From Sun to Food
EQuIP Rubric for Science Evaluation

Unit Name: MySci: From Sun to Food
Grade: 5th
Date of Review: February 2019
Overall Rating (N, R, E/I, E): E
Category I: NGSS 3D Design Score (0, 1, 2, 3): 3
Category II: NGSS Instructional Supports Score (0, 1, 2, 3): 3
Category III: Monitoring NGSS Student Progress Score (0, 1, 2, 3): 2
Total Score (0-9): 8
Click here to see scoring guidelines

This review was conducted by the Science Peer Review Panel using the EQuIP Rubric for Science.

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

Summary Comments

The reviewers commend the authors of this unit for creating such an engaging and coherent set of lessons. The authors of this unit "From Sun to Food" have provided a variety of different learning opportunities that give students the opportunity to integrate the three dimensions. The phenomenon of "We eat pizza made of many ingredients. How has this pizza been made?" is made sense of by students when they draw a model of their pizza farm and revise throughout the lesson. They then focus on designing a farm that minimally harms the environment. The storyline of the pizza farm pulls together the learning well in all four sections of this unit.

This unit is well supported with a variety of ways to integrate Common Core State Standards and provides resources that support the application of those standards. The progression of learning builds in rigor and complexity as students apply their understanding of the science to engineer a farm with the capacity to produce ingredients for pizza with the constraints of environmental considerations.

While this unit has several strengths, the reviewers identified several areas of improvement, particularly in Category III. While exemplars are provided, a user of this unit may need to modify to clearly define the range of acceptable work for students. Additionally, while there are plenty of opportunities for multiple types of assessment, this unit would be strengthened with more teacher support for identifying what student learning is being measured and how a teacher might adjust instruction based on that information.

Category I. NGSS 3D Design

Score: 3

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: Extensive

(None, Inadequate, Adequate, Extensive)

The reviewers found extensive evidence that learning is driven by students making sense of phenomena and designing solutions to a problem because each section of the unit revisits phenomena and supports the students in making sense of where the ingredients of pizzas come from. Students spend considerable time revisiting the ideas in each investigation and life sciences ideas such as food chains, energy cycling, and processes within ecosystems.

In Section 1: Curriculum, the Storyline describes that the unit is driven by the anchoring phenomenon stated in Lesson 1 as "We eat pizza made of many ingredients. How has this pizza been made?" Students then draw a model of their pizza farm. This model is refined lessons 1-9 (Evaluate section of the lesson plan in the Curriculum Guides 1-3) as students engage in scientific explorations that result in more in-depth understandings of the phenomena related to this anchoring phenomenon.

Students return to the phenomenon multiple times over the course of the unit to add layers of explanation based on learning from each investigation. After the phenomenon is introduced in Lesson 1, it is revisited in several places, including the Elaborate phase of Lesson 2, Elaborate phase of Lesson 3, and Evaluate phase of Lesson 4. Each lesson has a section where the phenomena is revisited applying newly acquired learning to their farm models and allowing student understanding to be applied.

Engineering is a learning focus (Lessons 10 and 11 from Section 4) and is integrated with disciplinary core ideas from physical science, PS3.D Energy in Chemical Processes and Everyday Life and life science, LS1.C Organization for Matter and Energy Flow in Organisms, LS2.A Interdependent Relationships in Ecosystems and LS2.B Cycles of Matter and Energy Transfer in Ecosystems.

- In Lesson 11, students apply what they learned as they developed and refined their Pizza Farm model in lessons 1-9 to design a farm that minimally harms the environment.
- In Lesson 10, students apply what they have learned to improve and protect their school environment.
- Possible problems that students might seek to solve based on awareness and learning from this unit are "lack of recycling/ineffective recycling programs, food waste, paper waste, lack of green space/native /vegetable garden, a garden that has been struggling or something else that students come up with" (page 5 Section 4: Curriculum).

Sense making for students is a driving factor in this unit with multiple opportunities to develop and ask questions and revise ideas to incorporate new learning.

Suggestions for Improvement
N/A

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: Extensive
(None, Inadequate, Adequate, Extensive)

The reviewers found extensive evidence that the materials give students opportunities to build understanding of grade-appropriate elements of the three dimensions.

Science and Engineering Practices (SEPs): Extensive
The reviewers found extensive evidence that students have the opportunity to use or develop the SEPs in this unit.

Developing and Using Models
Grade 3-5 Element: Develop and/or use models to describe and/or predict phenomena.

This unit is premised on students developing a model of a pizza farm in lesson 1 and then revisiting and refining that model with each lesson up through lesson 9. This model then is a springboard for students to develop a model of pizza farm that minimally harm the environment. In developing this pizza farm, student refine it to include what plants need to grow (lessons 2, 3), photosynthesis (lesson 6) and energy transfer (lesson 8) and cycling of materials (lessons 4 and 9).

The developers also identify the Energy Diagram for Pizza as another model, which is pre-designed, but students use a word bank to complete the diagram. Students apply what they learn from this activity, when they develop models of food chains and food webs within a Missouri Pond (Elaborate page 7 Section 3: Curriculum).

Another model identified by the developers is the photosynthesis game in the NGSS MLS document (Lesson 6). Students use a model that is given to them to understand the process of photosynthesis, which they then describe in their Student Journals on page 16.

Other examples found by reviewers include:

- Page 3, with the addition of arrows to show the flow of how energy and matter move on the farm; This model is revisited throughout the lessons (e.g., they revisit the model in Lesson 3 after they learn about air, light, and water)
- Page 10-11, students create a model playing the Photosynthesis Game

- Lesson 4, page 17, the students revisit the model to include what they have learned in this lesson (e.g., that dead plants and animals break down and they matter becomes part of the soil)
- On page 19 - "I Am What I Eat" flowchart: This example is already formatted for students who complete the flowchart by filling in vocabulary, which is not really asking students to create the model or use it to explain phenomena.
- Page 21, where students can also use a model to communicate their argument regarding Decomposition and if there were no decomposers in an ecosystem. This is the best evidence for this SEP, which asks students to use the model to explain their phenomena.

Plan and Carry Out Investigations
Grade 3-5 Element: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

There are multiple examples of students being asked what new questions they have (e.g., Section 3, Lesson 8 Evaluate, Section 3 Lesson 9 Evaluate).

One below-grade-level example can be found in Lesson 2, in which students are given instructions about an investigation that is already planned. The sprouter is set up and the type and quantity of beans are handed to students. They are given explicit directions about what data to collect and how to calculate the measurements.

Lesson 2 also includes an investigation regarding how plant increase in mass; however, students do not plan the investigation nor are there opportunities to discuss the variables or number of trials. Students are asked on page 7 of the student journal, "What other investigations would you like to do to further investigate your claim about what causes plant matter to increase?" This may be part of getting to "collaborative" part of this element.

Evidence of students using the element can be seen in Lessons 3 and 4, beans under different conditions, and decaying leaves. Specifically:

- In Lesson 3, the class discusses variables related to an experiment where beans will be grown under different conditions. Students compare plant growth under a variety of conditions, water, air, and light.
- In Lesson 4, page 15, students plan an investigation to observe plant materials in water, soil, and other plant materials (Students journal page 12) to see what happens to dead plant material. And it is evident in the discussion on page 22 of the Teacher Pages when the class talks about the variables to keep the same such as the amount and type of plant material, etc.

Plan and Carry Out Investigations
Grade 3-5 element: Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

Students use and develop this element in Lesson 2 and Lesson 3 with the attention to predictions and patterns. For example, in Lesson 2, students consider the massing of the dry seeds and then the wet seeds to provide evidence about where the plant's mass comes from as it grows.

Asking Questions and Defining Problems
Grade 3-5 Element: Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause-and-effect relationships

Students have multiple opportunities to engage with this practice; however, the "predict reasonable outcomes based on patterns" part of the element is not explicit in many of the opportunities to question. For example,

- Multiple examples of students being asked what new questions they have (e.g., Section 3, Lesson 8 Evaluate, Section 3 Lesson 9 Evaluate).
- In Lesson 1, page 5, students add questions to a chart produced in class in the Explore and Explain phases. Students ask questions about eating pizza, where the ingredients for pizza come from, and what happens to the pizza after you eat it. These questions frame the unit and the answers will be investigated in a variety of ways throughout the unit.
- In Lesson 2, page 10, students ask questions about the type of food that grows from their experience in the Explain section.

Asking Questions and Defining Problems
Grade 3-5 Elements: Use prior knowledge to describe problems that can be solved; 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~~.

Students partially use and develop these elements. In Lesson 10, students explore the school environment to document how the school uses its resources. Then students work in small groups to ask a question or choose a problem for which they would like to develop a solution. In Lesson 11, in which they develop a question to investigate and record it in Student Journal, page 22. They can then make predictions based on learning from the unit. The part of the element not addressed may be included in the Extend portion of the lesson on page 6 of Section 4, where students implement their solution and there is some consideration of cost and time.

Engaging in Argument from Evidence
Grade 3-5 Element: Construct and/or support an argument with evidence, data and/or a model

Examples of students using this element include:

- On page 11 of the Student Science Journal, students "argue" using evidence from their experiment about where plants get matter they need to grow. It asks students to describe how their thinking has changed as a result of class experiments and discussions and asks for evidence from the experiments in their response.
- Students also argue what might happen if there were no decomposers (page 21 Student Science Journal, titled Decomposition) using evidence from their experiments on dead plant material as well as on the book, *A Log's Life*
- Students also use this element on page 6 in the Elaborate phase of Lesson 10, and on student page 7 when asked about the change in mass in the sprouts.

Analyzing and Interpreting Data
Grade 3-5 Element: Represent data in graphical displays, (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships

Partial or below-grade-level examples include:

- On Student page 10, Lesson 2, the Bean Data Collection sheet, students graph the stem length over time. Students calculate total mass change (Day 5-Day 1): “After students calculate total mass change for each of the seed types, allow them to work in groups to answer the analysis questions after the data table.”
- On student page 13, the Evaluate section asks students to use data to answer the question, “What is the relationship between dead plants and soil?” This data comes from a table that has been completed (see student page 12), so students themselves were not representing data.

Analyzing and Interpreting Data
Grade 3-5 element: *Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computations*

Students use this element when they interpret their data table for the experiments that they run in Lessons 2, 3, and 4 (See Student Science Journal pages 6-10 and pages 12-13)

Analyzing and Interpreting Data
Grade 3-5 element: *compare and contrast data collected by different groups in order to discuss similarities and differences in their findings*

Students use this element in Lesson 4 when each groups of students tested dead plant material under a different set of conditions.

Obtaining, Evaluating, and Communicating Information
Grade 3-5 Element: Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem

This unit has many supporting materials such as the books and online resources.

- In Lesson 6, students obtain and combine information from the playing the photosynthesis game, from watching a video and from reading the book *Photosynthesis: Changing Sunlight into Food* (page 8 Section 2: Curriculum).
- In Lesson 7, students combine information from an exercise activity, with a reading from the book Living *Sunlight: How Plants Bring the Earth to Life* and later in the lesson combine this learning with the Forest Slide Show (page 5 Section 3: Curriculum).
- In lesson 9 students obtain and combine information from the experiment that they did in lesson 4 with videos on decomposition with the book *A Log’s Life*.

Disciplinary Core Ideas (DCIs): Extensive
There is extensive evidence that this unit provides opportunities to develop and use specific elements of the DCIs. Nine DCIs are listed in the unit, although the performance expectations explicitly link to the following DCIs:

PS3.D Energy in Chemical Processes and Everyday Life
Element: the energy released from food was once energy from the Sun that was captured by plants in the chemical process that forms plant matter from air and water
Examples:

- The photosynthesis game could be a model of this element description.
- Teacher page 15, Read Aloud Guide: Living Sunlight, is support for this element.

- Lesson 6 is the photosynthesis game where students use ping pong balls to model how water, carbon dioxide, and sunlight make sugar.
- Lesson 8 is where students study food chains, starting with the sun.
- Evidence can be also found for this DCI in Lessons 1 and 7

LS1.C Organization for Matter and Energy Flow in Organisms
Element: Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion; Plants acquire their material for growth chiefly from air and water
Examples:

- Students watch a video that supports the idea that food gives animals energy, although not explicitly linked to warmth and growth.
- Lesson 2, page 10, after the sprout lab, the students support an argument that plants get the materials they need for growth chiefly from air and water
- Evidence can also be found for this DCI in the he read aloud Guide on Teacher page 13 for Photosynthesis and Lessons 2, 3, 5 and 6.

LS2.A Interdependent Relationships in Ecosystems
Element: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.
Examples:

- Student page 17 where students are asked, “What do living things get from plants?” (*Note: may want to adjust to “What do animals get from plants?” for clarity.*)
- Student page 18, Energy Diagram for Pizza
- Student page 19, I Am What I Eat Flow Chart,
- Several texts including Pass the Energy, Please!, Living Sunlight, A Log’s Life, etc.
- Teacher page 23 titled Decomposition asks students what might happen if there were no decomposers in an ecosystem.
- Additional evidence can be found in Lessons 1, 7, 8 and 9.

LS2.B Cycles of Matter and Energy Transfer in Ecosystems
Element: Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.
Examples:

- Several texts support the idea of cycling matter and energy including Pass the Energy, Please! (Teacher page 18), Living Sunlight (Teacher page 15), and Log’s Life (Teacher page 27).
- Students create and use models that support this DCI including: Photosynthesis Game (Teacher page 10), and the Pizza Farm model (Teacher page 3), which is revised by students as their ideas evolve.
- Additional evidence can be found in Lesson 1, 7 and 8.

There is evidence for one other DCI not identified by the unit: **PS1.A: Structure and Properties of Matter**
Grade 3-5 element: The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.

One example of students using this element is in Lesson 9, where students describe what happened to the matter of a tree that has died and seemingly "disappeared" due to decomposition.

Crosscutting Concepts (CCCs): Extensive
There is extensive evidence that this unit provides opportunities to develop and use specific elements of the CCCs because of the unit's strong use of Systems and System Models. While the reviewers saw evidence that students used System and System Models, Structure and Function, Cause and Effect, Scale Proportion and Quantity in service of making sense of phenomenon, some of the other CCCs were used in a more marginal way.

Structures and Function

Lesson 5, page 5, the students learn the structure and function of a stem by observing a video on a celery stalk experiment or the review suggests that they can complete the experiment in class. The students will learn that plant have this tubing system called 'Vascular plants

Patterns
3-5 Element: Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products.

The reviewers did not see evidence for this element. Student journal on pages 7 and 10 ask students to describe the patterns they notice. In order to fully address this element, if students notice a pattern that is important to understanding the DCI, then that pattern should be used to communicate and/or analyze the change in the mass of the spouts for example. Currently the unit only requests students to notice a pattern.

Systems and System Models
Grade 3-5 element: A system can be described in terms of its components and their interactions.
This crosscutting concept is the essence of the unit. For example:

- This CCC is carried throughout the unit with the referencing of the "system" of the Pizza Farm. Students talk about their pizza farm and its components, the plants and the animals, the source of the ingredients for the pizza. Students discuss the way plants interact with water, air and sunlight to grow, as well as how the plants interact the animals to provide them with energy, and they discuss how dead plants interact with environment to decompose. See evidence for multiple opportunities in Lesson 1, Lesson 5, Lesson 10 and Lesson 11.
- On Student Page 3, with the addition of arrows to show the flow of how energy and matter move on the farm. The addition of the arrows appears to represent the interactions.
- In Lesson 8, the students describe how energy moves through a food chain (student workbook page 19).

Systems and System Models
Grade 3-5 element: A system is a group of related parts that make up a whole and can carry out functions that its individual parts cannot.

Examples of evidence:

- This element is evident in Lesson 5, when students talk a about the plant being a system made of different parts such as the flower, fruit, stem, roots and leaves (page 15 Student Science Journal).

Energy and Matter: Flows, Cycles, and Conservation
Grade 3-5 Element: Energy can be transferred ~~in various ways~~ and between objects.

The reviewers found evidence that this element is partially addressed. The emphasis in this unit is on the transfer of energy and not the various ways energy is transferred between objects (e.g., How does the sun's energy get to the plant? How does the plant's energy provide a person energy?).

Flows, cycles, and investigation are central to this entire unit and specifically addressed with:

- Photosynthesis (Lesson 6) - In Lesson 6, teacher page 7, students learned that the process of photosynthesis involves energy (sunlight) and small particles that move in to the plant, and the plants use energy to change air and water into their own matter.
- Food Chains (Lesson 8) - In this lesson, "students add arrows to their diagram to show the flow of energy form the sun to Carlos." (Carlos is making and eating a pizza.) Students also trace the flow of energy in Missouri Pond. Pages 18, 19, and 20 are all ways in which students document the various ways energy is transferred and between objects.

Energy and Matter: Flows, Cycles, and Conservation
Grade 3-5 Element: Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems.
For example:

- Sprouter investigation (Lesson 2) - Students measure the weight of the dry beans before and after water has been added to the beans. As the beans are sprouting, students measure the weight of the seeds with the tray before rinsing and after the water has been drained. This procedure is being followed to show that the water is being transported into the seeds in this system of the bean sprouter. The goal is to show that in a system that supports plant growth the observed increased mass of the sprouting plant is not coming from soil but from water (and air). Lesson 2 is followed up by Lesson 3, where students grow beans in a closed system (the plant within a plastic bag) to establish the materials that are needed to be transported into a plant for a plant to grow.)
  Decomposition (Lesson 4 and Lesson 9) - In Lesson 4, students set up an experiment to test the decomposition of plant materials under different conditions. And in Lesson 9 evaluate the results of that experiment and along with additional learning, realize that dead plants become matter that is transported into the system of the soil.

- Photosynthesis (Lesson 6) - This is also addressed in Lesson 6, where students "build glucose" within the system by rearranging water and carbon dioxide molecules (ping pong balls) by that have been transported into the plant system. (The concept of the plant as a system is established in Lesson 5.)

Other CCC opportunities identified for this unit include:

Cause and Effect: **Mechanism and Prediction**
Element: Cause and effect relationships are routinely identified, tested, and used to explain change.
For example:

- In Lesson 2, students predict and test what effect adding water will have on the beans. Students then determine what causes the bean sprouts to change in mass.
- In Lesson 7 on why plants are important, students explore what caused the changes in the world map forests from 1990 to 2015. Page 17 of the student journal may have students consider what they think caused the change, which could identify a change or identify an effect or consequence of the change.

Scale, Proportion, and Quantity
Element: *Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume*.
For example:

- In Lesson 2, length and mass (weight) measurements are made in the sprouter and bean investigations
- In Lesson 3, students use standard units to measure length of root stems and roots
- In Lesson 9 and 11, there are calculations of total kilocalories produced by the farms which students design.

Suggestions for Improvement
SEPs
It may be helpful to make clear to teachers that identifying independent and dependent variables is helping to partially develop a middle school level element of **Planning and Carrying out Investigations** so they know it's beyond the 3-5 grade band expectation.

CCCs
To strengthen the use of CCCs in this unit, the CCCs must be used in service of making sense of the phenomenon. This is done mostly with Systems and System Models, but the unit would benefit from more meaningful uses of other CCCs. For example, simply asking students what patterns they notice is a good first step, but may not be sufficient for facilitating sensemaking using **Patterns**.

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: Extensive
(None, Inadequate, Adequate, Extensive)

The reviewers found extensive evidence that student performances integrate elements of the three dimensions in service of figuring out phenomena and/or designing solutions to problems. The authors have done a good job of integrating multiple SEPS and CCCs with the DCIs so that students can design a farm with minimal impact on the environment. The developer has a framework that shows how the three dimensions are connected towards the back of the Teacher Resource book. Also, each lesson discusses the SEPs and CCCs.

The driving questions related to phenomena that students make sense of include:

- where do ingredients that make up pizza come from?
- how do plants that provide some of the ingredients take sun's energy, water and carbon dioxide and make food?
- What are the food chains associated with humans eating pizza? (Note this is not precisely the phenomena identified by the authors. See section A).

Here are several examples related to the overall unit phenomenon of designing a pizza farm:

- In Lesson 1, students *develop* an initial model (SEP) of their pizza farm to *predict* (Cause and Effect CCC) how energy and matter (DCI) move through the farm. The movement of energy and matter brings in the CCC of Energy and Matter (element: *energy can be transferred in various ways and between objects*.) This CCC and the SEP of modeling is integrated with the DCI LS2.B Cycles of Matter and Energy Transfer in Ecosystems. Furthermore, the farm is a system, which addresses the element of System and System models- *a system can be described in terms of its components and their interactions*.
- In Lesson 2 (Section 1 Curriculum page 15), Lesson 3 (Section 1 Curriculum page 19), and Lesson 5 (Section 2 Curriculum page 9), students return and revise their initial model (SEP) each time adding more details. The new learning represented in the revised models uses this element of DCI LS1.C *plants acquire their material for growth chiefly from air and water* and addresses the element of CCC of energy and matter that addresses conservation of matter and the how matter is transported into, out of and within systems. In Lesson 9 (Section 3: Curriculum p. 16) Students again revise their model (SEP) still addressing the CCC Energy and Matter and the DCI of LS2.B Cycles of Matter and Energy Transfer in Ecosystems.
- In a design challenge in Lesson 11 (Section 4: Curriculum pages 10-12), students redesign their pizza farms continuing to use the SEP of modeling but now also employing SEP of Using Mathematics and Computational Thinking to demonstrate an understanding of the core ideas in DCI ESS3.C.

Here's an example of a lesson-level activity:

- On page 11 of the Student Science Journal, students are using Engaging in Argument From Evidence (SEP), Cause and Effect (CCC), and PS1. A: Structure and Properties of Matter (DCIs). They "argue" using evidence from their bean sprout experiment about where plants get matter they need to grow. It asks students to describe how their thinking has changed as a result of class experiments and discussions and asks for evidence from the experiments in their response.

Suggestions for Improvement

N/A

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 Engage Section of every lesson started with questioning. Typically, students are asked a question that involves reviewing knowledge specifically from the previous lesson (noted in Lessons 3, 4, 5) or lessons before that (Lesson 9, 10, 11) to set the groundwork for the current lesson's exploration. Coherence is achieved by students continually coming back to the pizza farm and refining their model of the farm based on the learning from the lesson that they have just completed. The pizza farm then is the springboard for the "design challenge" in Lesson 11.

Suggestions for Improvement
As mentioned in Criterion I.B, consider increasing opportunities for students to develop their own questions rather than relying on teacher-developed questions.

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 the science domains when appropriate because the performance expectations come from Life Science, Earth and Space Science, Physical Science (referencing DCIs LS1.C, LS2.A, LS2.B, ESS3.C, LS1.C, PS3.D, ETS1.A, and ETS1.B). The links are made across the domains and support students making sense of the ideas at the element level.

Suggestions for Improvement
There may be opportunities for students to consider ideas in ESS2.A for soil.

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 mathematics and English language arts (ELA) standards because skills from Common Core State Standards (CCSS) are referenced in each lesson.

ELA examples:

- Students' verbal and written responses to Read-Aloud Photosynthesis: Changing Sunlight into Food, Pass the Energy Please, A Log's Life;
- Summarizing investigation in Lesson 4;
- Claims/Evidence/Reasoning on Decomposition in Lesson 9;
- Research Lessons 10 & 11; and

- students writing about a tomato plant in Lesson 2

Mathematics examples:

- In Lesson 2, calculations of bean sprout mass, graphing plant growth; and
- In Lesson 11, calculating kilocalories, reading and & developing pictograms.

Suggestions for Improvement

Some of the math opportunities are not grade-appropriate. For example, independent and dependent variable relationships are more appropriate for middle school in the CCSS (6.EE.9), although measurement opportunities are more aligned with third grade CCSS standards.

Overall Category I Score (0, 1, 2, 3): 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

Score: 3

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 Authority: 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. The idea of developing students' understanding about where that food comes from is relevant to understand complex ideas about uses of land, chemical processes, and our ability to alleviate food shortages.

Students can relate to the phenomena because many students enjoy eating pizza and have prior experience of eating pizza (e.g., in Lesson 1, the students were asked to imagine their favorite pizza and discuss key ingredients). Under Teaching Tips, developers mention the option of substituting another favorite meal that may be more relevant to the community from which the students come (pages 6 and 7 Section 1: Curriculum). Also, when students go to make their pizza farm model, the materials suggestion teachers may show them pictures of wheat plants and/or tomato plants which might be helpful for urban students who may be unfamiliar with what these plants (page 9 Section 1: Curriculum).

Significantly, the unit provides an opportunity for students to connect instruction to their school community.

- In Lesson 10, students identify a problem that they see in their school, then develop a solution to that problem and present that solution.
- In Lesson 4, students are asked, "'Does anyone compost at their house or school?' If your school composts leftover lunch materials, discuss that. Ask the students what compost is good for, and how it gets used." (page 16)

There are also multiple occasions within the Evaluate section of lessons that support teachers in connecting students' questions to targeted learning (e.g., specific guidance for teachers to question student experiences).

Abundant links to short videos (media) support and/or build on firsthand experiences throughout. Here are some lesson-level examples:

- The sprouter investigation (Lesson 2), bean investigation (Lesson 3 & 5), investigation of the decomposition of a plant part (Lesson 4 & 9) all provide opportunities for firsthand experiences as does the modeling activity of the Photosynthesis Game in Lesson 6.

- Lesson 10 provides an opportunity for students to apply their learning from previous lessons to the school community.
- In Lesson 4, students are asked whether they compost at their house or school, if the school composts leftover lunch materials, to connect and lead to a discussion about the purpose and benefits of composting generally.
- The unit has a parent letter to go home, which may help connect instruction with students' homes.

Suggestions for Improvement
N/A

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: Extensive
(None, Inadequate, Adequate, Extensive)

The reviewers found extensive 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 for sharing their ideas, the unit provides explicit ways to support metacognition, and there is guidance for teachers to respond orally to students' ideas.

There are multiple examples of evidence for providing students opportunities to express ideas and respond to peers:

- In many lessons, during the Engage section, students turn and talk to partners after a question is presented. Turn and talk provides opportunities for students to respond and provide feedback to students and it is used multiple times throughout the unit (e.g., Lesson 8, page 6 in the Engage section).
- In the Explore section of lessons 1, 3, 4, 5, 7, 8, and 9, questions set the stage for the activities that follow. For example, Lesson 5 asks: What were the results of our bean experiment? What did they tell us about what plants need to grow?
- In the Explain section of every lesson 1-9, students are given opportunities to express their ideas about what happened in the lesson typically through whole class discussions. Sometimes this is accomplished by extended questioning where students would justify their answer (Lesson 3, page 17), or by representing their understandings first in their Journals and then by sharing what they have written or drawn (Lessons 1, 6 and 8).
- In Lesson 3 Explain, students are asked about the important ideas that came from their discussions and then provided an opportunity to change the farm model. While this is not feedback specific to what they have created, it allows students to express, clarify, justify, interpret, and represent their ideas and respond to peer input. Feedback might be something specific to their own model that someone has questions or comments about.
- "Talk Moves" are referenced in Lesson 2, and 9 and there is a Gallery Walk in Lesson 9.
- Links to other strategies are provided, such as the Discussion Diamond in Lesson 7, mention of applications such as Quizizz in Lesson 6, Teaching Tip in Lessons 1 and 10 and self-documentation techniques Lesson 10.

- Students have a journal for recording responses throughout the unit.
- In the Evaluate section of each Lesson 2-9, students are asked, “Have we answered any of your questions about pizza yet? What new questions, do you have?

Suggestions for Improvement
Consider creating more modalities for teacher feedback.

Lesson 3 Elaborate section states, “You may want to give students time to provide each other with feedback on their models.” To make the evidence stronger for this criterion, opportunities like this should not be stated as optional.

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. The materials make clear the expected level of proficiency students should have with all three dimensions.

The design of this unit is built, lesson by lesson, on student’s learning from the previous lesson or from previous years for multiple dimensions. For example:

- Lesson 1 student do an initial model (SEP) based on their current knowledge of energy transfer and material cycling (CCC) with their pizza farm. In preparing to develop this model, student review the learning from K-2 on the differences between living and nonliving things. In Lesson 1 (Section 1: Curriculum page 7), the authors state students may come with an understanding of what living things need to survive (DCI LS1.C). This is to help students prepare for the modeling (and later designing) a pizza farm, and the developer explicitly suggests teachers can differentiate the lesson based on their previous knowledge. They also note that in grades K-2 students may have developed or used a model (SEP), and that “In K-2, students may understand that objects can break into smaller pieces and be put together into larger pieces. We build on this by introducing the idea that energy can be transferred, and food matter can be broken down and then built up into new matter” (CCC).
- The students refine their model by doing experiments to figure out what plants need to grow, how plants get their energy, and how this energy is transferred to those who eat plants or those who eat the creatures who eat the plant and how the plants’ materials are recycled back to soil that in turn supports the plant (Lesson 9, Explore, page 9). This builds on what was learned in Lesson 1.
- In Lesson 5, Engage Section, it states that “students may come with background knowledge of the structures and functions of different parts of a plant” (4-LS1-1, CCC). In this unit, the students build background knowledge of why plants have those structures.
- In lesson 6, developers note that students should come to this lesson with an understanding that things can be broken apart and put together since this the K-2 CCC of Matter and Energy.

- The students apply their learning to solve two problems (SEP). One problem is in their own community and one in developing a model of a farm that minimally harms the environment. Both of those solutions involve the CCC of energy transfer and cycling of matter.
- The summary of prior learning before starting Lesson 7 (Section 3: Curriculum page 6) says: “In the previous lessons, students figured out that plants need small particles of carbon dioxide and water to build their matter, and light energy to change those small particles into their own plant matter.” (DCI LS1.C *plants acquire their material for growth chiefly from air* and water; CCC Energy and Matter- *matter is made of particles.)* “...They figured out that different parts of the plant help the plant get those materials.” (CCC Structure and Function.)

Suggestions for Improvement

In order to earn an Extensive rating in this criterion, the unit must not only make clear the expected level of proficiency students should have with all three dimensions for the core learning in the unit, but it should also provide suggestions for adaptation in all three dimensions if students are above or below this level.

It may be helpful to put prior learning connections either in the framework of the standards pages or place them within the unit when they appear in each lesson for extra clarity for the user.

Consider more explicit references to SEPs and CCCs from previous years, as the prior learning tends to focus more on DCIs. For example, when **Planning and Carrying out Investigations** with students in grade 5, students should already know what a fair test is and what variables are identified and used. Lesson 2, 3, and 4 is an opportunity for teachers to formatively observe how much of the prior understandings are successfully being applied in new investigations.

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. Investigations use scientifically accurate information in texts and activities. Lessons 4, 5, 6, 8, and 9 have strong evidence of connections to scientifically accurate information.

Suggestions for Improvement

Some areas in this unit may include above grade-appropriate scientific information. Examples of areas for reconsideration include: Elaboration on the forest in lesson 7 because the relationship between CO2 and global warming is not discussed at 3-5 grade band; the relationship between oxygen and cellular respiration also appears above grade level.

Consider providing some information to the teachers to support them in addressing potential student misconceptions (in particular, students who may not know the connection between wheat and pizza crust, cows and milk, and cows and pigs and pepperoni).

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: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials provide guidance for teachers to support differentiated instruction because there are multiple ways students could access learning and, in that respect, learning was differentiated. The multiple ways include partner talk, whole class conversations, Read-Alouds, videos, hands-on activities, modeling.

There are multiple resources and strategies offered support differentiation. For example:

- The unit provides a variety of ways students can access learning: partner talk, “think, pair, share”, whole class conversations, group work, Read-alouds, videos, hands-on activities, and modeling. By offering a variety of different approaches to learning, the authors have provided one way of differentiating instruction.
- The authors provide many opportunities for students to work with a partner or in small groups. Talking with classmates helps English learners strengthen their language skills. Students, who are weak writers benefit from discussion on a topic before writing on that topic. Specifically,
  - Lesson 2, the engage section, the students share their Tomato Writing Prompt (Student Page 5) with a partner or in small groups.
  - Lesson 6, the engage section, the students are invited to turn and talk from questions that are asked by the teacher.
- Below are three instances the authors have specifically identified ways to differentiate:
  - “for differentiation you could have students design their own investigations based on the Engage question or you could walk students through the steps.” (Section 1: Curriculum page 17)
  - “allow student to change or refine any answers on Student page 16. For differentiation for ELL learners, you could also allow them to draw pictures. As an alternative, or for extra multimedia opportunities for your students to solidify their knowledge of photosynthesis, allow students to go through the following slide show.” (Section 2: Curriculum page 6)
  - “For ELL or struggling readers, you could read chosen articles aloud as they follow along or you could use partner reading strategies. Here are some further ideas from ASCD for helping ELL.” (Section 4: Curriculum page 7, 8, Explain section)

Suggestions for Improvement

Given the length of this unit and the complexity of some of the concepts, more differentiation would be useful. Suggest more challenging assignments for advanced students and alternative assignments to struggling learners. While unit provides multiple ways by which students can receive information, students typically are not provided with multiple ways by which they can demonstrate knowledge. For example, in lesson 11, when students design their ideal farm, some students may find it more meaningful to use manipulatives than pencil and paper or integration of other technologies where available.

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: Extensive

(None, Inadequate, Adequate, Extensive)

The reviewers found extensive evidence that the materials support teachers in facilitating coherent student learning experiences over time because, as mentioned above, lesson summaries and lesson engagement sections link student learning experiences over time.

The Engagement section of each lesson promotes student questioning, which then drives the learning in the lesson. Continually coming back to the pizza farm and refining the model based on the learning in the lesson ensures sense-making in terms of content and the process itself involves the SEP of **Developing and Using Models** the CCC of **System and Systems Models**.

Suggestions for Improvement

N/A

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 adjusts supports over time. Students are able to practice using the SEPs/CCCs in order to develop understanding of the DCIs with iterative practice. The supports are offered and gives the teacher flexibility to decide how use them and slowly remove them.

Some evidence that meets this criterion includes:

- Students moving from teacher Read-Aloud opportunities with guiding questionnaires in Lessons 5, 6, 7, 8, and 9 to doing their own research in Lessons 10 and 11.
- To assist ELLs and struggling reader with their research, the unit materials suggest Newsela to find the same articles at different reading levels.

- Also suggested is reading aloud the articles, pairing students with partners, and chunking the lesson. (page 8 Section 4: Curriculum).

In Lesson 8, students work in their Journals to develop the Energy Diagram for Pizza on 18. Here they are provided with scaffolds of a word bank. This concept of energy transfer is given slightly different approach on page 19 when students fill out the "I Am What I Eat" Flow Chart. This flow chart is very guided with a word bank and an examples bank. Then student get to apply about food chains when they develop their own food chains involves plants and creatures in a Missouri Pond.

The teacher resource states, "**Pages 14-17:** You can omit these pages, or use them for differentiation purposes" (page 13). It is unclear whether these are additional reading to provide more information or if they include a new way to think about or understand an idea.

Suggestions for Improvement

Structured research sheets could be developed that would prompt students to consider multiple sources and use sentence stems to support students to be more independent over time. "Chunking" might be a way to make progress with some students and provide a check-in so that teachers would be able to monitor progress without developing dependence for planning, researching and writing.

Consider adding more specific guidance to teachers about how to gradually release supports over time.

An opportunity is missed for gradual increase in responsibility for students to plan and carry out investigations. For example:

- Lesson 2 is structured experiment where student follow a given procedure. This gives the class an opportunity to review, learn about independent variables, dependent variables, and fair tests.
- Consider then in Lesson 3 suggesting students work in groups to choose an independent variable to investigate and then be allowed to set up their own experiment to do so.
- Then, in lesson 4, students could be provided with materials but working in groups, develop their own experiment to answer the question, "What happens to plants after they die?"

In Lesson 4, the extension activity is to create a brochure about composting. Consider making it clearer how this extends learning of students engaging in the SEP to build understanding.

Overall Category II Score (0, 1, 2, 3): 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

Score: 2

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 and/or design solutions.

Direct, observable evidence is included in student journals, conversations/dialogue, and labs. There is evidence in Lessons 1-11 that is produced by students with varying levels of support where three-dimensional student performances are observable.

Examples of three-dimensional learning include:

- In the Student Science Journal (pages 6 and 7), students record and analyze their results as they carry out the sprouter investigation. This activity integrates the SEP of **Planning and Carrying out an Investigation** (*element: plan and conduct an investigation collaboratively …. the number of trials considered*), with the CCC of **Cause and Effect** to explain what caused the change in mass (*element: relationships are routinely identified to explain change).* The goal of this investigation is for students to understand DCI LS1.C (*element: plants acquire their materials for growth chiefly from air and water*).
- In the Student Science Journal (page 16), students reflect on the photosynthesis game and relate this game to experiments done on beans. This reflects learning of all elements of the CCC related to Energy and Matter, and connects to student understanding of the following DCIs LS1.C (the element pertaining to plants), LS2.A and LS2.B. In their writing on page 16, students are engaging in the SEP of constructing explanations *by using evidence (e.g. measurements, observations, patterns).*

Suggestions for Improvement

Consider incorporating a checklist from the Evidence Statements so teachers have more guidance for their observations.

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. The unit provides many checks for understanding along the way, and on several occurrences throughout the unit, provides follow up questions the teacher can ask the student to advance thinking through student discourse based on student responses.

Formative assessments are included in activities within the Student Journal, which students write in during each lesson, and the pizza farm model with its ongoing refinements as students learn more. These can be reviewed and evaluated by the Teacher to adjust instruction or re-teaching and to determine if individual students are struggling with a concept.

The formative assessments include

- Energy Transfer and Cycling of Matter (pages 4, 5, 11, 13, 16, 18, 20);
- Patterns (page 15);
- Cause and Effect (page 17);
- Analyzing Data (page 6, 8, 10, 12);
- Argue from Evidence (page 11, 21);
- Construct Explanations (page 13, 20); and
- Obtain, Evaluate and Communicate (page 22, 25-27)

The answer key (Teacher Pages) for the Student Science Journal provides exemplary responses along with follow up questions teachers could respond with based on student responses. The follow-up questions allow teachers to create student discourse as a mechanism to make students consider other things and advance student understanding. For example, some questions nudge students to moving beyond their current thinking (e.g., thinking about what variables they left out, like light, air, or water).

Example from Lesson 1:

> Exemplar: I think air and water caused the change in mass. There was no soil, and the only things the plants had were air and water.
> If students have other ideas, for example that it was the light, ask students: *Why do you think that? What evidence from our experimental setup might disprove that? How could we further design an experiment to see if that idea is on the right track?*

Example from Lesson 6:

> Exemplar: The game showed us what is happening in the plant experiment that we can't see. The game showed us that plants need air and water to build sugar, and sunlight energy starts this process. The sugar is food that helps the plant grow (build their own matter). Plants in our experiment that didn't have air or water did not grow well. Plants that didn't have light grew, but didn't look normal.
>
> If students leave out details about light, ask: *What was needed to start our photosynthesis game? What happened to the plants that were in the dark? How does this show us that light is energy, and is not used to build the plant's matter? What is the energy doing for the plant?*
> If students leave out details about water, ask: *What were the two ping pong bag types we created? What were they used to make? What happened to our beans that did not get water?*
> If students leave out details about air, ask: *What were the two ping pong bag types we created? What were they used to make? What happened to our beans that did not get air?*

Finally, each lesson has either small group discussion and/or whole group discussion, during which there are multiple opportunities for the teacher to check for student understanding and adjust instruction if needed.

Suggestions for Improvement

This unit meets the basic requirements for an Adequate rating for this criterion, but would greatly benefit from strengthening the supports to teachers for adjusting instruction based on information gained from formative assessments. For example:

- The follow-up questions provided create an opportunity to use student discourse as a mechanism to make students consider other things and advance student understanding, but it would be appropriate to provide more support for the teachers about how to use student discourse effectively.
- This criterion would be strengthened by adding more specific and robust supports to adjust instruction based on formative assessments. Throughout the unit, consider adding suggestions such as, “if students are still having problems understanding energy transfer at this point, consider using their work in Lesson X with the food web to clear up misconceptions.” This would provide specific ways for formative assessments to inform instruction.

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: Inadequate

(None, Inadequate, Adequate, Extensive)

The reviewers found inadequate evidence that the include aligned rubrics and scoring guidelines that help the teacher interpret a range of student performances for all three dimensions. Answer keys and student exemplary answers were included.

Assessment or learning targets are given at beginning of each lesson. In the Evaluate section of the lesson, the unit highlights evidence teachers should look for in terms of student work and responses. Icons are provided to teachers when they should be checking for student understanding. In the Teacher Pages answer key to the Student Journal, exemplary responses are provided.

However, reviewers did not see evidence of an indication as to what is acceptable if not exemplary, or a range of responses. Assessment targets for all three dimensions were not always clear.

Examples:

- There is a student rubric for the Pizza Farm Model on page 4 of the Student Journal.
- There is clear guidance to support teachers with read alouds with text dependent questions and making inferences, see Read Aloud Guide: A Log’s Life, or Read Aloud Guide: Pass the Energy Please (page 20).
- The pre/post summative assessment includes a teacher answer key to help with scoring. However, guidance for teachers appears to simply have the “right” answers. The reviewers did not find evidence of qualitative descriptors for students’ responses to distinguish between a range of student performances. While there is occasionally an exemplar student answer, there is not a rubric with ranges of student responses to help the teacher assess a variety of responses, or key criteria to use while assessing.

Suggestions for Improvement

In order to earn an Extensive rating, teacher keys should include rubrics that allow for a range of responses (not just exemplary), with clear guidance provided for teachers to interpret student progress in all of the targeted dimensions and their use together.

Consider including additional guidance either by scoring guide or rubric that would encourage students' self-assessment and reflection about their own progress similar to the one used in Lesson 1. Provide a new rubric or perhaps repeat the rubric from Lesson 1 for the final Pizza Farm Model in Lesson 8. Students may want input in developing the rubric.

More specifically, consider providing a scoring guide or rubric for the School Community Action Plan from Lesson 10 and for Lesson 11 Farm Design to Minimally Impact the Environment. If students are going to present to a group (class, audience, etc.), consider a way for them to receive feedback from the audience.

III.D. Unbiased tasks/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: Adequate
(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials assess student proficiency using accessible and unbiased methods, vocabulary, representations, and examples.

The formative assessments, such as the tasks in the Student Science Journal, appear unbiased. The concepts assessed may be challenging for some students, but there are sufficient conversations, read-alouds, videos and hands-on activities that students should be able to complete these tasks. The language used in the Student Science Journal appears neutral and straightforward. The formative task of having students draw and revise a model of how matter and energy move through a pizza farm is also one which is accessible to all students once they know which farm plants and animals provide the ingredients for the pizza. Students in Grade 5 know pizza and most have probably enjoyed eating it.

Suggestions for Improvement

The pre/post assessments provided in the unit may not be accessible to struggling readers (including ELs) for a couple reasons:

- Section 1, Section 2 and Section 4 of the pre/post assessment all start with one or more paragraphs of background text.
- There may be some jargon or inaccessible words in the assessments (e.g., the term "trophic level" is used throughout Lesson 8 questioning but trophic is not a word emphasized in lesson 8 or Section 3 nor is listed in the glossary).

Because of this, the author may want to reconsider the reading load and vocabulary used in the pre/post assessment, as it may limit the accessibility of the assessment to all students.

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-, self, formative, and summative measures that assess three-dimensional learning. The students are continually applying the appropriate elements of the three dimensions to make sense of their Pizza Farms, then to re-design their Pizza Farms to minimally impact the environment, and a variety of different measures of learning are used throughout, including:

- The unit has a pre-assessment and a summative post-assessment as well as well as extra practice for each of the 4 sections of the unit. Students conduct a self-assessment in Lesson 1 with the original pizza farm model.
- Additionally, Lessons 10 and 11 act as a form of summative assessment because students apply learning acquired in lesson 1-9 to solve two different problems. The solutions to these problems require applying SEPS and the CCC **Systems and Energy** transfer.
- Formative assessments include modeling, graphing, arguing from evidence, presentations. Suggested follow up questions based on student answers provide

Suggestions for Improvement

While there are plenty of opportunities for different types of assessment, consider adding more teacher support to know what student learning is being measured when and what to do with that information. To move this criterion to Extensive, consider the following:

- Adding a range of student responses and interpretation guidance to support score interpretation
- Adding assessment targets for using the three dimensions together and incorporating them into the scoring guidance.
- Adding clear guidance for teachers to interpret student progress, in relation to both the instructional materials as well as the targeted elements.

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: Adequate
(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials provide multiple opportunities for students to demonstrate performance of practices connected with their understanding of DCIs and CCCs.

The teacher can provide feedback by evaluating responses in the Student Journal, by viewing the ongoing revisions to the model of the pizza farm, and by listening in on student conversations. Students' ideas can be revised and added on to throughout the lessons in the unit so that ideas can continue to be developed based on experiences within each lesson.

Suggestions for Improvement
Consider formalizing feedback so students understand that as their ideas grow and change so do their observable representations. You might consider using a checklist of features, or places within student journals where peers and teacher may offer comments or advancing questions that require students to consider new ideas.

Overall Category III Score (0, 1, 2, 3): 2

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

Overall Score

Category I: NGSS 3D Design Score (0, 1, 2, 3): 3
Category II: NGSS Instructional Supports Score (0, 1, 2, 3): 3
Category III: Monitoring NGSS Student Progress Score (0, 1, 2, 3): 2
Total Score: 8
Overall Score (E, E/I, R, N): E

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)
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 (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

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)*