide L: "How successful was I at...using fossil evidence to describe what it was like long ago?" (Lesson 13, Teacher Guide) The whole class does a quick thumbs-up, thumbs-down, thumbs-sideways check-in.

Although this is claimed as a self-assessment opportunity, the criteria for how students are expected to think about the three dimensions of learning as they respond to this prompt are not identified.

- Lesson 14, Fossil Self-Assessment: "How successful was I at using fossil evidence to explain plants, animals, and places long ago?" This question aligns with the Lesson Level learning goal of "**Interpret fossil evidence (data) to describe the type of organisms in a place long ago and explain what the place was like given the evidence."** (Lesson 14, Teacher Guide)

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

- The rationale and flow of the assessment system are outlined in the document "Assessment System Overview," which describes the lesson learning goals, assessment types, purposes, and locations for each assessment throughout the unit. The document also provides information on what to look for and listen to with each assessment.
- Each lesson plan includes a "Lesson Assessment Guidance" section that echoes the information from the Overview about the Learning Goal, type and location of assessment, and what to look and listen for. This section also adds a "How Can I Use This Assessment Information?" column to help teachers understand how they might use their collected data to inform or adjust instruction for individuals or the whole class.

Criterion-Based Suggestions for Improvement: N/A

III.F. Opportunity to Learn

ADEQUATE

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 **adequate** evidence that the materials provide multiple opportunities for students to demonstrate the performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts, and to receive feedback. Although students may have multiple opportunities to evaluate and adapt their thinking, they are not utilizing this feedback individually and are not applying it to future assessment opportunities.

The materials offer multiple, interconnected opportunities for students to demonstrate their progress toward proficiency over time. However, students are not prompted to utilize this feedback individually and apply it to future assessment opportunities.

For example, students build toward 3-LS3-1: **Analyze and interpret data to provide evidence** that plants and animals have traits inherited from parents **and that variation of these traits exists in a group of similar** organisms, as seen in:

- Lesson 5, Learning Goal 1: "**Analyze and interpret data to provide evidence that related dogs inherit similar patterns of traits from their parents**." (Lesson 5, Teacher Guide)
  - Lesson 5, Explore, Assessment Opportunity: "Formative Assessment: You can support the development of students' data analysis by asking students to describe the patterns found in the Parent and Puppy Trait datasets. Asking students what they notice about the amounts between puppies vs. their parents and puppies from one family vs another should help prime students' thinking around inheritance." (Lesson 5, Teacher Guide)

- Lesson 6, Learning Goal: "**Analyze and interpret patterns in dogs' instinctual behaviors to provide evidence that puppy siblings inherit information from parents that influences behavioral traits**." (Lesson 6, Teacher Guide)
  - Lesson 6, Synthesize, Assessment Opportunity: "Formative assessment: This is the third opportunity to collectively assess Learning Goal 6. Use the discussion around revising the Class Consensus Model to listen for students to describe patterns in dogs' instinctual behavior as evidence that puppy siblings inherit information from parents that influences behavioral traits. Refer to the Lesson Assessment Guidance at the beginning of the lesson for more information." (Lesson 6, Teacher Guide) However, since this SEP is addressed through teacher-led whole-class discussion, it is not evident that individual students would receive feedback to help them better leverage the practice.
- Lesson 12, Learning Goal: "**Analyze and interpret fossil age data to determine how long humans and dogs have been working together**.
  - Lesson 12 Lesson Assessment Guidance: "You can support the analysis and interpretation of these timelines using the follow up discussion prompts during the Synthesize. At any point, additional reflections on time scales could be helpful, especially reflecting on our own personal history time scale (8 years old on a 100 year time scale) compared to Earth's time scale. This comparison of relative time to us versus Earth may be helpful to students developing a sense of what counts as very long ago to us compared to very long ago on Earth's timeline." (Lesson 12 Teacher Guide).

Students build toward 3-LS1-1. **Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death**, as seen in:

- Lesson 1, Learning Goal: "**Use observations of newborn, puppy, and adult photos to explain how newborn puppies begin their lives looking so similar but change during their lives to look so different**."
  - Lesson 1 Lesson Assessment Guidance: "Students' initial explanations (or models) provide an opportunity to gather evidence around learning goal 1.A with the purpose of determining support students may need in upcoming lessons around the practices of explanation and modeling, and ideas around patterns of change as living things grow up (life cycles) and patterns and cause and effect related to inheritance and variation of traits. Students will continue to develop these ideas and practices throughout this unit. Accept all ideas including various models of communication like written and/or verbal. Students will likely identify influences from parents, dog breeds, and/or training in their initial explanations, but you can expect a range of ideas at this point." (Lesson 1, Teacher Guide) However, since this SEP is addressed through partner work and the lesson does not state any feedback exchanged, it is not evident that individual students would receive feedback to help them better leverage the practice.
- Lesson 2, Learning Goal: "**Use a model describing evidence of similarities and differences between wolf and dog puppies to explain the ways puppies change to become more like adults."**
  - Lesson 2, Synthesize, Assessment Opportunity: "Formative assessment: The class discussion around similarities and differences in puppy growth and development provide an opportunity to gather evidence about Learning Goal 2, with the purpose of providing feedback and supporting students in using evidence to support the patterns they identify. Students may need to revisit parts of the video and/or text about domesticated and wolf puppies to recall evidence they can use to support their explanations of how the puppies change from birth to 8 weeks of life. If a student is struggling to make comparisons, have them focus on 1 or 2 changes that occur (e.g. what they eat) and revisit the timeline looking for evidence of how that change(s) happen(s) for both puppies. Then, ask if those changes were similar and/or different." (Lesson 2, Teacher Guide)

- Lesson 3, Learning Goal: "**Uncover patterns to develop a model that explains how different canines undergo similar developmental processes and stages as part of their life cycle**."
  - Lesson 3, Synthesize, Assessment Opportunity: "3.2 Key Formative Assessment: Collaboratively constructing the canine life cycle consensus model is an assessment for learning goal 3. During this task, students share the similarities they notice when comparing all *A Canine's Life* diagrams generated by the class. Using the similarities, students reach consensus on what to call each life stage and process in the canine's life cycle. Actual terms may vary, and therefore multiple correct responses are possible. Refer to Printable Chart Images as a guide. Also, use Following Student Sensemaking (Lessons 2-4) to document individual students thinking during or after this discussion. Lesson 3 Instructional Guidance provides additional guidance to support students who may struggle. You can also use A Canine's Life Handout if you want students to individually reflect on what they figured out." (Lesson 3, Teacher Guide) Since the Modeling element MOD-E1, which uses modeling to uncover patterns, is addressed through teacher-led whole-class discussion, it is not evident that individual students would receive feedback to help them better leverage the practice.
- Lesson 4, Learning Goal: "**Develop a model to describe that while animals have unique and diverse life cycles, they all follow the same pattern**."
  - Students complete the New Animal Predictions assessment where they create a model to show that a newly discovered animal's life cycle would be similar to that of other animals. Suggestions for teachers to give feedback are found in the Lesson 4 Teacher Assessment Tool, Lesson 4 Instructional Guidance and Key, in the table labeled "If you notice...Possible Next Steps..."
- Lesson 11, Learning Goal: "**Examine historical evidence across long time periods to develop a model describing how people and dogs have lived together today and in the past**."
  - Lesson 11, Synthesize, Assessment Opportunity: "Formative Assessment: Completing the Dogs Working With People Through History is the assessment for learning goal 11 with the purpose of creating initial models to describe how people and dogs have worked together today and in the past. These models are intended to be broad and raise questions about whether relationships between humans and dogs have always been the same. Students' initial models help you determine the support students may need around modeling, and making sense of a phenomenon along a time scale to uncover patterns that may otherwise remain unseen." (Lesson 11, Teacher Guide) Students also work with partners to compare and contrast their models before having a consensus discussion.

Students build toward 3-LS3-2: **Use evidence to support the explanation that a dog's traits can be influenced by their environment,** as seen in:

- Lesson 7, Learning Goal: "**Use evidence to support the explanation that a dog's traits can be influenced by their environment, like learning new jobs**."
  - Lesson 7, Synthesize, Assessment Opportunity: "Formative assessment: Students' partner work on the Sled Dog Explanation is an opportunity to formatively assess students on learning goal 7. As you provide in-the-moment feedback to students while they work with partners, during the discussion to construct the What does an explanation need? chart, and/or in written notes on their handouts later, bear in mind that students will have another opportunity to individually construct an explanation in Lesson 8 where they can take up the feedback you offer." (Lesson 7, Teacher Guide)

- Lesson 8, Learning Goal: "**Use observations and patterns to support an explanation describing how dogs have inherited specific trait variations in the ways they look and act**."
  - Lesson 8, Synthesize, Assessment Opportunity: "These explanations provide an opportunity to formatively assess learning goal 8 with the purpose of providing information to direct your instruction and offering feedback to students that they can respond to. As students demonstrate their understanding for why people often chose poodles for retrieving wild game, ask them to provide evidence to support their claims. Use the Poodle Explanation Instructional Guidance tool to guide your assessment and decide on next steps for students based on their responses. Provide feedback to students on their use of evidence and give students time to reflect on the feedback you provide." (Lesson 8, Teacher Guide)

Students build toward 3-LS4-1: **Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago**, as seen in:

- Lesson 13, Learning Goal: "**Analyze and interpret fossil data to determine when wooly mammoths lived on Earth and what their environments were like."**
  - Lesson 13, Synthesize, Assessment Opportunity: "Key Formative Assessment, Peer Feedback and Self-check: This is a moment of formative assessment for learning goal 13, and anticipating learning goal 14. A shift in this moment is toward the practice of constructing explanations using the data we examined in the lesson. Use Lesson 13 Instructional Guidance for instructional guidance and to provide feedback to your students. Use Giving and Receiving Feedback if students need support in giving and receiving feedback. Students' assessment handout includes a moment to ask for help from you, but you can also use slide L to get a quick assessment of how students are feeling across the class." (Lesson 13, Teacher Guide)
- Lesson 14, Learning Goal: "**Analyze and interpret fossil data to describe the type of organisms in a place long ago and make sense of what the place was like given the evidence."**
  - Lesson 14, How Can I Use This Assessment Information?: "Students have had multiple opportunities in Lessons 11-13 and now during the formative moments here in Lesson 14 to interpret fossil evidence in whole groups, small groups, and partners, so your notes on the Following Student Sensemaking (Lessons 11-14) tool can inform your feedback and instruction as the class approaches the end of the unit (see the Lesson 13 Instructional Guidance tool for additional suggestions." (Lesson 14, Teacher Guide)

Students build toward 3-LS4-2: **Use evidence to construct an explanation** for how the **variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates and reproducing,** as seen in:

- Lesson 9, Learning Goal: "**Use observations and patterns as evidence to support an explanation that variations in wolf traits can result in an advantage to survival**."
  - Lesson 9, How Can I Use This Assessment Information?: "If a student struggles to identify trends in the data, have a student use their finger on the class pictograph to trace the trend over time. You can ask questions such as, As you move from 1995 to 2020, does the line go up or down? What does that tell us about how many wolves have a particular fur color? If the relative number of wolves with gray fur is going down, what must be happening to the relative number of wolves with black fur? If wolves with one color fur are increasing, what does that tell us about which fur color may have an advantage? If a student struggles to use evidence to support their explanation, ask them to show or describe the evidence we collected during the lesson. You can ask questions such as, What does our graph tell us about the number of wolves with a particular fur color? What did we learn from scientists about fur color and matching traits when we read the article? What source helped us decide which matching trait was more important for survival? It may also be helpful to look through the

evidence with your student and possibly articulate your thinking as you model how you would use evidence in an explanation." (Lesson 9, Teacher Guide)

- Lesson 10, Learning Goal: "10.B **Use evidence to construct an explanation that timing of fur color change (cause) may provide advantages in surviving (effect).**"
  - Lesson 10, How Can I Use This Assessment Information? "Use Scoring Guidance for Canine Explanation or Scoring Guidance for Bunnies Explanation to help you better pinpoint student struggles. You can use these tools to focus the feedback you provide to students on their explanations and also adjust your instruction based on patterns you notice across explanations. For example, you may consider allowing students to revise their responses using the feedback." (Lesson 10, Teacher Guide)

The materials contain opportunities for teacher and peer feedback.

- 3.3 Trait Variations Assessment System Overview states the following about peer feedback: "These lessons provide opportunities to support students in working together to give and receive feedback on their ongoing work. Students have opportunities to use the feedback to make revisions. Peer feedback is closely tied with the classroom agreement "We look, listen, and respond to each other's ideas" and "We let our ideas change and grow." (3.3 Trait Variations Assessment System Overview Document) It also highlights Lessons 4, 8, and 13 as specific opportunities for students to engage in feedback. Each lesson has a specific document that supports students in providing feedback for the identified feedback activity in the lesson.
- Lesson 4, Explore, Step 2: "Provide peer review and feedback. Display slide F. When students complete their individual work on their special animal, ask students to trade handouts and read each other's ideas. Using Giving and Receiving Feedback ask students to give their 1-2 feedback ideas to their partner." (Lesson 4, Teacher Guide) This opportunity to revise based on feedback will also help prepare them for the key formative New Animal Predictions assessment.
- Lesson 8, Synthesize, Step 4:" As students demonstrate their understanding for why people often chose poodles for retrieving wild game, ask them to provide evidence to support their claims. Use the Poodle Explanation Instructional Guidance tool to guide your assessment and decide on next steps for students based on their responses. Provide feedback to students on their use of evidence and allow them time to reflect on the feedback you have given. Refer to the Assessment Guidance at the beginning of the lesson." (Lesson 8, Teacher Guide)
- Lesson 13, Synthesize, Step 6:" Use Lesson 13 Instructional Guidance for instructional guidance and to provide feedback to your students. Use Giving and Receiving Feedback if students need support in giving and receiving feedback. Students' assessment handout includes a moment to ask for help from you, but you can also use slide L to get a quick assessment of how students are feeling across the class." (Lesson 13, Teacher Guide)

Opportunities for teacher feedback are included in the "How can I use this assessment information?" section of the Lesson Assessment Guidance in some lessons or the body of the lesson. In these feedback experiences, students are given the opportunity to use this feedback to revise their work and adjust their thinking. However, students are not consistently given the opportunity to apply this feedback to future assessment opportunities. For example,

- Lesson 3, Navigate, Step 6: "Collect A Canine's Life Handout. You can give feedback using a sticky note and return it to students before the assessment in Lesson 4. Emphasize that you are excited to see all of the great life cycle models they made and you will return them with feedback during a future lesson." (Lesson 3, Teacher Guide) This is offered as a suggestion on how to provide feedback; therefore, not all students are given the opportunity to receive or apply this feedback.
- Lesson 7, Synthesize, Assessment Opportunity: "Formative assessment: Students' partner work on the Sled Dog Explanation is an opportunity to formatively assess students on learning goal 7. As you provide in-the-moment

feedback to students while they work with partners, during the discussion to construct the What does an explanation need? chart, and/or in written notes on their handouts later, bear in mind that students will have another opportunity to individually construct an explanation in Lesson 8 where they can take up the feedback you offer. Refer to the Assessment Guidance at the beginning of the lesson." (Lesson 7, Teacher Guide) Here, the teacher is providing in-the-moment feedback to students working in pairs; individual students are not given feedback, and they are not given the opportunity to apply this feedback to future assessments.

- Lesson 8, Synthesize, Assessment Opportunity: "Key formative assessment: These explanations provide an opportunity to formatively assess learning goal 8 with the purpose of providing information to direct your instruction and offering feedback to students that they can respond to. As students demonstrate their understanding for why people often chose poodles for retrieving wild game, ask them to provide evidence to support their claims. Use the Poodle Explanation Instructional Guidance tool to guide your assessment and decide on next steps for students based on their responses. Provide feedback to students on their use of evidence and give students time to reflect on the feedback you provide. Refer to the Assessment Guidance at the beginning of the lesson." (Lesson 8, Teacher Guide)
- Lesson 10, Assessment Guidance: "Use the formative assessment opportunity to provide feedback to students that will help them be successful on the summative assessment task. For example, if you anticipate students may struggle with the summative assessment task given their discussion in Synthesize, consider doing the Explanation about Canines together first to talk through how to examine the photos as data and use them to write an explanation. Then have students complete an Explanation about Bunnies individually." (Lesson 10, Teacher Guide) Teachers are suggested to provide individual feedback for the Explanation about Bunnies; however, if teachers choose not to use this assessment as the feedback opportunity, students may not receive any feedback.
- Lesson 13, Synthesize, Assessment Opportunity: "Key Formative Assessment, Peer Feedback and Self-check: This is a moment of formative assessment for learning goal 13, and anticipating learning goal 14. A shift in this moment is toward the practice of constructing explanations using the data we examined in the lesson. Use Lesson 13 Instructional Guidance for instructional guidance and to provide feedback to your students. Use Giving and Receiving Feedback if students need support in giving and receiving feedback. Students' assessment handout includes a moment to ask for help from you, but you can also use slide L to get a quick assessment of how students are feeling across the class." (Lesson 13, Teacher Guide) The Giving and Receiving Feedback document is a generic handout that does not offer guidance for students to give feedback related to any specific DCI, CCC, or Practice(s).
- Lesson 14, Lesson Assessment Guidance: "Use the Fossil Self-Reflection to provide you insight from the students' perspective on how they are growing their understanding and/or struggling. Take time to conference with students and/or provide written feedback and additional support as needed before students complete their La Brea Tar Pits Fossils. See the Scoring Guidance for Fossil Interpretation for feedback and instructional guidance suggestions regarding the La Brea Tar Pits Fossils summative assessment." (Lesson 14, Teacher Guide)

Criterion-Based Suggestions for Improvement:

- Ensure that "[s]tudents have opportunities to use their feedback to construct new learning and improve their performance in preparation for the next assessment opportunity." [Detailed Guidance, p. 47]
  - Consider including established times within the lesson for students to use the feedback they have received to improve their performance on upcoming assessments individually.
  - Consider more robust self-evaluation and peer evaluation opportunities that target elements of each dimension separately.

Category Ratings

CATEGORY I	**NGSS 3D Design** *(Criteria A–F)*	0	1	(2)	3
CATEGORY II	**NGSS Instructional Supports** *(Criteria A–G)*	0	1	2	(3)
CATEGORY III	**Monitoring NGSS Student Progress** *(Criteria A–F)*	0	1	2	(3)
TOTAL SCORE				**8**	

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