The Importance of Biodiversity

DEVELOPER: Stile

GRADE: 6–8 **| DATE OF REVIEW:** December 2022

equip
Educators Evaluating Quality Instructional Products

NextGen Science
WestEd

The Importance of Biodiversity

EQuIP RUBRIC FOR SCIENCE EVALUATION

OVERALL RATING: E/I

TOTAL SCORE: 6

CATEGORY I: NGSS 3D Design Score	CATEGORY II: NGSS Instructional Supports Score	CATEGORY III: Monitoring NGSS Student Progress Score
2	2	2

Click here to see the scoring guidelines.

This review was conducted by NextGenScience using the EQuIP Rubric for Science.

CATEGORY I CRITERIA RATINGS			CATEGORY II CRITERIA RATINGS			CATEGORY III CRITERIA RATINGS		
A.	Explaining Phenomena/ Designing Solutions	Adequate	**A.**	Relevance and Authenticity	Extensive	**A.**	Monitoring 3D Student Performances	Adequate
B.	Three Dimensions	Adequate	**B.**	Student Ideas	Inadequate	**B.**	Formative	Adequate
C.	Integrating the Three Dimensions	Adequate	**C.**	Building Progressions	Adequate	**C.**	Scoring Guidance	Extensive
D.	Unit Coherence	Adequate	**D.**	Scientific Accuracy	Adequate	**D.**	Unbiased Tasks/Items	Extensive
E.	Multiple Science Domains	Adequate	**E.**	Differentiated Instruction	Inadequate	**E.**	Coherence Assessment System	Adequate
F.	Math and ELA	Adequate	**F.**	Teacher Support for Unit Coherence	Adequate	**F.**	Opportunity to Learn	Inadequate
			G.	Scaffolded Differentiation Over Time	Adequate			

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EQuIP RUBRIC FOR SCIENCE EVALUATION

Summary Comments

Thank you for your commitment to students and their science education. NextGenScience is glad to partner with you in this continuous improvement process. It is obvious that this unit was thoughtfully crafted, and it is strong in several areas, including providing students with authentic scientific data presented in easily accessible data tables and models for students to quickly understand and use in response to lesson prompts.

During revisions, the reviewers recommend paying close attention to the following areas:

- **Modifying the phenomena and problem claimed in the unit.** Although students are presented with a real-world problem, there is a mismatch between what the lesson sequence claims is the anchoring phenomena and what drives learning. Changing some of these claims and revising some of the sections of the lesson sequence could help increase sense-making and problem solving throughout the unit.
- **Unit Coherence.** The lessons currently consist of activities that may appear unconnected from a student perspective. Changing the lesson sequence could give students a chance to see how their investigations are connected to each other and could provide students with opportunities to build their knowledge since they would be slowly developing a solution to a real-world problem using an understanding of the targeted DCI elements.
- **Differentiated Instruction.** Although the materials provide suggestions for differentiation, these suggestions are often broad, generic statements unrelated to the targeted three dimensions. Consequently, these generalized statements do not serve as guidance for teachers seeking to support struggling learners in meeting the learning goals. Additionally, forms of support are often additional practice opportunities. While these alternate assignments provide students with additional opportunities to engage with the learning, they do not provide strategies for dealing with the core issues that impede learning. Changing some of this guidance to specific, targeted strategies to support specific needs of both struggling and advanced learners would increase opportunities for all students.
- **Feedback for Learning.** Students currently do not have any formal opportunities to build their understanding based on feedback from their teachers or their peers. Although the materials provide suggestions for feedback from the teacher to the student along with opportunities for students to share their ideas with their peers, there is no evidence that students will have time to utilize these interactions for purposeful growth. Providing prompts for students to clearly use this feedback to slowly develop their own understandings could help scaffold students towards deep sense-making.

Note that in the feedback below, black text is used for either neutral comments or evidence the criterion was met, and purple text is used as evidence that doesn't support a claim that the criterion was met. The purple text in these review reports is written directly related to criteria and is meant to point out details that could be possible areas where there is room for improvement. Not all purple text lowers a score. Much of it is too minor to affect the score. For example, even criteria rated as Extensive could have purple text that is meant to be helpful for continuous improvement processes. In these cases, the criterion WAS met. The purple text is simply not part of the argument for that Extensive rating.

CATEGORY I

NGSS 3D DESIGN

I.A. EXPLAINING PHENOMENA/DESIGNING SOLUTIONS

I.B. THREE DIMENSIONS

I.C. INTEGRATING THE THREE DIMENSIONS

I.D. UNIT COHERENCE

I.E. MULTIPLE SCIENCE DOMAINS

I.F. MATH AND ELA

The Importance of Biodiversity

EQuIP RUBRIC FOR SCIENCE EVALUATION

I.A. EXPLAINING PHENOMENA/DESIGNING SOLUTIONS

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.

Rating for Criterion I.A. Explaining Phenomena/Designing Solutions	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that learning is driven by students making sense of phenomena or designing solutions to a problem. The materials present a scenario that could serve as a phenomenon and present a design challenge that could be used as an anchoring problem. However, students are not supported to authentically engage in figuring out the phenomenon or designing a solution to the problem.

The unit is largely anchored by the phenomenon that global bee diversity is in decline. To ensure the ecosystem remains healthy, bee diversity needs to be saved. Student questions are captured at the beginning of the unit and are arranged in a Driving Question Board (DQB) that is organized by the teacher and the class. Additionally, students return to the DQB to update their thinking at the end of some of lessons throughout the unit. However, the instructional materials do not leverage these questions so that they drive the learning sequence. Consequently, students are not supported to authentically engage in figuring out why bee populations are declining or in designing a solution for that problem. Although a learning journal is used for student reflection at the end of each lesson, evidence of teacher guidance to support connections between these reflections to support student sense-making and to drive the upcoming lessons was not located. Finally, students are told that bee populations are declining and spend some time figuring out why before being presented with a design challenge near the end of the unit. However, their solutions don't really address why bee populations are declining and how humans can stop that from happening.

Some related evidence includes:

- Lesson 1: Students are presented with a variety of newspaper headlines that tell them that bee populations are “in crisis”. Students analyze graphs in Question 2 and Question 4, confirming these headlines. Later, in the “Challenging the Daily News” section, students are asked to write a question that challenges the Daily News article’s interpretation of the world bee crisis, therefore

contradicting the data. Although this is a valuable exercise, given the previous data analysis activities it is likely that students will find this very confusing.

- Lesson 2: Students are presented with a picture of what the Earth would look like without bees to begin the lesson. They then engage in a series of activities that guide them to learn more about pollination. After uncovering the importance of bee diversity in pollinating a variety of plants, they are then presented with the driving question, "Do we need to save the bees?". Given that this instructional sequence, along with those in subsequent lessons, tells students why bees are important, it is unlikely that students would authentically try to answer this question and figure out if bees should be saved. The answer is implicitly given to students.
- Lesson 8: Students are told that they will be defining a problem. After watching a video about the engineering design process, students are then given images from the simulations in Lessons 3 and 7. The problem is presented to the students very late in the lesson. As a result, it does not serve as a driver of instruction and instead becomes an additional investigative task that students complete. Consequently, little of the student learning is driven by a need to figure out a phenomenon or solve a problem.
- Lessons 9: Students are tasked with developing a solution that will "save or replace bees". Although the goal of the unit has been to help students see that bees should be saved, students "learn about" bees and their importance rather than using this information to ultimately seek solutions to the declining bee population.

Student questions are elicited in the unit. However, most of these questions are not connected to determinations of what "next steps" should be taken by students and, therefore, do not motivate sense-making or problem solving in the unit. For most of the unit, the teacher tells students what they will be doing and why and presents them with questions that they will be answering in the lessons.

Related evidence includes:

- Lesson 3: Students are asked what they notice and what questions they have because of engaging with the simulation. However, there is no evidence that students return to these observations or questions.
- Lesson 3: Guidance is provided for the teacher to start the lesson with the DQB and then students use a simulation that models an ecosystem containing various species of wildflowers and bees to better understand the importance of bee species variety to the biodiversity of an ecosystem. They create predictions and then test both scenarios to see the outcomes. Students then complete the "Link, Extend, Question" routine. In this activity, students are expected to connect to their prior learning and identify the questions they still have. However, there is no evidence that connections students have made to prior learning or the questions they still have will be leveraged to motivate the learning within the sequence.
- Lesson 4: Students watch a video about the benefits of bees. Teacher guidance is provided: "explain that this lesson continues to build on the question from the DQB, "Why should we care about bees?" There isn't evidence that students' questions are used to drive the instructional sequence.

- Lesson 4: Students complete the "Link, Extend, Question" routine at the end of the lesson. There is no evidence that connections students have made to prior learning or the questions they still have are leveraged to motivate the learning for the next lesson.
- Lesson 5: Students are asked to recall what they have learned in the unit. There is no evidence that students return to the previous "Link, Extend, Question" responses or the DQB, and student ideas are not used to drive learning.
- Lesson 6, Question #1: Students are asked to "list questions they have about the scenario." However, there is no evidence that students return to these questions. As a result, student ideas are not being leveraged to drive the learning.
- Lesson 6: Students complete the "Link, Extend, Question" routine at the end of the lesson. However, there is no evidence that connections students have made to prior learning or the questions they still have are leveraged to motivate the learning later in the sequence.
- Lesson 7, Question #1: Students are asked to list ways "the expanding city might affect Farmer Camilla's farm and the surrounding ecosystem." However, these ideas are not revisited in the instructional sequence.
- Lesson 7: Students complete the "Link, Extend, Question" routine at the end of the lesson. However, there is no evidence that connections students have made to prior learning or the questions they still have are leveraged to motivate the learning later in the sequence.

Suggestions for Improvement

Consider helping students see the connections between what they are learning and what they are trying to explain or solve. For example:

- Consider revisions that leverage the "Link, Extend, Question" routine to help students see the connections between what they are learning and what they are trying to explain or solve. While this routine is a method that can help students track their learning, their ideas are not currently leveraged or acknowledged later in the unit. Consequently, it may be unclear to students why they are being asked to engage in this activity over and over.
- Consider revisions that would allow student questions to be explicitly elicited throughout the lesson and that would allow these questions to serve as the driving lever for instruction. Students could be positioned so that their curiosity is driving the lesson sequence. To do so, it would be helpful for the phenomenon or design problem to be consistently referenced throughout each subsequent lesson in the sequence. Students ideally would be able to take what they have learned in each lesson and build on it in the next lesson to have the scientific knowledge to be able to take each next step to continue to engage with the design problem they are intending to solve or a phenomenon they are trying to explain. Additionally, students would ideally be cognizant of the fact that each step is a process in which they collect information that they will ultimately use to design a solution or explain a phenomenon.
- For more information on using phenomena and problems to drive instruction, see Using Phenomena in NGSS-Designed Lessons and Units and Problems with Problems: Improving the Design of Problem-Driven Science and Engineering Instruction.

I.B. THREE DIMENSIONS

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.

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

Rating for Criterion I.B. Three Dimensions	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that the materials give students opportunities to build understanding of grade-appropriate elements of the three dimensions. Students have opportunities to develop and use many, but not all, of the claimed SEP, DCI, and CCC elements.

Science and Engineering Practices (SEPs) | **Rating: Adequate**

The reviewers found adequate evidence that students have the opportunity to use or develop the SEPs in this unit. There is a mismatch between some of the SEP claims in the unit and the evidence that students use or develop those SEPs. Students also are not supported to develop increased understanding of the claimed SEPs.

SEP CATEGORY ADDRESSED (OR NOT ADDRESSED)

Asking Questions and Defining Problems

- *Ask questions that challenge the premise(s) of an argument or the interpretation of a data set.*
  - Lesson 1: This element is claimed. In Question 6, students are instructed to ask questions that challenge the Daily News article's interpretation of the bee crisis. However, because the Daily News article doesn't contain data, students will most likely instead be using a different element of the claimed SEP: *Ask questions to identify and/or clarify evidence and/or the premise(s) of an argument.*
  - Lesson 5: This element is claimed. In Question 4, students are asked to create questions that challenge the premise of their partner's claims. Students might use this element, but the student prompt is "You'd likely have questions for the person making this claim, like 'Where have you been looking? What makes you think it would be the same elsewhere?'" Therefore, it is more likely that students will be using a different SEP element: *Ask questions to identify and/or clarify evidence and/or the premise(s) of an argument.* In Question 9, students generate two questions about the evidence that supports their claim. Although students may use the claimed SEP element, it is likely

that they instead use the following: *Ask questions to ~~identify and/or~~ clarify evidence and/or the premise(s) of an argument.*

Constructing Explanations and Designing Solutions

- *Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.*
    - Lesson 10: This element is claimed. In Question 7, students evaluate their prototype against their chosen set of criteria.
    - Lesson 11: This element is claimed. In Question 3, students are provided with criteria and constraints that they use to self-assess their designs. In Question 4, students identify how they will revise their design because of this assessment.
    - Lesson 12: This element is claimed. In Question 2, students prepare a presentation of their design. Based on the guidance provided in the "Preparing your presentation" section, it is likely that students are instead engaging with the following: 3–5 element from **Engaging in Argument from Evidence**, "*Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem*".
    - Lesson 13: This element is claimed. Students share their designs with their peers in a gallery walk. As they do so, they engage with a step in the design cycle. However, students use an element from **Engaging in Argument from Evidence** in this lesson rather than the claimed element from **Constructing Explanations and Designing Solutions**.

Engaging in Argument from Evidence

- *Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.*
    - Lesson 8: This element is claimed. However, there is no evidence that students use the claimed element. In Question 4, students do work collaboratively to establish criteria for the design solution and in the creation of the brief (Question 7). As they do so, they engage in the following 3–5 element of **Asking Questions and Designing Solutions**. *Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.*
    - Lesson 9: This element is claimed. In Question 5, students identify the advantages and limitations of the design solutions they have brainstormed. As they do so, they engage with the claimed SEP.
    - Lesson 13: This element is claimed. In Question 2, students assess their peers' designs using a rubric of identified criteria and constraints. As they do so, they engage with the claimed SEP.

Obtaining, Evaluating, and Communicating Information

- *Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in, and/or evidence about, the natural and designed world(s).*

- Lesson 2: This element is claimed. Students read in Lesson 2, but students are not reading scientific texts (e.g., with methods, data) that have been adapted for classroom use. Instead, they are provided with a textbook-like explanation that has been written for students.
- Lesson 4: This element is claimed. In Question 5, students are assigned a leveled text to read and share with their group in a jigsaw type activity. It is important to note that although the Teacher's Guide states that the articles represent different levels of complexity, they all appear to be the same. Consequently, providing a Lexile level may help teachers identify the difficulty level of the text.
- Lesson 5: This element is claimed. However, there is no evidence of this element in this lesson.

Disciplinary Core Ideas (DCIs) | **Rating: Adequate**

The reviewers found adequate evidence that students have the opportunity to use or develop the SEPs in this unit. There is a mismatch between some of the DCI claims in the unit and the evidence that students use or develop those DCIs.

DCI CATEGORY ADDRESSED (OR NOT ADDRESSED)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- *Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.*
  - Lesson 2: This element is claimed. In the "Ecosystems are Dynamic" section (between questions 5 and 6) students are told that ecosystems are dynamic and that their characteristics change over time. Students are therefore building toward an understanding of the element. In Question 9, students are provided with a food web of the GawnFishin ecosystem and are asked to predict the impacts of the stability of this ecosystem if more whales are added to the community. As students complete this question, they engage with the claimed DCI element.
  - Lesson 6: This element is claimed. In Question 7, students describe how human activities affect bee populations and how these changes could impact the stability of all populations within an ecosystem. As they do so, students use the claimed DCI element.
  - Lesson 7: This element is claimed. In Questions 5 and 6, students engage with the claimed DCI element as they describe the changes that occur during the simulation.

LS4.D: Biodiversity and Humans

- *Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on — for example, water purification and recycling.*
  - Lesson 2: This element is claimed. Students complete an activity where they see that bees pollinate specific plants. When they're asked what would happen if all the bees except one species were removed, they are expected to know that it would reduce the available food options. As students do so, they engage with the claimed DCI element.

- Lesson 3: This element is claimed. As students complete the "Camilla's Fruit and Veg Market" simulation, they engage with the following portion of the claimed DCI, *Changes in biodiversity can influence humans' resources, such as food, ~~energy, and medicines, as well as ecosystem services that humans rely on — for example, water purification and recycling~~*. In Question 8, students are asked to "*explain how changes in wildflower populations affect the biodiversity of an ecosystem and the availability of food humans rely on*." Students are then provided with the "hint" that they need to look to the model to "*to show how small changes in an ecosystem impact biodiversity and human food resources".* As students complete this question, they may use this element to support their sense-making of the claimed DCI. However, after completing the simulation multiple times, the results were often very similar (even when eliminating a type of flower). Consequently, students may be simply repeating what they have previously been told rather than engaging in sense-making.
- Lesson 4: This element is claimed. In the "Finding the Central Idea in Texts" section (between Questions 3 and 4), students read about the following portion of the claimed DCI element, "*Changes in biodiversity can influence ~~humans' resources, such as food, energy, and medicines, as well as~~ ecosystem services that humans rely on — for example, water purification and recycling*. Students then analyze the graph in Question 4, confirming what they have just read. Students therefore develop this portion of the DCI element but do not use it to support sense-making. In Question 9, students are asked to describe how the reduction of gray wolves in Yellowstone could have possibly affected human resources. The reading passage prior to this question tells students that lowering the wolf population increases the elk population, which over-consumed plant life, causing erosion. Although students develop the DCI element through reading, it is not likely that they engage in sense-making using the DCI since they likely just repeat what they read in their responses to Question 9.
- Lesson 5: This element is claimed. In Question 10, students are asked to explain how food security could be impacted due to a lack of biodiversity. Although students engage with the DCI element and demonstrate an understanding of this core idea, there is no evidence that they use this understanding to make sense of the phenomenon of declining bee populations.
- Lesson 8: This element is claimed. However, there is no evidence that students use this element in Lesson 8.
- Lesson 11: This element is claimed. In Question 3, students self-assess their design solutions against identified criteria. If students meet the "three star" level of the rubric for Criterion 3, they would be using with the grade-level-appropriate element of the claimed DCI. If students score at the lower levels, they most likely only use elements from the 3–5 or K–2 grade bands.
- Lesson 12: This element is claimed. Students create presentations for their design solutions. If student designs meet the criteria that have been established, it is likely that they will use the claimed DCI. However, there is no evidence that all students will do so.

- Lesson 13: This element is claimed. Students present their design solutions to the class where they will be critiqued by their peers. If student designs meet the criteria that have been established, it is likely that they will use the claimed DCI. However, there is no evidence that all students will do so.

ETS1.B: Developing Possible Solutions

- *There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem.*
  - Lesson 9: This element is claimed. In Question 5, students identify the advantages and limitations of the design solutions they have brainstormed. As they do so, they are using a systematic process for evaluating a solution, and therefore potentially building toward this element. However, they are not fully using the claimed element because they are not asked to show understanding that there are systematic processes. Additionally, students have not been introduced to the actual criteria or constraints of the design challenge at this point in the lesson sequence.
  - Lesson 10: This element is claimed. In Question 7, students are asked to evaluate their design's structure and function against criteria and constraints. However, students are not presented with the criteria and constraints of the problem until Lesson 11. Consequently, students are not fully using the claimed DCI.
  - Lesson 11: This element is claimed. In Question 2, students use a rubric to assess their design solution to determine how well it meets the established criteria and constraints. As they do so, they might implicitly build toward the claimed DCI element.
  - Lesson 13: This element is claimed. In Question 2, students use a rubric to assess one group's design solution to determine how well it meets the established criteria and constraints. As they do so, they might implicitly build toward the claimed DCI element.

Crosscutting Concepts (CCCs) | **Rating: Adequate**

The reviewers found adequate evidence that students have the opportunity tocan use or develop the CCCs in this unit. There is a mismatch between some of the CCC claims in the unit and the evidence that students use or develop those CCCs.

CCC CATEGORY ADDRESSED (OR NOT ADDRESSED)

Patterns

- *Graphs, charts, and images can be used to identify patterns in data.*
  - Lesson 1: This element is claimed. In Question 5, students are asked to compare the overall trends in the two graphs. As they do so, they use the claimed element.
  - Lesson 2: This element is claimed. In Question 6, students are asked to identify the daily activity pattern of the honeybee using the chart. As they do so, students use the claimed CCC.
  - Lesson 4: This element is claimed. In Question 4, students analyze a graph that shows the relationship between water quality and biodiversity. However, as they do so, they

do not need to use an understanding that the provided graphs can be used to identify patterns. Consequently, students are not using the claimed CCC.

- Lesson 5: This element is claimed. In Question 6, students are asked to use patterns in the data to evaluate a claim. As they do so, they are using an understanding of the claimed CCC.

Stability and Change

- *Small changes in one part of a system might cause large changes in another part.*
  - Lesson 3: This element is claimed. In Question 7, students are told what stability and change is and then are asked to provide an example of where one small change created larger changes in the model. As students complete this question, they build an understanding of the CCC and may use this element to support their sense-making of the DCI. In Question 9, students are provided with a food web of the GawnFishin ecosystem. Students are asked to predict the impacts of the stability of this ecosystem if more whales are added to the community. As students complete this question, they use the claimed CCC element.
  - Lesson 6: This element is claimed. In Question 7, students describe how human activities affect bee populations and how these changes could impact the stability of all populations within an ecosystem. As students do so, they use the claimed CCC element.
  - Lesson 7: This element is claimed. In Question 3, students are asked to describe how the stability of the model ecosystem is impacted by the growing city. As they do so, they use the claimed CCC element. Note however that although students can experience the bee populations reduced in the simulation, the actual number of crops increased compared to earlier simulations, which may cause confusion. In Question 6, students describe their strategy for maintaining stability as the ecosystem changed and are prompted to use the claimed CCC in their answer. As a result, it is likely that most students will use this element in their answer.

Structure and Function

- *Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.*
  - Lesson 9: This element is claimed. However, there is no evidence the claimed CCC is used.
  - Lesson 10: This element is claimed. In Question 2, students are asked to explain how a honeycomb's shape or structure supports a hive's function. As they respond to this prompt, students most likely use a **Structure and Function** element from a lower grade band. In Question 3, students are asked why they need to consider the structure of their design. As they do so, they are using the claimed CCC.
  - Lesson 11: This element is claimed. In Question 2, students assess their designs to see if they meet the established criteria and constraints. As they do so, students may engage with the claimed CCC as they focus on Constraint #1. However, it is unlikely that all students will be doing so and those that are may not be doing so explicitly.

- Lesson 12: This element is claimed. However, there is no evidence that students use the claimed CCC.
- Lesson 13: This element is claimed. In Question 2, students assess presented designs to see if they meet the established criteria and constraints. As they do so, students may be engaging with the claimed CCC as they focus on Constraint #1. However, it is unlikely that all students will be doing so and those that are may not be doing so explicitly.

Suggestions for Improvement

Science and Engineering Practices

- Providing students with more opportunities to engage deeply with and develop new understanding of grade-appropriate SEP elements could strengthen the evidence for this criterion.

Disciplinary Core Ideas

- Providing students with more opportunities to engage deeply with grade-appropriate DCI elements could strengthen the evidence for this criterion.

Crosscutting Concepts

- Consider reducing the number of targeted CCC elements to those that explicitly support students as they figure out phenomena or solve problems.
- Consider making crosscutting concept learning explicit to students. Guiding students explicitly about when to use CCC elements could help ensure that all students have a chance to develop and use grade-appropriate elements and would help ensure that they would be able to reuse these concepts again for sense-making and problem solving in the future.

I.C. INTEGRATING THE THREE DIMENSIONS

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

Rating for Criterion I.C. Integrating the Three Dimensions	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that student performances integrate elements of the three dimensions in service of figuring out phenomena or designing solutions to problems. Students have opportunities to engage in multi-dimensional learning in service of problem solving or sense-making. However, the number of opportunities for all students to use the three dimensions in an integrated manner, in which each dimension supports the understanding of the others, is limited for a unit of this length.

The Teacher's Guide, page 24, states that "each lesson contains one or more Key Questions where students demonstrate their achievement against the three-dimensional learning goal." Some examples include:

- Lesson 2, Question 8: Students are asked to write an explanation for how biodiversity would be affected if all bees other than squash bees were removed from an ecosystem. As they do so, students most likely use portions of an element from **LS2.C Ecosystem Dynamics, Functioning, and Resilience (DCI)** along with an unclaimed element from **Constructing Explanations and Designing Solutions (SEP)**. Although elements from **Obtaining, Evaluating, and Communicating Information** and **Patterns** are claimed in this key question, there is no evidence that all students will use these elements in their explanations.
- Lesson 3, Question 8: After having completed a simulation about pollination and its effects on Farmer Camilla's garden ecosystem, students are asked to "explain how changes in the wildflower population affect the biodiversity of an ecosystem and the availability of food humans rely on." As they respond to this prompt, students use elements from **LS4.D Biodiversity and Humans (DCI)** along with elements from **Developing and Using Models (SEP)**, and an unclaimed element of **Constructing Explanations and Designing Solutions (SEP).** Although an element from **Stability and Change** is also claimed in this key question, it is likely that many students will not use the element in their explanations and those that do may do so implicitly.
- Lesson 4, Question 8: Students are asked to "Explain the relationship between bees and biodiversity. What makes bees so important to humans? *Hint: For this question, you will need to use patterns in data. Summarize the scientific texts to show your understanding of why biodiversity is so important to us.*" As they respond to this prompt, they are using elements from **LS4.D Biodiversity and Humans (DCI)** along with elements from **Obtaining, Evaluating, and Communicating Information (SEP)** and **Patterns (CCC).**
- Lesson 5, Question 8: Students are asked to propose a claim to answer the question, "Do we need to save the bees?" As they do so, students use elements from **LS4.D Biodiversity and Humans (DCI)** along with an unclaimed element 3–5 element of **Engaging in Argument from Evidence (SEP)** which is supported by an unclaimed element from **Obtaining, Evaluating, and Communicating Information (SEP).** While an element from **Patterns (CCC)** is claimed in this key question, it is likely that many students will not use this element in their explanations and those that do may do so implicitly.
- Lesson 6, Question 7: Students are asked to generate a written explanation that discusses how human activities have affected honeybee populations. Students are explicitly told to use evidence from graphs to explain "how these changes have affected the stability of all populations in the ecosystem." As they do so, students use elements from **LS2.C Ecosystem Dynamics, Functioning, and Resilience (DCI), Analyzing and Interpreting Data (SEP),** and **Stability and Change (CCC)**. Students also implicitly use an element from **Patterns.**
- Lesson 7, Question 6: After interacting with simulation, students are asked to, "**Explain** your strategy for maintaining the stability of bee, wildflower, and crop populations as the city expanded. In your response, refer to the reasons why your strategy was necessary. Use specific examples from the model to support your answer. *Hint: Consider how the model shows that*

small disruptions to an ecosystem can cause changes to all the populations within it." As they do so, students will most likely use an element from **LS2.C Ecosystem Dynamics, Functioning, and Resilience (DCI)** along with an unclaimed element of **Obtaining, Evaluating, and Communicating Information (SEP)** and an element of **Stability and Change (CCC)**.

- Lesson 9, Question 8: Students participate in the engineering design process to save or replace their chosen bee. Then they justify which idea they want to design based on the criteria and constraints their chosen solution meets. As they do so, students most likely use an element from **LS2.C Ecosystem Dynamics, Functioning, and Resilience (DCI)** and/or **LS4.D Biodiversity and Humans (DCI)** along with a 3–5-level element of **Engaging in Argument from Evidence (SEP)** and **Stability and Change (CCC).**
- Lesson 11, Question 5: Students are asked to self-assess their design solution to a rubric of established criteria and constraints. Students who meet the highest level of expectation for all categories on the rubric will engage with elements from **LS4.D Biodiversity and Humans (DCI),** along with elements from **Constructing Explanations and Designing Solutions (SEP)** and an unclaimed element of **Stability and Change (CCC).** Students who score at lower levels on the rubric will not be meeting grade-level expectations of these dimensions. Additionally, students may be using an element of **Structure and Function** but will most likely be doing so implicitly.
- Lesson 12, Question 2: Students are asked to generate a presentation to accompany their design solution. As they do so, they use an element of **Obtaining, Evaluating, and Communicating Information** (SEP) along with an element of element from **LS2.C Ecosystem Dynamics, Functioning, and Resilience (DCI)** and/or **LS4.D Biodiversity and Humans (DCI)** and possibly an element from **Structure and Function (CCC)** and/or an unclaimed element from **Stability and Change (CCC).**

Suggestions for Improvement

- Consider providing students with additional three-dimensional learning opportunities that incorporate SEPs other than **Obtaining, Evaluating, and Communicating Information**.
- Incorporating suggestions from the Criterion I.B section of this report might also help increase the rating for this criterion.
- In Lesson 4 there is a missed opportunity to integrate elements from the CCC **Stability and Change** with DCI and SEP elements as students figure out keystone species.

The Importance of Biodiversity

EQuIP RUBRIC FOR SCIENCE EVALUATION

I.D. UNIT COHERENCE	
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.	
Rating for Criterion I.D. Unit Coherence	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that lessons fit together coherently to target a set of performance expectations. The lessons are all thematically connected and work together to help students develop towards proficiency in the targeted set of performance expectations. However, there are numerous missed opportunities for students to build upon what they have figured out in previous lessons to help them make sense in subsequent ones.

In Lesson 2, guidance is provided on the development of a DBQ. Additionally, students are asked to engage in the "Link, Connect, Question" routine where students are asked to link the current lesson to prior knowledge and generate additional questions about what they need to figure out after many of the lessons. Although there are opportunities for students to return to the DQB and record what they have learned in the lesson and possible new questions they may have, there are numerous missed opportunities for students to build upon what they have figured out in previous lessons to help them sense-make or problem solve in subsequent ones.

Related evidence includes:

- Lesson 2: Students discuss what a world without bees could look like, make personal connections, and then watch a video featuring a bee pollinating a plant before learning more information about the pollination process. After revisiting the graphs from Lesson 1, students are given information about the different types of bees and the bee activity graphic. At the end of the lesson, students are introduced to the unit guiding question, "Do we need to save the bees?" To close the lesson, students are asked to create questions for the DQB.
- Lesson 3: Guidance is provided for the teacher to start the lesson with the DQB and then students use a simulation that models an ecosystem containing various species of wildflowers and bees to better understand the importance of bee species variety to the biodiversity of an ecosystem. They create predictions then test both scenarios to see the outcomes. After evaluating their predictions, students answer questions and then conclude the lesson by writing in their learning journal. There is a missed opportunity for students to return to the DQB at the

end of the lesson (or at the beginning of the next lesson) to address questions answered and create new questions for the unit.

- Lesson 4: After watching a video featuring some of the benefits bees provide to humans, students summarize and discuss their thoughts. The teacher is told to, "explain that this lesson continues to build on the question in Lesson 2 from the DBQ, "Why should we care about bees?" before students read about keystone species. The students return to the DQB to address questions answered in the previous lesson, but these opportunities are not used to support students in making connections between those previously answered questions and the activities in the current lesson. Students read about how biodiversity impacts clean water to practice finding the central ideas in scientific texts before participating in a jigsaw type activity where students are given different texts about how bees support humans and biodiversity in ecosystems. After summarizing their learning from each article and answering two application questions, students reflect on the lesson by writing in their learning journal.
- Lesson 5: The lesson begins with students brainstorming one or two things they have learned in the unit thus far. However, there is no evidence that students are supported in leveraging what they have learned to make coherent connections to what they are experiencing in this lesson.
- Lesson 6: Students are given a scenario and graphs to complete the claim, evidence, reasoning routine to reinforce Lesson 5. Then students return to the DQB to address any questions answered and choose three questions to focus on for the lesson. However, the next section moves into colony collapse disorder without providing any guidance for teachers on how connections could be made to the student selected questions. After the students complete readings and answer questions about how colony collapse disorder affects humans, they complete their reflection in their learning journal.
- Lesson 7: Students revisit the DQB to address questions answered and create new questions for the unit before returning to the model from Lesson 3 to explore the impacts of an expanding city and farming practices on the biodiversity of an ecosystem. Guidance is given to teachers on how to connect to students' experiences, community, and backgrounds to the lesson before moving into the simulation portion of the lesson. The students complete the Predict, Observe and Explain routine to better understand the first scenario. Before running the model again, students are asked to choose one question from the DQB and explain whether the question can be answered by what they observed in the model ecosystem. However, no guidance is given to teachers as to how to connect the student generated questions to the simulation.

The unit helps students build proficiency in most of the targeted PEs. While students have opportunities to build proficiency in the targeted SEP element for each PE, they do not have opportunities to reach full proficiency in all the targeted DCI and CCC elements in each PE.

The target PEs are listed as:

- **MS-ETS1-2**. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- **MS-LS2-4**. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Suggestions for Improvement

- Providing students opportunities to build full proficiency in all the claimed DCI and CCC elements in the target PEs could strengthen the evidence for this criterion. Alternately, consider modifying the PE claims to clarify that students will only build partial proficiency during the unit, and specify which parts.
- Applying the suggestions for improvement from Criterion I.B could also help strengthen the evidence for this criterion.
- Consider sequencing the investigative phenomena and problems and the content in each lesson such that they build off each other and make sense to the students. Allowing students to apply what they learn to fully address each scenario presented to them could help their perception of coherence in the unit.

I.E. MULTIPLE SCIENCE DOMAINS

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.

Rating for Criterion I.E. Multiple Science Domains	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that links are made across science domains when appropriate because the phenomena and problems presented to the students can be completely explained using the targeted Disciplinary Core Ideas from the life sciences domain. However, the materials do not support student use of the crosscutting concepts to make connections across domains.

Related evidence includes:

- Solutions to the problem, "*Do we need to save the bees*?", can be accomplished using grade-appropriate elements from the life science domain.
- Student use of CCC elements is grade appropriate and sometimes used in service of sense-making. However, students are not prompted or supported to see connections between how CCC elements are useful or connected between science disciplines.

Suggestions for Improvement

Consider revisions that support students to use grade-appropriate elements of the crosscutting concepts to make connections across science domains.

I.F. MATH AND ELA	
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.	
Rating for Criterion I.F. Math and ELA	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that the materials provide grade-appropriate connections to the Common Core State Standards (CCSS) in mathematics, English language arts (ELA), history, social studies, or technical standards because CCSS standards are identified for every lesson. There is evidence that students engage with those standards, and there is some evidence that these connections are made explicit to them. Providing additional opportunities for students to speak and listen to their peers and increasing the number and diversifying the types of reading materials presented to students would strengthen the rating for this criterion.

Some examples include:

Common Core Literacy Standards

- RST.6–8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
    - Lesson 4: In Question 3, students identify the central idea of provided text. Prior to this question, the following teacher guidance is provided, "*Highlight the connections to the Common Core State Standards in English Language Arts of Reading Standards for Literacy in Science and Technical Subjects by pointing out how central ideas can be conveyed through particular details in the text*." However, the guidance is classified as a differentiation opportunity and therefore may not be used for all students.
- *WHST.6-8.1a: Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.*
    - Lesson 5: This standard is claimed for this lesson. However, evidence of students using this standard to better understand the science content was not located. Also, it is not called out on the Stile app. Therefore, teachers are not likely to help students make the connection that they are using ELA to support their science understanding if it is not included in the lessons.
- *WHST.6–8.1b Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.*

  - Lesson 1: This lesson is claimed to be aligned with this standard. However, evidence of students using this standard to better understand the science content was not located. Also, it is not called out on the Stile app. Therefore, teachers are not likely to help students make the connection that they are using ELA to support their science understanding if it is not included in the lessons.
  - Lesson 5: In Question 5, students are asked to identify provided statements as either evidence or reasoning to support a claim. Prior to this question, the following teacher guidance is provided, "*Highlight the connections to the Common Core State Standards in English Language Arts of Writing Standards for Literacy in History/Social Studies, Science and Technical Subjects by pointing out that claims are supported by logical reasoning and relevant, accurate data."* However, the guidance is classified as a differentiation opportunity and therefore may not be used for all students. Additionally, these callouts are not located within the lessons in the Teacher's Guide PDF, they are listed at the front of each lesson, so teachers aren't likely to help students make the connection that they are using ELA to support their science understanding if they aren't included in the lesson itself.
- RST.6–8.7 Integrate quantitative and or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
  - Lesson 4: This standard is claimed to be aligned with this lesson. However, evidence of students using this standard to better understand the science content was not located. Also, it is not called out on the Stile app. Therefore, teachers are not likely to help students make the connection that they are using ELA to support their science understanding if it is not included in the lessons.
  - Lesson 6: Students read a passage entitled, "*Where did the honey bees go*?" and are instructed to analyze a graph titled, "*Number of honey bee colonies reported in the US over time*." Prior to these sections, the following teacher guidance is provided, "*Highlight the connections to the Common Core State Standards in English Language Arts of Reading Standards for Literacy in Science and Technical Subjects by pointing out how technical information can be expressed visually*. However, the guidance is classified as a differention opportunity and therefore may not be used for all students.
  - Lesson 10: Students read about and then design their own prototypes. Prior to these sections, the following teacher guidance is provided, "*Highlight the connections to the Common Core State Standards in English Language Arts of Reading Standards for Literacy in Science and Technical Subjects by pointing out how technical information can be expressed visually*. However, the guidance is classified as a differention opportunity and therefore may not be used for all students.

Common Core Math Standards

- 6.EE.C.9 Represent and analyze quantitative relationships between dependent and independent variables.

- Lesson 1: Students analyze graphs showing changes in bee populations over time. Prior to this section, the following teacher guidance, labeled as explicit teaching, is provided, "*Highlight the connections to the Common Core State Standards in Mathematics of Expression and Equations by pointing out the independent and dependent variables and the relationship between them.*"
- Lesson 6: Students are instructed to analyze a graph titled, "*Number of honey bee colonies reported in the US over time*." Prior to this section, the following teacher guidance, labeled as explicit teaching, is provided, "*Highlight the connections to the Common Core State Standards in Mathematics of Expression and Equations by pointing out the independent and dependent variables and the relationship between them.*"

Suggestions for Improvement

- Consider making connections to the ELA standards explicit to students when using them in the unit.
- Consider explicitly identifying within lesson materials the ELA and Mathematics standards are being used in the lessons to provide greater clarity to educators.
- Consider reducing the number of CCSS elements claimed in the Teacher's Guide to focus on those that are most closely related to students' activities.

OVERALL CATEGORY I SCORE: **2** (0, 1, 2, 3)	
Unit Scoring Guide – Category I	
Criteria A-F	
3	At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C
2	At least some evidence for all unit criteria in Category I (A–F); adequate evidence for criteria A–C
1	Adequate evidence for some criteria in Category I, but inadequate/no evidence for at least one criterion A–C
0	Inadequate (or no) evidence to meet any criteria in Category I (A–F)

CATEGORY II

NGSS INSTRUCTIONAL SUPPORTS

II.A. RELEVANCE AND AUTHENTICITY

II.B. STUDENT IDEAS

II.C. BUILDING PROGRESSIONS

II.D. SCIENTIFIC ACCURACY

II.E. DIFFERENTIATED INSTRUCTION

II.F. TEACHER SUPPORT FOR UNIT COHERENCE

II.G. SCAFFOLDED DIFFERENTIATION OVER TIME

II.A. RELEVANCE AND AUTHENTICITY

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.

Rating for Criterion II.A. Relevance and Authenticity	Extensive *(None, Inadequate, Adequate, Extensive)*

The reviewers found extensive evidence that the materials engage students in authentic and meaningful scenarios that reflect the real world.

Students have opportunities to experience phenomena/problems directly. Some examples include:

- Lesson 1: The anchoring phenomenon of the global decline in bee species diversity is introduced to students through various newspaper headlines and graphs. The teacher is prompted to ask students how the news articles connect to their daily lives.
- Lesson 2: Although the sequencing might result in a lack of authentic student engagement, students are presented with the problem, “Do we need to save the bees?”
- Lesson 8: Students are introduced to the culminating engineering design challenge to save or replace the bees. After learning about the engineering design process, students are given images from the model simulations in Lessons 3 and 7 and asked to define the problem. Then working in groups, students choose one bee species to focus on for the upcoming lessons before creating the design brief.
- Lesson 9: After watching a video about the research and brainstorming phases of the engineering design process, students are asked to research existing solutions that people are using to help save the bees before creating a summary about their chosen bee species. In groups students then brainstorm and evaluate their solutions. To close the lesson, students choose the best solution and then create a sketch of their proposed design.
- Lesson 10: Students learn about the structure and function of the beehive before creating a prototype design for the solution and evaluating the prototype against their chosen set of criteria.

The unit includes suggestions for how to connect instruction to students' lives and how to make it more relevant. Some examples include:

- Lesson 1, Teacher's Guide, page 48: Suggested instructional strategies are provided in the "Connecting to students' experiences, community and backgrounds" section.
- Lesson 2, Teacher's Guide, page 56: A suggestion is given to replace the bee species found in the table with those found in "your" region along with the plants they populate.
- Lesson 2, Stile app: Teacher guidance is provided for students to consider "what their home, school, and town would look like without bees." Additional guidance is provided for students who may not be able to imagine what the world would look like with no bees.
- Lesson 3, Teacher's Guide, page 64: A suggestion is made to extend the learning from the bees in the model to bees that inhabit "your local area."
- Lesson 4, Teacher's Guide, page 82: Suggested prompts include, "Do they have honey in their pantries at home? Do they know someone who owns a honey hive?" Additionally, guidance is provided on how to make connections between biodiversity and water purification by asking students questions about waterways near their homes.
- Lesson 4, Stile app: Suggested guidance includes allowing students to share their own stories about how they have benefited from honeybees. Additionally, the following suggested question is provided: "Does honey have a special place in their cultural background?".
- Lesson 5, Teacher's Guide, page 90: Suggested guidance includes having students create a list of food types they have eaten in the previous day and identify which types depend on bees in some way.
- Lesson 6, Teacher's Guide, page 101: Guidance is provided to "ask students about their own experiences with bees." Included in this guidance are questions about students being stung by bees, which would help students connect with the theme of bees but not the actual phenomena or problem the lesson is trying to solve.
- Lesson 7, Teacher's Guide, page 109 and within Lesson 7, Stile app: Guidance is provided to help students who live in urban areas to make connections to areas where bees are pollinating flowers and for those in rural areas to consider the impact of farming practices on bee populations.
- Lesson 8, Teacher's Guide, page 126: Suggestions on how to alter the engineering challenge to focus on local bee populations are provided.

Suggestions for Improvement

Consider revisions that would support teachers in anticipating issues that may arise when students communicate about their lives outside of school (such as students sharing about negative experiences with bees such as stings or allergic reactions).

II.B. 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.

Rating for Criterion II.B. Student Ideas	Inadequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found inadequate evidence that the materials provide students with opportunities to both share their ideas and thinking and respond to feedback on their ideas. Students have opportunities to express, clarify, and represent their ideas in the unit. However, students are not prompted to reflect on any feedback they are given, and it is unclear if students are provided time to reflect on how their thinking is different from their peers or are provided with opportunities to reflect on how their thinking has changed during the unit. Additionally, there is limited evidence that students will have opportunities to return to the feedback provided to them by their teachers to revise their thinking.

Some examples include:

- Lesson 1: Students are introduced to the phenomenon through the Six Thinking Hats routine to encourage group work and thinking about different perspectives. Although this routine is referenced again in the unit, there is limited evidence that it will support group participation and it serves more as a support to explicit teacher guidance.
- Lesson 5: Students are asked to make a claim about bees and their importance to humans. Then they are encouraged to partner up and share their claims and ask questions that could challenge their partner's claim. However, there is no evidence that students will revise their original thinking because of sharing their claim with their peers.
- Lesson 7: Students are provided an opportunity to share the observations they've collected from the simulation with a peer.
- Lesson 8: Students work together to define the engineering problem they will solve and the criteria and constraints they will work within. Guidance is provided that all group members should agree on the decision. However, there is no evidence that students will use these discussions to revise their own thinking or if they will just agree to a design without considering how it changes their understandings.
- Lesson 9: Students brainstorm solutions to the design solution. Students then evaluate and identify the three best solutions from their group based on advantages and limitations. However, there is no evidence that students will use these evaluations to revise their own thinking.
- Lesson 10: Students watch a video about bees working in a hive. To stimulate their thinking, they record their own ideas about why hives are designed as they are, their partner's ideas, and the classes' ideas. However, there is no evidence that students will return to their original ideas to make revisions because of working with partner's or the class.

- Lesson 13: Students share their solutions in an engineering showcase through a gallery walk and conduct peer assessments. However, there is no evidence that students will revise their original thinking because of the peer assessment.

Students may have some opportunities to receive teacher feedback, although the teacher is not explicitly instructed to provide the feedback to students or allow them time to reflect on it. Thus, these opportunities are not set up in a way that ensures all students will receive feedback. For example:

- Each lesson has a "Key Question" and in the Stile app there is a link to a PDF document that gives teachers logistical information about how feedback can be provided on the platform. However, guidance for what that feedback could look like or when to give it is not located on the hyperlinked page, which could cause confusion for some teachers. In addition, these "Key Questions" are treated as assessments. Therefore, students would only be receiving feedback on this assessment question once in each lesson and the feedback might only take the form of "right" vs. "wrong."
- The weekly planning guide located in the Teacher's Guide, pages 35–39, has feedback listed under the "Preparation Required" tab. However, teachers using the Stile app do not have this information so it could be confusing. Also, the PDF lesson plans do not include the term "feedback" at the "Key Questions" part in the lesson. Therefore, teachers may not know that it is needed at that point in the lesson.

Suggestions for Improvements

- Consider establishing a feedback cycle at several points in the unit through which students can receive and respond to teacher feedback.
- Consider structuring the peer and teacher feedback opportunities in a way that all students are guaranteed to receive constructive feedback and have explicit time set aside to reflect on and respond to the feedback.
- Consider modifications to the "Link, Extend, Question" routine to prompt students to reference and revise their understandings as they compare them to their peers' ideas and the feedback they receive from their teachers.

II.C. BUILDING PROGRESSIONS

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.

Rating for Criterion II.C. Building Progressions	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that the materials identify and build on students' prior learning in all three dimensions because prior student learning expected for the dimensions is identified in the materials and a learning progressions chart is included. However, although the materials indicate whether each element is being "developed", "used", or "assessed," it is unclear from the learning progressions chart which portions of the "developed" element(s) are built upon from one lesson to the next, and through which activities that development is meant to occur.

Related evidence includes:

- SEP, DCI, and CCC Progression Charts are provided in the Teacher's Guide (pages 9–16). These charts detail how students will be using a particular SEP, CCC, or DCI category in the lessons. However, the chart does not include the prior proficiency students are expected to have for specific elements in all three dimensions.
- Teacher's Guide, pages 10–12: Learning progressions for the three dimensions are provided. A symbol system is used to identify if the element is being developed, mastered, or assessed in the lesson. However, it is unclear which portion of the element is being developed in each lesson.
- Teacher's Guide, pages 14–16, expected prior knowledge for all three dimensions is identified. A symbol system is used to show how each standard is intended to be built upon and used in each lesson throughout the unit. However, the chart does not include the level of prior proficiency students are expected to have for specific elements in all three dimensions. In addition, suggestions are later included for teachers to support students in developing the what the materials identify as "required prior knowledge" (pages 43–45), which indicates that the knowledge isn't required prior to the unit. The suggestions for support could be used to help students meet the targeted claims and are not referencing prior knowledge that students will need to begin building towards these targets.
- Teacher's Guide: Page 17 is titled, "Scientific Background", and includes background information to support teachers in understanding the science behind the unit.

- Each lesson in the Teacher's Guide has a "prior knowledge" and "Common Misconception" section on the first page that address any dimensions students should be familiar with from previous grades and any misconceptions that students may have. However, levels of prior proficiency students are expected to have for specific elements in all three dimensions are not specified.

Suggestions for Improvement

- Consider revisions that explicitly state the expected level of proficiency students should have for all targeted elements of the three dimensions.
- Consider revisions that would clearly describe the progression of learning for specific portions of the targeted elements so that teachers can clearly see how each section works coherently to build towards the targeted elements.
- Consider revisions which would include definitions and/or descriptions of what is meant when an element is being "developed, used, or assessed" within a particular lesson.

II.D. SCIENTIFIC ACCURACY	
Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning.	
Rating for Criterion II.D. Scientific Accuracy	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that the materials use scientifically accurate and grade-appropriate scientific information. However, some ideas are presented to students in a way that is likely to cause misconceptions.

Related evidence and reasoning include, but is not limited to:

- Throughout the unit, illustrations are used to depict various types of bees. Most of the bees presented are in cartoon drawing form with eyes and a smiling mouth. The cartoon drawings anthropomorphize bees.
- Lesson 2: Students learn about pollination.
    - They are presented with a pollination video that uses cartoon drawings to show details of the pollination process. The cartoon drawings could possibly anthropomorphize this process and could promote an inaccurate understanding of pollination.

  - Students are asked to label the steps to summarize how a bee helps a plant reproduce. The pictures featured in the text are cartoon drawings. This could promote an inaccurate understanding of pollination.
  - Students are presented with "Bee Characters" to learn about the different types of bees and the plants they pollinate. The cartoon drawings anthropomorphize bees.
- Lesson 3: Students interact with a model to simulate how changes in biodiversity affect human food sources. Then they match the bees to the flowers, fruits, and vegetables they pollenate. The cartoon drawings anthropomorphize bees.

Suggestions for Improvement

Consider adjusting the pictures and video referenced above to ensure they will not promote misconceptions or inaccurate thinking for students.

II.E. DIFFERENTIATED INSTRUCTION

Provides guidance for teachers to support differentiated instruction by including:

i. Appropriate reading, writing, listening, and/or speaking alternatives (e.g., translations, picture support, graphic organizers, etc.) for students who are English language learners, have special needs, or read well below the grade level.

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.

Rating for Criterion II.E. Differentiated Instruction	Inadequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found inadequate evidence that the materials provide guidance for teachers to support differentiated instruction because there is limited evidence of strategies provided to explicitly support students who are struggling with the learning targets, read below the grade level, or are multilingual learners.

Some options are provided that could help students who are struggling to meet the learning targets. However, these options do not explicitly address specific learning targets and are instead generalized instructional moves for the teacher. At the beginning of each lesson in the Teacher's Guide PDF there is a "Differentiation" section to provide teachers with support in assisting students who might not be

meeting their goals. However, most of these suggestions appear to be generic support related to a specific question in the lesson or refer teachers to an unknown place in the document. Also, these suggestions are not located in the Stile app so teachers may not see these suggestions if they are only located on the PDF document. For example:

- Lesson 2: "Question 3: You may wish to add images for each of the words to the right of the canvas for an additional level of support" (Teacher's Guide, page 56). However, this is the only support for differentiated learning in the lesson.
- Lesson 3: "Refer to the 'Differentiation for students who require additional support' section for strategies that can be applied in this lesson" (Teacher's Guide, page 64). However, this document only provides generalized statements and is not lesson specific.
- Lesson 4: "Assign 'The business of bees' article for the research task. This is the least complex of the three articles" (Teacher's Guide, page 81). Although the guidance states that this strategy should be used for "students who require support" it is unclear what type of support it would address.
- Lesson 5: "Question 5: Discuss the difference between a premise and evidence with these students. A premise is a statement or assumption a claim is based on. Evidence is data to support the claim. The structure of this lesson allows you to gauge student progress and work with a smaller group of students who require your support, while others work independently" (Teacher's Guide, page 90). However, this is the only support for differentiated learning in the lesson and it may be too generalized to provide the support required for some struggling learners.
- Lesson 7: "Refer to the 'Differentiation for students who require additional support' section for strategies that can be applied in this lesson" (Teacher's Guide, page 109). However, this document only provides generalized statements and is not lesson specific.
- Lesson 8: "The use of group work in this lesson will offer support for students who require additional support. Students should be grouped with others who are willing to engage them in discussion and help them to express their ideas" (Teacher's Guide, page 126). However, this support may be too generalized to provide the support required for some struggling learners.
- Lesson 9: "Allow these students to select their roles first when working as a team. Encourage them to consider which roles might suit them best. Artist and architect roles might be particularly well-suited" (Teacher's Guide, page 145). However, this support may be too generalized to provide the support required for some struggling learners.

Some strategies are provided to address the needs of multilingual learners, learners with disabilities, and those who read below grade level. However, these options do not explicitly address specific learning targets and are instead generalized instructional moves for the teacher. Some examples include:

- An overview of how the unit provides differentiation strategies for different types of learners is in the Teacher's Guide document on pages 26–30. It features an overview of the various types of support as well as Accessibility and ELL supports. However, these are focused on the features of the Stile app and not the supports the teacher can provide for the students.
- Lesson 6: "Refer to the 'Differentiation for English Language Learners' section for strategies that can be applied in this lesson" (Teacher's Guide, page 100). However, this document only

provides generalized statements and is not lesson specific. Consequently, teachers may find the guidance ineffective when seeking to support struggling learners.

- Lesson 7: "Refer to the 'Differentiation for English Language Learners' section for strategies that can be applied in this lesson" (Teacher's Guide, page 109). However, this document only provides generalized statements and is not lesson specific. Consequently, teachers may find the guidance ineffective when seeking to support struggling learners.
- Lesson 9: "Refer to the 'Differentiation for English Language Learners' section for strategies that can be applied in this lesson" (Teacher's Guide, page 158). However, this document only provides generalized statements and is not lesson specific. Consequently, teachers may find the guidance ineffective when seeking to support struggling learners.
- Lesson 10: "Differentiating for English Learners: Encourage students to use translation and built-in narration tools in Stile if required to support their understanding of the terminology in the rubric" (Teacher's Guide, page 165). This is the same generic support that is also provided to the students who require support in this same lesson.
- Lesson 11:
    - "Differentiating for English Learners: Encourage students to use translation and built-in narration tools in Stile if required to support their understanding of the terminology in the rubric" (Teacher's Guide, page 165). This strategy is unlikely to support multilingual learners to make connections to the materials for the purpose of sense-making.
    - "Differentiating for students who require support: Encourage students to use the built-in narration tools in Stile if required to support their understanding of the terminology in the rubric" (Teacher's Guide, page 165). This strategy is unlikely to support students to make connections to the materials for the purpose of sense-making.

The materials suggest additional experiences for students who need "extensions." However, these opportunities do not identify an expected level of proficiency that must be met by the student to require an "extension." Additionally, these opportunities do not identify which of the dimensions or what aspect of the phenomena and/or problem they are intended to enrich.

- Lesson 3: On page 64 of the Teacher's Guide, the following guidance is provided, "Capable students can attempt to answer Question 9, the Challenge Question. This question requires students to draw on their knowledge of food webs from the previous unit, Food Chains and Food Webs." However, students are not extending their understanding of stability but are applying what they have learned in this unit to a different ecosystem.
- Lesson 5: On page 90 of the Teacher's Guide, the following guidance is provided, "Capable students can attempt to answer Question 10, the Challenge Question. This question requires students to extend their understanding of biodiversity" (Teacher's Guide, page 90). Although the question is labeled as an extension or "challenge", it is likely that it will be answered by all students and not just those needing extensions. Additionally, it is unclear what prerequisite skills a student would need to have in order to need this "challenge."
- Lesson 6: On page 100 of the Teacher's Guide, the following guidance is provided, "Capable students can attempt to answer Question 8, the Challenge Question. This question requires students to draw on their own research skills to learn more 'resilience and resistance.'" As

students do so, they engage with a high school-level element of DCI **LS2.C**. However, the question does not provide opportunities for extension in the other dimensions.

- Lesson 8: On page 126 of the Teacher's Guide, the following guidance is provided, "Students should be encouraged to select a bee species that is present in your region." It is unclear how this would extend students in any of the dimensions or how it would deepen their understanding of a phenomena and/or problem.

Suggestions for Improvement

- Consider providing easily identifiable callouts throughout the lessons in the Stile app that provide explicit differentiated strategies teachers can use to support students in their development of the three dimensions.
- To provide differentiation supports for students with special needs, consider including supports to assist teachers with presenting abstract content in small incremental steps.
- Consider providing strategies that help students meet the targeted expectations for all three dimensions. Consider explicitly identifying these strategies with the student needs that they can help meet.
- Consider offering extensions that focus on specific learning targets, including elements of the SEPs and CCCs.

II.F. TEACHER SUPPORT FOR UNIT COHERENCE

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.

Rating for Criterion II.F. Teacher Support for Unit Coherence	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that the materials support teachers in facilitating coherent student learning experiences over time because teachers are provided with guidance and routines that establish and reinforce coherence from a student's perspective. However, it is not clear if students will understand how their learning in all three dimensions progresses.

Guidance is provided to teachers throughout the unit linking student engagement across lessons by providing some explicit connections between lessons.

Related evidence includes:

- Lesson 2: Explicit teaching guidance is provided that tells teachers to guide students to take a second look at the data from Lesson 1. Additionally, they are told, "This is a great opportunity to return to any questions they might still have from Lesson 1."
- Lesson 2: Students are told that they will create a DQB. Although some generic guidance is given in the Teacher's Guide on how to generate and curate student questions, guidance on how to use questions from students to drive sense-making for the unit were not located.
- Lesson 3: Explicit teaching guidance is provided to "refer back to the Driving Questions Board that students created at the end of the previous lesson" to begin the lesson. Additionally, teachers are told to choose a question like "Why should we care about the bees?" and that they are to explain that "this question drives the learning for today's lesson."
- Lesson 4: Explicit teaching guidance is provided that teachers should return to the DQB and to continue to "explain that this lesson continues to build on the question 'Why should we care about bees?'" before students read about keystone species. However, there is no guidance for teachers on how to leverage this question that students might have partially answered in Lessons 2 and 3 to drive additional sense-making. Additionally, there is no guidance on how to use additional student questions to support sense-making.
- Lesson 5: The lesson begins with students recalling one or two things they have learned in the unit thus far. However, there is no guidance for the teacher on how to support students as they engage in this brainstorm by using either the DQB or the "Link, Extend, Question" routine.
- Lesson 6: Explicit teaching guidance is provided for students to return to the DQB and to "check off any questions that have been answered in the previous lessons." However, there is no guidance for teachers on how to cultivate and add questions to the DQB.
- Lesson 7: Explicit teaching guidance is provided for students to return to the DQB and to "revisit any questions that ask about the relationship between bees and humans." Additionally, teachers are told that they are to "Draw out questions that focus on the ways humans could be impacting bee populations. These questions will help drive the lesson." However, there is no guidance provided on how to leverage these questions or how to elicit questions from students if those described are not generated during the discussion.

Throughout the unit guidance is provided for the "Key Questions" in each lesson where the teacher is given guidance to make these connections that would allow students to recognize what they have learned in all three dimensions. However, there are some discrepancies about the callout boxes. The Stile app and the Teacher Guidance document do not have the same callouts. Additionally, there is no evidence that this feedback will be shared with students, which would result in a key aspect of this criterion not being met.

Related evidence includes:

- The "Learning Progression" portion of the Teacher's Guide, pages 9–13, includes the learning progression for all three dimensions for each lesson throughout the unit. However, this information is not included in the Stile app.
- Lesson 2:

- "Read the text under 'Ecosystems are dynamic' to students and use the 'patterns' banner in the lesson to explicitly teach the Crosscutting Concept of **Patterns**. Place students in pairs to work on Questions 6 and 7" (Teacher's Guide, page 58).
- Stile app: "A chart a day shows many patterns at play. Charts are a great tool for identifying patterns. Take a look at the daytime chart of bee activity below to see if you notice any patterns." This is not the same callout box located in the Teacher's Guide.
- "Question 8 is the Key Question for this lesson. See scoring guidance for assessing Biodiversity and Humans; Ecosystem Dynamics, Functioning, and Resilience; Obtaining, Evaluating, and Communicating Information; and Patterns with this question" (Teacher's Guide, page 59).

- Lesson 8: A call out box for **Cause and Effect** is included in the Stile app. "In this lesson, we are trying to define a problem and to solve it. When defining problems its helpful to think about them in terms of cause and effect. State what caused the problem, as this will help you think of solutions." However, this is not located in the Teacher's Guide document.

Suggestions for Improvement

- Consider including explicit teacher guidance and strategies for supporting students to see how their learning in all three dimensions connects to their sense-making and problem solving in both the Teacher's Guide document and the Stile app.
- Consider providing some guidance and strategies for teachers to support students in seeing how their grade-appropriate CCC and SEP learning contributes to problem solving.

II.G. SCAFFOLDED DIFFERENTIATION OVER TIME

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.

Rating for Criterion II.G. Scaffolded Differentiation Over Time	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that the materials support teachers in helping students engage in the practices as needed and gradually adjust supports over time. Although scaffolding for some SEP elements is introduced across different lessons, the scaffolding is not reduced over time in a way that would support students using the elements more independently over the course of the unit.

The learning progressions chart, page 10 of the Teacher's Guide, and the prior knowledge chart, page 15 of the Teacher's Guide, clearly state which SEP elements are used in specific lessons and whether those elements are being developed, mastered, or assessed. However, the initial scaffolding of the targeted SEP elements is unclear, and the scaffolds are not reduced gradually over time.

Some evidence includes:

Asking Questions and Defining Problems

- *Ask questions that challenge the premise(s) of an argument or the interpretation of a data set.*
  - Lesson 1: The anchoring phenomenon of the global decline in bee species diversity is introduced to students through various newspaper headlines and graphs. Students are asked to write a question that challenges the Daily News article about the bees disappearing. This is the only lesson identified where students develop knowledge of this SEP. Therefore, it is unlikely they will master this element by Lesson 5 if they don't have prior experiences with this element.
  - Lesson 5: At the end of the lesson, students apply the Claim, Evidence, Reasoning model to answer the question: Do we need to save the bees? Then, they create two questions a classmate could ask about the evidence they used to support their claim. No clear reduction in scaffolding for asking questions was located. Additionally, while unclaimed, there is no scaffolding for the use of evaluating a claim supported by evidence.

Constructing Explanations and Designing Solutions

- *Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.*
  - Lesson 10: Students learn about the structure and function of the beehive before creating a prototype design for the solution and evaluating the prototype against their chosen set of criteria.
  - Lesson 12: Students prepare presentation of designs for their final engineering showcase. No clear reduction in scaffolding for designing solutions was located.
  - Lesson 13: Students share their solutions in an engineering showcase through a gallery walk and conduct peer assessments before returning to the class DQB to reflect on questions answered and learning throughout the unit. No clear reduction in scaffolding for designing solutions was located.

Constructing Explanations and Designing Solutions

- *Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion***.**
  - Lesson 5: Although not claimed, there is evidence of scaffolding of this element in this lesson. After reviewing some examples of claims, students are walked through the Claim, Evidence, Reasoning model for writing before they practice identifying claims in various questions about biodiversity. At the end of the lesson, students apply the Claim, Evidence, Reasoning model to answer the question: Do we need to save the bees?

Engaging in Argument from Evidence

- *Evaluate competing design solutions based on jointly developed and agreed upon design criteria.*

- Lesson 8: Students are introduced to the culminating engineering design challenge to save or replace the bees. After learning about the engineering design process and defining the problem, the ideas of criteria and constraints are presented. Although students are encouraged to generate these on their own, in the student version of the lesson the criteria are listed, and students are asked to rank them in order of importance. Therefore, the expectations are contradictory, and any potential scaffolding may not be coherently applied. The constraints are given to students as well, making it difficult for teachers to gauge whether students have fully grasped these concepts.
- Lesson 9: After watching a video about the research and brainstorming phases of the engineering design process, students are asked to research existing solutions that people are using to help save the bees before creating a summary about their chosen bee species. In groups students then brainstorm and evaluate their solutions. To close the lesson, students choose the best solution. No clear reduction in scaffolding for evaluating design solutions was located.
- Lesson 13: Students share their solutions in an engineering showcase through a gallery walk and conduct peer assessments using the class-created criteria and constraints. No clear reduction in scaffolding for engaging in arguments was located.

Obtaining, Evaluating and Communicating Information

- *Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific and/or technical information to describe patterns in and/or evidence about the natural and designed world(s).*
  - Lesson 4: Students are assigned a leveled text to read and share with their group in a jigsaw type activity. The teacher notes on the Stile app state, "the least complex text is 'The business of bees' and the most complex text is 'Fewer pollinators lead to lower plant diversity.'" However, the text appears to be the same complexity, proving a Lexile level may help teachers identify the difficulty level of the text. No clear reduction in scaffolding for **Obtaining, Evaluating and Communicating Information** was located such that each student would build their proficiency and independence in this SEP element.

Suggestions for Improvement

- Consider including progressively reduced teacher scaffolds so that students can develop and demonstrate their ability to use the elements more independently or deeply by the end of the unit.
- Consider revisions which would provide teacher supports for a variety of students, with diverse needs, to assist in the building of understanding and proficiency in SEPs over time.

The Importance of Biodiversity

EQuIP RUBRIC FOR SCIENCE EVALUATION

OVERALL CATEGORY II SCORE: **2** (0, 1, 2, 3)	
Unit Scoring Guide – Category II	
Criteria A-G	
3	At least adequate evidence for all criteria in the category; extensive evidence for at least two criteria
2	Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A
1	Adequate evidence for at least three criteria in the category
0	Adequate evidence for no more than two criteria in the category

CATEGORY III

MONITORING NGSS STUDENT PROGRESS

III.A. MONITORING 3D STUDENT PERFORMANCES

III.B. FORMATIVE

III.C. SCORING GUIDANCE

III.D. UNBIASED TASK/ITEMS

III.E. COHERENT ASSESSMENT SYSTEM

III.F. OPPORTUNITY TO LEARN

III.A. MONITORING 3D STUDENT PERFORMANCES

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.

Rating for Criterion III.A. Monitoring 3D Student Performances	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that the materials elicit direct, observable evidence of students using practices with core ideas and crosscutting concepts to make sense of phenomena or design solutions. Students produce artifacts that require them to use more than one dimension in service of problem solving or sense-making. However, not all targeted learning is assessed.

Some evidence includes:

- Lesson 2, Question 8: Students are asked to write an explanation for how biodiversity would be affected if all bees other than squash bees were removed from an ecosystem. As they do so, students most likely use portions of elements from **LS2.C Ecosystem Dynamics, Functioning, and Resilience (DCI),** along with an unclaimed element from **Constructing Explanations and Designing Solutions (SEP)**. Although elements from **Obtaining, Evaluating, and Communicating Information** and **Patterns** are claimed in this key question, there is no evidence that all students will use these elements in their explanations.
- Lesson 3, Question 8: After having completed a simulation about pollination and its effects on Farmer Camilla's garden ecosystem, students are asked to "explain how changes in the wildflower population affect the biodiversity of an ecosystem and the availability of food humans rely on." As they respond to this prompt, students use elements from **LS4.D Biodiversity and Humans (DCI)** along with elements from **Developing and Using Models (SEP)**, and an unclaimed element of **Constructing Explanations and Designing Solutions (SEP).** Although an element from **Stability and Change** is also claimed in this key question, it is likely that many students will not use the element in their explanations and those that do may do so implicitly.
- Lesson 4, Question 8: After reading passages of scientific texts, students are asked to "Explain the relationship between bees and biodiversity. What makes bees so important to humans? *Hint: For this question, you will need to use patterns in data. Summarize the scientific texts to show your understanding of why biodiversity is so important to us.*" As they respond to the prompt, they use elements from **LS4.D Biodiversity and Humans (DCI)** along with elements from **Obtaining, Evaluating, and Communicating Information (SEP)** and **Patterns (CCC).**
- Lesson 5, Question 8: Students are asked to propose a claim to answer the question, "Do we need to save the bees?". As they do so, students use elements from **LS4.D Biodiversity and Humans (DCI)** along with an unclaimed 3–5 element of **Engaging in Argument from Evidence (SEP)** which is supported by the claimed element from **Obtaining, Evaluating, and**

Communicating Information (SEP). While an element of **Patterns (CCC)** is claimed in this key question, it is likely that many students will not use element in their explanations and those that do may do so implicitly.

- Lesson 6, Question 7: Students are asked to generate a written explanation that discusses how human activities have affected honeybee populations. Students are explicitly told to use evidence from graphs to explain "how these changes have affected the stability of all populations in the ecosystem." As they do so, students use elements from **LS2.C Ecosystem Dynamics, Functioning, and Resilience (DCI), Analyzing and Interpreting Data (SEP),** and **Stability and Change (CCC)**. Students also implicitly use elements from **Patterns.**
- Lesson 7, Question 6: After interacting with a simulation, students are asked to "**Explain** your strategy for maintaining the stability of bee, wildflower, and crop populations as the city expanded. In your response, refer to the reasons why your strategy was necessary. Use specific examples from the model to support your answer." As they do so, students most likely use an element from **LS2.C Ecosystem Dynamics, Functioning, and Resilience (DCI)** along with an unclaimed element of **Obtaining, Evaluating, and Communicating Information (SEP)** along with an element of **Stability and Change (CCC)**.
- Lesson 9, Question 8: Students participate in the engineering design process to save or replace their chosen bee. Then they justify which idea they want to design based on the criteria and constraints their chosen solution meets. As they do so, students most likely use an element from **LS2.C Ecosystem Dynamics, Functioning, and Resilience (DCI)** and/or **LS4.D Biodiversity and Humans (DCI)** along with a 3–5 element of **Engaging in Argument from Evidence (SEP)** and **Stability and Change (CCC).**
- Lesson 11, Question 5: Students are asked to self-assess their design solution using a rubric of established criteria and constraints. Students who meet the highest level of expectation for all categories on the rubric will use elements from **LS4.D Biodiversity and Humans (DCI),** along with elements from **Constructing Explanations and Designing Solutions (SEP)** and an unclaimed element of **Stability and Change (CCC).** Students who score at lower levels on the rubric will not be meeting grade level expectations of these dimensions. Additionally, students may be using an element of **Structure and Function** but will most likely be doing so implicitly.
- Lesson 12, Question 2: Students are asked to generate a presentation to accompany their design solution. As they do so, they are using an element of **Obtaining, Evaluating, and Communicating Information** (SEP) along with an element from **LS2.C Ecosystem Dynamics, Functioning, and Resilience (DCI)** and/or **LS4.D Biodiversity and Humans (DCI)** and possibly an element from **Structure and Function (CCC)** and/or an unclaimed element from **Stability and Change (CCC).** Although there is a claimed element from **Constructing Explanations and Designing Solutions** it is most likely not being used by students in this lesson.

Formal assessment tasks in the materials are driven by phenomena and sometimes require students to use three dimensions at a grade-appropriate level. However, they are not as effective as they could be. For example, there are two check-ins in the unit that consist of multiple choice and fill in the blank questions. However, these check-ins are very short, and the scenarios and graphs presented are very

similar to the lessons; therefore, students are not likely to show true sense-making through these scenarios.

Suggestions for Improvement

Consider either adding in opportunities through which students can show an understanding of all targeted learning or making revisions to reduce the assessment claims, addressing the mismatch between what is claimed and what students do in the lessons.

III.B. FORMATIVE

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

Rating for Criterion III.B. Formative	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that the materials embed formative assessment processes throughout that evaluate student learning and inform instruction. Formative assessment opportunities are present and identified, and guidance for what to look for in student responses and how to modify instruction is provided. However, these identified assessments are not embedded instructional tasks but are separate "assessment events" with limited opportunities for students to share their thinking in a manner other than responding to a written question, meaning that not all students might have an equitable opportunity to share their thinking.

Some evidence includes:

- Teacher's Guide, page 24, establishes that each lesson contains one or more "key questions" that teachers can use as formative assessment opportunities. Each "key question" includes a model answer along with "Suggestions for supporting students to build toward the model answer" in the Teacher's Guide.
- On pages 76–78 of the Teacher's Guide, some formative assessment guidance for Check-In #1 is provided, including specific strategies for supporting students.
- On pages 120–122 of the Teacher's Guide, some formative assessment guidance for Check-In #2 is provided, including specific strategies for supporting students.

Suggestions for Improvement

Consider adding additional opportunities within formative assessments that allow multiple ways for students to demonstrate their thinking to attend to students' individual levels and needs.

III.C. SCORING GUIDANCE

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.

Rating for Criterion III.C. Scoring Guidance	Extensive *(None, Inadequate, Adequate, Extensive)*

The reviewers found extensive evidence that the materials include aligned rubrics and scoring guidelines that help the teacher interpret student performance for all three dimensions. Scoring guidance to interpret student progress in relation to the learning targets is included. However, students are not supported to track their own progress towards learning expectations.

Some evidence includes:

- In the Teacher's Guide, an exemplar answer is provided for a key question(s) in each lesson in the unit.
- In the Teacher's Guide, a rubric is provided for the key question(s) found in each lesson. This rubric identifies the targeted elements assessed and provides scoring guidance for both a model answer and those that answers that are still "building towards model answer." However, in Lesson 2, Page 61, feedback is only provided for two of the three dimensions claimed as targets.
- In the Teacher's Guide, scoring guidance is provided for each question in the Check-In(s). This guidance includes identifying which dimension(s) is being assessed in each question using a color-coding system. Additionally, teacher guidance ("advice") is provided to "support students in reaching an at-level response".
- Summative assessment: The materials provide an standards alignment overview document. However, the specific dimensions claimed to be covered by the multiple questions in the assessment were not located. A rubric for each short answer question is provided that includes student responses linked to explicit elements. In addition, guidance on how to interpret the responses relative to the integration of dimensions and sense-making were located. An explanation for responses above, at, and below level are included.
- On pages 76–78 of the Teacher's Guide, some scoring guidance for Check-In #1 is provided, including:
    - Page 76: Elements (or portions of elements) being assessed for each dimension are identified. Additionally, CCSS elements, if assessed, are identified.
    - Pages 77–78: The specific element(s), or portions thereof, are identified.
- On pages 120–122 of the Teacher's Guide, some scoring guidance for Check-In #2 is provided, including:
    - Page 120: Elements (or portions of elements) being assessed for each dimension are identified. Additionally, CCSS elements, if assessed, are identified.

- Pages 121–122: The specific element(s), or portions thereof, are identified.

Suggestions for Improvement

- Consider revisions that would support students in interpreting their own progress towards mastery of the targeted elements and the learning performance.
- Consider revisions to the Key Question rubrics to align with the three-dimensional tasks that students are engaging with.

III.D. UNBIASED TASK/ITEMS

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

Rating for Criterion III.D. Unbiased Task/Items	Extensive *(None, Inadequate, Adequate, Extensive)*

The reviewers found extensive evidence that the materials assess student proficiency using accessible and unbiased methods, vocabulary, representations, and examples. The unit offers opportunities that measure student learning in a variety of ways. Over the course of the unit students write, discuss, and verbally present. However, students have few opportunities to respond with a modality of choice.

Related evidence includes:

- Multiple lessons throughout the unit feature videos with Closed Captioning.
- Students are given an appropriate amount of text in their tasks and the items are grade appropriate.
- When suggestions for "alternative means of expression" are provided, they suggest that students who may struggle with written expression could be provided with "open response" questions. However, this suggestion is found in the differentiation document on pages 26–27 of the Teacher's Guide and might not actually be used as an opportunity of choice by students.

Suggestions for Improvement

- Consider incorporating reminders for educators to offer students a choice of modality (e.g., oral, written, gestures, drawing) during assessment opportunities.
- Consider providing scaffolding and support guidance to teachers so that they can support students as they engage with the tasks.

III.E. COHERENT ASSESSMENT SYSTEM

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

Rating for Criterion III.E. Coherent Assessment System	Adequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found adequate evidence that the materials include pre-, formative, summative, and self-assessment measures that assess three-dimensional learning. Pre-, formative, summative, and self-assessment types are included in the unit, and the materials provide guidance for how assessments can be used to support students in meeting three-dimensional learning goals. However, the materials do not explain how the different assessment types work together to provide a coherent assessment system.

While multiple examples of each type occur during the unit, evidence of at least one example of each type is provided below.

Pre-Assessment:

- The Teacher's Guide includes a pre-test table that illustrates where each claimed element for the unit is assessed in the pre-test and provides scoring guidance for student answers. This includes at level and below level responses. In addition to this, suggestions are included for teachers to support students in developing what the materials identify as "required prior knowledge" (pages 43–45), which indicates that the knowledge isn't required prior to the unit. The suggestions for support could be used to help students meet the targeted claims and are not referencing prior knowledge that students will need to begin building towards these targets.

Formative Assessment:

- There are key questions in each lesson that are aligned to elements students are expected to develop or use within that lesson. The Teacher's Guide states, "Key Questions are accompanied by a model answer, as well as a rubric to support assessing student learning. Based upon how students perform against the criteria within the rubric, there are targeted suggestions for how you can support continued student learning within each dimension" (page 24).
- See additional evidence under Criterion III.B of this document.

Summative Assessment:

- A summative assessment is included in the materials. On page 180 of the Teacher's Guide, a standards alignment document is provided for the summative assessment. A rubric for each short answer question is provided that includes student responses linked to explicit elements,

and guidance on how to interpret the responses relative to the integration of sense-making was located. An explanation for responses above, at, and below level are included.

Self-Assessment:

- The teacher is told that the student learning journal "is a place for students to record reflections, wonderings and questions throughout the unit. Students will be asked to contribute to it regularly as a way of capturing their learning from individual lessons and from the unit as a whole. The learning journal is structured as a graphic organizer and includes prompts and examples as scaffolding from which students can develop their ideas" (Teacher's Guide, page 20).
- Lesson 10: Students evaluate their design structure and function to meet the design task's criteria and constraints through a self-assessment.

Suggestions for Improvement

The Lesson 10 Self-Assessment exercise is very valuable to student learning. Consider adding in more opportunities for self-assessment throughout the unit.

III.F. OPPORTUNITY TO LEARN	
Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback.	
Rating for Criterion III.F. Opportunity to Learn	Inadequate *(None, Inadequate, Adequate, Extensive)*

The reviewers found inadequate evidence that the materials provide multiple opportunities for students to demonstrate performance of practices connected with their understanding of core ideas and crosscutting concepts. Although there are multiple opportunities for students to show their learning, there are minimal peer or teacher feedback loops present through which students have opportunities to receive feedback, reflect on that learning, and reapply their understandings for growth.

While there are "Suggestions for Support" provided in the Teacher's Guide for each key question in each lesson, there is no guidance for how teachers can alter instruction to allow students to use these suggestions to revise their thinking. See related evidence in Criterion II.B. This results in no formal opportunity for feedback loops through which students can improve their performance.

Students receive some possible written and oral feedback from the teacher multiple times throughout the unit. However, they are not explicitly prompted to reflect on it. Each lesson contains a "key question" that assesses multidimensional elements. The Teacher's Guide provides a model answer and suggestions to help students get to the model answer. However, there are no explicit instructions that ensure this feedback will be provided to students or that students will then have an opportunity to reflect upon it and revise their ideas.

Students receive some written and oral feedback from their peers in unit. However, they are not explicitly prompted to reflect on it. For example:

- In Lesson 5, students are asked to pair up and ask questions that could challenge their partner's claim. However, there is no evidence that students will use that feedback to revise their claim.
- In Lesson 13, students use the provided rubric to evaluate another group's design. Although students receive feedback from their peers, it takes place in Lesson 13, the very last lesson of the unit. Therefore, students are less likely to grow in their understanding of the concept during the unit.

Multiple opportunities are provided for student performance of **Constructing Explanations and Designing Solutions** in connection with the DCIs and CCCs.

Related evidence includes:

- Lesson 10: Students learn about the structure and function of the beehive before creating a prototype design for the solution and evaluating the prototype against their chosen set of criteria.
- Lesson 11: Students look at both the criteria and constraints through self-assessment before improving on their designs.
- Lesson 12: Students prepare presentation of designs for their final engineering showcase.
- Lesson 13: Students share their solutions in an engineering showcase through a gallery walk and conduct peer assessments before returning to the class DQB to reflect on questions answered and learning throughout the unit.

Suggestions for Improvement

- Consider providing additional opportunities for peer written and oral feedback earlier in the unit. Supports for formal written feedback from the teacher and for students to use the feedback to revise their explanations and models before the final lesson would be very beneficial.
- Consider providing opportunities for students to show their new thinking as a response to feedback they have received from their teachers or peers.

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EQuIP RUBRIC FOR SCIENCE EVALUATION

OVERALL CATEGORY III SCORE: **2** (0, 1, 2, 3)	
Unit Scoring Guide – Category III	
Criteria A-F	
3	At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion
2	Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A
1	Adequate evidence for at least three criteria in the category
0	Adequate evidence for no more than two criteria in the category

SCORING GUIDES

SCORING GUIDES FOR EACH CATEGORY

UNIT SCORING GUIDE – CATEGORY I (CRITERIA A-F)

UNIT SCORING GUIDE – CATEGORY II (CRITERIA A-G)

UNIT SCORING GUIDE – CATEGORY III (CRITERIA A-F)

OVERALL SCORING GUIDE

Scoring Guides for Each Category

Unit Scoring Guide – Category I (Criteria A-F)	
3	At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C
2	At least some evidence for all unit criteria in Category I (A–F); adequate evidence for criteria A–C
1	Adequate evidence for some criteria in Category I, but inadequate/no evidence for at least one criterion A–C
0	Inadequate (or no) evidence to meet any criteria in Category I (A–F)

Unit Scoring Guide – Category II (Criteria A-G)	
3	At least adequate evidence for all criteria in the category; extensive evidence for at least two criteria
2	Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A
1	Adequate evidence for at least three criteria in the category
0	Adequate evidence for no more than two criteria in the category

Unit Scoring Guide – Category III (Criteria A-F)	
3	At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion
2	Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A
1	Adequate evidence for at least three criteria in the category
0	Adequate evidence for no more than two criteria in the category

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EQuIP RUBRIC FOR SCIENCE EVALUATION

OVERALL SCORING GUIDE	
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)