Stackable Instructionally-embedded Portable Science (SIPS) Assessments Project

Grade 5 Science

Unit 4 Task 2 Specification Tool & Verification of Alignment

Earth and Its Gravitational Force and Motion

September 2023

Grade: 5	Unit: 4	Task Number: 2	Task Title: Meet the Beetles!

NGSS Performance Expectations

5-ESS1-1 Support an argument that apparent brightness of the sun and stars is due to their relative distances from the Earth. *[Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).]*

5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] *[Assessment Boundary: Assessment does not include causes of seasons.]*

Phenomena or Phenomena-rooted Design Problem

- Task focuses on the ability of dung beetles to navigate to safety or home after they collect dung using constellations.

Scenario/Context/Situation/Boundaries

- The scenario introduces a topic related to ancient people, and dung beetles today, using the stars and constellations as a navigation tool.
- Charts and tables provide students with information from multiple sources in order to address questions.
- The task closes with a question about how dung beetles use the night sky as a navigation tool.

Variable Features to Shift Complexity or Focus

- Complexity of scientific concept(s).
- Domain-specific vocabulary and definitions.
- Graphic organizers presented may be diagrams, graphs, data tables, and/or drawings.
- Data sets addressed in the scenario, including but not limited to:
  - Presence or absence of stars and/or constellations.
  - Patterns of sunrise and/or sunset.
- Patterns of appearance for stars and/or constellations
- Type of evidence/data that supports a claim.
- Use of cause-and-effect relationships to explain changes.

- Number of stars and their distances from the Earth.
- Representation of distance from Earth
- Representation of the brightness of stars

General Description of Task/Chain of Sensemaking

- Students interpret a visual representation of the position of the Big Dipper in the night sky at different times of the year to explain the pattern of movement. **[Prompt 1: 5-ESS1-2, KSA5]**
- Students use data to compare the brightness of the sun and other stars. **[Prompt 2, Part A: 5-ESS1-1, KSA2]**
- Students use data to explain the effect of distance on the apparent brightness of stars as compared to the actual brightness of stars. **[Prompt 2, Parts B & C: 5-ESS1-1, KSA3]**
- Students support an argument with different justifications for a claim about how the dung beetles use the stars to navigate. **[Prompt 3: 5-ESS1-1 & 5-ESS1-2, KSA1]**

Targeted PE-related KSAs

5-ESS1-2, KSA5: Identify similarities and differences in the timing of observable changes in shadows, daylight, and the appearance of stars to describe how events occur at different rates (e.g., Earth rotates on its axis once a day, while its orbit around the sun takes a full year).

5-ESS1-1, KSA2: Compare different stars' relative distance from Earth given information about their relative size and brightness.

5-ESS1-1, KSA3: Support an argument that differences in the apparent brightness of the sun compared to other stars are due to their relative distances from Earth.

Cross-performance Expectations Related KSAs to Target

5-ESS1-1 & 5-ESS1-2, KSA1: Support an argument given data in a way that facilitates analysis and interpretation of the position and motion of objects in the sky.

Student Demonstrations of Learning

- Uses organized data to find and describe relationships/patterns within the datasets.
- Sorts, classifies, communicates, and analyzes simple rates of change for natural phenomena using similarities and differences in patterns.
- Accurately uses reasoning to explain how relevant evidence/data can be used to explain a phenomenon related to the position and motion of the Earth, sun, moon, and stars.

Work Products

- Organize data in a table and/or graphical display (e.g., chart, graph).
- Interpretation of data.
- 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		X			X		X				X	
2 Part A	X			X				X		X		
2 Parts B & C		X		X					X		X	
3		X				X	X				X	

Rubric Considerations

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

Assessment Boundaries

- Assessment is limited to relative distances, not sizes, of stars.
- Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).

Common Misconceptions

- **5-ESS1-1**
  - The sun is bigger and brighter than some other stars.
  - All stars are the same size.
- **5-ESS1-2**
  - Celestial objects orbit around a stationary Earth.
  - The pattern of the visible stars does not change throughout the night.
  - Stars are only around at night and the sun is only around during the day.
  - Everyone on Earth experiences day/noon/night at the same time.

Possible Technical Terms for Task

● orbit, sun, Earth, seasons, apparent position, seasonal, apparent brightness, actual brightness, constellation, Milky Way

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-ESS1-1)**
- **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-ESS1-1)**
- **RI.5.8** Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s). (**5-ESS1-1)**
- **RI.5.9** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. **(5-ESS1-1)**

Writing

- **W.5.1** Write opinion pieces on topics or texts, supporting a point of view with reasons and information. **(5-ESS1-1)**

Common Core State Standards for Mathematics

Mathematical Practice

- **MP.2** Reason abstractly and quantitatively. **(5-ESS1-1, 5-ESS1-2)**
- **MP.4** Model with mathematics. **(5-ESS1-1, 5-ESS1-2)**

Mathematical Content

- **5.NBT.A.2** Explain patterns in the number of zeros of the product when multiplying a number by powers of 10 and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. **(5-ESS1-1)**
- **5.G.A.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-ESS1-2)**

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