Stackable Instructionally-embedded Portable Science (SIPS) Assessments Project

Grade 5 Science

Unit 3 Task 1 Specification Tool & Verification of Alignment

Earth Systems and the Solution of Water Problems

September 2023

The SIPS Grade 5 Science Unit 3 Task 1 Specification Tool & Verification of Alignment was developed with funding from the U.S. Department of Education under the Competitive Grants for State Assessments Program, CFDA 84.368A. The contents of this paper do not represent the policy of the U.S. Department of Education, and no assumption of endorsement by the Federal government should be made.

SIPS Grade 5 Unit 3 Task 1 Specification & Verification of Alignment

Grade: 5	Unit: 3	Task Number: 1	Task Title: Every Drop Counts

NGSS Performance Expectations

5-ESS2-2 Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. *[Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.]*

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 design problem related to water conservation is provided in the context of the volumes/percentages of freshwater reservoirs and how local behaviors can reduce the usage/waste of fresh water (i.e., use of water-saving devices and water-saving gardening strategies).

Scenario/Context/Situation/Boundaries

- The scenario introduces a setting related to preventable loss of fresh water in the context of households.
- Graphs, charts, and tables provide students with information from multiple sources in order to address questions and solve a problem in the context of the volumes/percentages of freshwater resources available for human use on Earth.
- The task closes with information regarding a simple engineering design problem and a set of meaningful criteria and constraints on a potential solution.
- Students develop a solution that best meets the criteria for success.

Variable Features to Shift Complexity or Focus

- Complexity of scientific concept(s).
- Domain-specific vocabulary and definitions.
- Type of mathematical measurements and representations used to describe characteristics and patterns of a scientific phenomenon.
- Context includes, but is not limited to:
  - Volumes/percentages of various reservoirs worldwide.
  - Volumes/percentages of freshwater reservoirs.
  - Volumes/percentages of surface water and groundwater.

- Water conservation.
- Risk of failure and/or potential negative impacts of failure in a solution.

- Examples of human activities that can have positive environmental impacts or activities that have known negative impacts.
- Scale of human activity (e.g., single-sourced, collective action, locally occurring, globally occurring, etc.).
- Format of "real-world" phenomenon under investigation: image, data, text, combination.
- Number, type, and complexity of representations of models, tables, graphs, and/or data sets.

General Description of Task/Chain of Sensemaking

- Students interpret a graphical representation of household water usage to answer questions. **[Prompt 1, Parts A – D: 5-ESS2-2 & 5-ESS3-1, KSA1]**
- Students combine and synthesize information on the effects of a given human activity on the environment to support an argument. **[Prompt 2, Part E: 5-ESS3-1, KSA6]**
- Students graph quantities of the distribution of saltwater and freshwater reservoirs on Earth. **[Prompt 2, Parts A & B: 5-ESS2-2, KSA7]**
- Students analyze their data to answer questions about the distribution of Earth's water resources. **[Prompt 2, Part C: 5-ESS2-2, KSA3]**
- Students generate a design solution that meets the criteria for success while staying within relevant constraints that use scientific ideas to conserve fresh water. **[Prompt 3, Parts A & B: 5-ESS3-1 & 3-5-ETS1-2, KSA1]**
- Students explain the benefits of their design solution, based on prioritization of some criteria over others, to address human activities that can have positive environmental impacts from activities that have known negative impacts. **[Prompt 3, Part C: 5-ESS3-1 & 3-5-ETS1-2, KSA2]**

Targeted PE-related KSAs

5-ESS3-1, KSA6: Explain, using evidence, the ways in which communities have positively impacted water sources.

5-ESS2-2, KSA7: Graph given data (using standard units) showing the distribution of saltwater and freshwater reservoirs on Earth.

5-ESS2-2, KSA3: Analyze data about varying reservoirs on Earth.

Cross-performance Expectations Related KSAs to Target

5-ESS2-2 & 5-ESS3-1, KSA1: Interpret data or a graph showing how a given human activity affects the Earth's resources and/or environments.

5-ESS3-1 & 3-5-ETS1-2, KSA1: Generate a design solution that meets the criteria for success while staying within relevant constraints that use scientific ideas to protect a given natural resource.

5-ESS3-1 & 3-5-ETS1-2, KSA2: Explain the functioning of a potential design solution in terms of the ability of the design to meet relevant criteria.

Student Demonstrations of Learning

- Uses multiple data sources to explain how human activities impact resources or the environment.
- Analyzes a bar chart/graph accurately showing percentages of the distribution of freshwater on Earth.
- Describes a claim you could make about water on Earth supported with information from completed charts.
- From provided texts or resources, accurately provides rationale to support a solution that mitigates the human impacts on the environment, air, land, or water.
- Generates a design solution that meets the criteria for success while staying within relevant constraints that uses scientific ideas to conserve fresh water.

Work Products

- A bar chart or graph.
- Interpretation and/or representation of data (e.g., diagrams, flowcharts).
- Complete a model of a design.
- 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 Parts A - D		**X**			**X**			**X**			**X**	
1 Part E		**X**			**X**			**X**			**X**	
2 Parts A & B	**X**			**X**				**X**		**X**		
2 Part C		**X**			**X**			**X**			**X**	
3 Part A			**X**		**X**				**X**		**X**	
3 Part B			**X**		**X**			**X**			**X**	
3 Part C		**X**		**X**			**X**				**X**	

Rubric Considerations

- Accuracy of the graph (including the scale).
- Accuracy of the model.
- 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-ESS2-2**
  - Most water on Earth is freshwater.
  - Most freshwater is available for human use.
- **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**
  - Choices among design solutions should be made on aesthetic preference rather than on meeting the criteria/constraints of a problem.
  - The wants or needs of a local community will not change over time.

Possible Technical Terms for Task

- salt water, fresh water, lakes, rivers, groundwater, glaciers, oceans, conservation, resources

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-ESS2-2, 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-ESS2-2, 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-ESS2-25-ESS3-1, 3-5-ETS1-2)**
- **MP.4** Model with mathematics. **(5-ESS2-2, 5-ESS3-1, 3-5-ETS1-2)**

Mathematics

- **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