Stackable Instructionally-embedded Portable Science (SIPS) Assessments Project

Grade 5 Science

Unit 3 Task 3 Specification Tool & Verification of Alignment

Earth Systems and the Solution of Water Problems

September 2023

Grade: 5	Unit: 3	Task Number: 3	Task Title: Protecting Earth's Soil

NGSS Performance Expectations

5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] *[Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]*

5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

3-5-ETS-1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Phenomena or Phenomena-rooted Design Problem

- A family needs to design a solution to the problem of soil erosion on their farm.

Scenario/Context/Situation/Boundaries

- Scenario presents a scenario about a farm that has been experiencing more severe weather in recent years.
- The problem the farm needs to solve is to reduce soil erosion.

Variable Features to Shift Complexity or Focus

- Complexity of scientific concept(s).
- Domain-specific vocabulary and definitions.
- The types of interaction between components of Earth's spheres.
- Context includes, but is not limited to:
  - Effect of water on the geosphere (e.g., beach deposition and erosion, river channel erosion, and deposition).
  - Effect of plants on the geosphere (e.g., roots breaking rocks, reducing erosion, decaying leaves changing the composition of soil).
  - Soil erosion.
- Type of model showing how Earth's systems interact.
- Type of model showing how Earth's systems interact in a specific event.
- Function of the model to explain the system underlying a phenomenon.
- Function of the model to describe a phenomenon.

- Components and types of models used to explain/show how a specific environment is negatively/positively impacted by human interaction.
- Number of different solutions for natural resource replenishment.

General Description of Task/Chain of Sensemaking

- Students identify a model showing how two of Earth's systems are involved in an event related to soil erosion. **[Prompt 1, Part A: 5-ESS2-1, KSA4]**
- Students identify and describe interactions and components interacting in two models interactions between Earth systems related to soil erosion with and without vegetation. **[Prompt 1, Part B: 5-ESS2-1, KSA5]**
- Students identify and describe interactions and components between two systems using a model of wind erosion. **[Prompt 2, Parts A & B: 5-ESS2-1, KSA5]**
- Students identify and describe the effects of human activity (i.e., agriculture) on Earth's resources (i.e., topsoil). **[Prompt 3, Parts A & B: 5-ESS3-1, KSA7]**
- Students identify how a solution (i.e., windbreak) helps humans to affect positive change based on ongoing processes (i.e., changing weather). **[Prompt 3, Part C: 5-ESS3-1 & 3-5-ETS1-2, KSA1]**
- Students describe an experimental procedure appropriate to draw conclusions about the functioning of the windbreak. **[Prompt 4, Parts A & B: 5-ESS3-1 & 3-5-ETS1-3, KSA2]**

Targeted PE-related KSAs

5-ESS2-1, KSA4: Identify and describe interactions and components between two systems.

5-ESS2-1, KSA5: Use a provided model to describe how two systems interact.

5-ESS2-1, KSA7: Identify the effects of human activity (e.g., in agriculture, industry, everyday life) affecting the Earth's resources and environments.

Cross-performance Expectations Related KSAs to Target

5-ESS3-1 & 3-5-ETS1-2, KSA1: Identifies how the design solution helps humans to affect positive change based on ongoing processes.

5-ESS3-1 & 3-5-ETS1-2, KSA2: Generate or select an experimental procedure appropriate to draw conclusions about the functioning of the solution.

Student Demonstrations of Learning

- Correctly identifies and describes relevant interactions of components within a system.
- Describes a phenomenon that includes the interaction of two systems.
- Correctly identifies and describes relevant interactions between components of two systems.
- From provided texts or resources, accurately explains the positive and/or negative human impacts on the environment, air, land, or water.
- From provided texts or resources, accurately provides a solution to mitigate the human impacts on the environment, air, land, or water.
- From provided texts or resources, accurately provides rationale to support a solution that mitigates the human impacts on the environment, air, land, or water.

Work Products

- Selected response.
- Constructed response.

Application of Universal Design for Learning-based Guidelines to Promote Accessibility (https://udlguidelines.cast.org/)

Multiple Means of Engagement	Multiple Means of Representation	Multiple Means of Action & Expression
- Context or content. - Age appropriate. - Appropriate for different groups. - Makes sense of complex ideas in creative ways. - Vary the degree of challenge or complexity within prompts.	- Provide visual diagrams and charts. - Make explicit links between information provided in texts and any accompanying representation of that information in illustrations, equations, charts, or diagrams. - Activate relevant prior knowledge. - Highlight or emphasize key elements in text, graphics, diagrams, and formulas. - Use outlines, graphic organizers, unit organizer routines, concept organizer routines, and concept mastery routines to emphasize key ideas and relationships. - Give explicit prompts for each step in a sequential process.	- Solve problems using a variety of strategies. - Sentence starters. - Embed prompts to "show and explain your work".

SIPS Assessments Complexity Framework Components

Prompt	A.1 Degree and nature of sense-making about phenomena or problems			B.1 Complexity of the presentation			B.2 Cognitive demand of response development			B.3 Cognitive demand of response production		
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
1 Part A	X			X				X		X		
1 Part B		X			X			X			X	
2		X		X				X			X	
3 Parts A & B		X		X					X		X	
3 Part C		X			X			X			X	
4		X		X					X		X	

Rubric Considerations

- Sophistication of the explanations.
- Completeness and accuracy of response.

Assessment Boundaries

- Assessment is limited to the interactions of two systems at a time.

Common Alternate Conceptions

- **5-ESS2-1**
  - There has been life on Earth since its formation.
  - The Earth does not change.
  - Hydrosphere includes only liquid water.
- **5-ESS3-1**
  - Local behavior can only lead to local consequences (or that global behavior can only lead to global consequences).
  - Humans have total control over Earth's systems.
  - Local waste disposal is a termination stage in the cycling of Earth's matter (i.e., once it's in the garbage can, the waste disappears).
  - All naturally occurring substances in Earth are good and all substances added to Earth by humans are bad.

- **3-5-ETS-1-2**
  - o   Choices among design solutions should be made on aesthetic preference rather than on meeting the criteria/constraints of a problem.
  - o   The wants or needs of a local community will not change over time.

Possible Technical Terms for Task

- atmosphere, hydrosphere, geosphere, biosphere, vegetation, soil, stream table, erosion

Common Core State Standards for Literacy

Reading Informational

- **RI.5.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. **(5-ESS3-1, 3-5-ETS1-2)**
- **RI.5.7** Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. **(5-ESS2-1, 5-ESS3-1, 3-5-ETS1-2)**
- **RI.5.9** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. **(5-ESS3-1, 3-5-ETS1-2)**

Writing

- **W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work and provide a list of sources. **(5-ESS3-1)**
- **W.5.9** Draw evidence from literary or informational texts to support analysis, reflection, and research. **(5-ESS3-1)**

Common Core State Standards for Mathematics

Mathematical Practice

- **MP.2** Reason abstractly and quantitatively. **(5-ESS2-1, 5-ESS3-1, 3-5-ETS1-2)**
- **MP.4** Model with mathematics. **(5-ESS2-1, 5-ESS3-1, 3-5-ETS1-2)**

Mathematics

- **5.G.2** Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane and interpreting coordinate values of points in the context of the situation. **(5-ESS2-1)**
- **3-5.OA** Operations and algebraic thinking **(3-5-ETS1-2)**

Task Notes

SIPS Assessments Complexity Framework

Component		Complexity		
		Low	**Moderate**	**High**
Connections to Curriculum and Instruction	**A.1 Degree and nature of sense-making about phenomena or problems**	• Requires one or two dimensions • One dimension may have a greater degree of emphasis than another • Requires previously learned ideas or concepts	• Requires integration of two dimensions in the service of sense-making • Requires integration of same or different combinations of dimensions as represented in the PE bundle • Requires a combination of previously learned ideas or concepts and newly presented information	• Requires integration of three dimensions in the service of sense-making • Requires integration of same or different combinations of dimensions as represented in the PE bundle • Requires a combination of previously learned ideas or concepts and newly presented information
Characteristics of the Tasks	**B.1 Complexity of the presentation**	• The amount and type of information provided in the scenario supports limited simple connections among ideas or concepts • Provides few, simple graphics/data/models • Includes definitions or examples • Phenomenon or problem presented in a concrete way with high level of certainty	• The amount and type of information provided in the scenario supports multiple evident connections among ideas or concepts • Provides graphics/data/models • Limited use of definitions or examples • Phenomenon or problem presented with some level of uncertainty	• The amount and type of information provided in the scenario supports multiple and varied complex connections among ideas or concepts • Provides complex graphics/data/models • Phenomenon or problem presented with high-degree of uncertainty
	B.2 Cognitive demand of response development	• Requires well-defined set of actions or procedures • Requires a connection or retrieval of factual information • Response requires a low level of sophistication with routinely encountered well-practiced applications	• Requires application of ideas and practices given cues and guidance • Requires drawing relationships and connecting ideas and practices • Response requires a moderate level of sophistication with typical but relatively complex representation of ideas and application of skills	• Requires selection and application of multiple complex ideas and practices • Requires high degree of sense-making, reasoning, and/or transfer • Response requires a high level of sophistication with non-routine or abstract representation of ideas and application of skills

B.3 Cognitive demand of response production	• Responses include selection from a small set of options presented as text (e.g., word, short phrase) or other formats (e.g., a simple graphic or process)	• Responses include one or more sentences or a paragraph, a moderately complex graphic, or multiple steps in a simple or moderately complex process	• Responses include multiple paragraphs, multiple graphics of at least moderate complexity, or multiple steps in a complex process