Supplemental Resource

*Elementary Science Unit*

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| **Stage 1 – Desired Results** | | | | |
| **Established Goals** | **Transfer** | | | |
| **NGSS-MS-ESS1-1**: Develop and use a model of the Earth-sun-moon system to describe cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.  **NGSS-MS-ESS1-2**: Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.  **NGSS-MS-ESS1-3**: Analyze and interpret data to determine scale and properties of objects in the solar system.  **CCS-RST.6-8.7**: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., diagram, table).  **CCS-WHST.6-8.2.D**: Use precise language and domain-specific vocabulary to inform about or explain the topic. | *Students will be able to independently use their learning to…*  \* Collect data as evidence to make logical inferences about natural phenomena.  \* Use modeling and mathematics as strategies for understanding systems and relationships in the natural world.  \* Apply knowledge of science engineering to engage in public discussions on relevant issues in a changing world. | | | |
| **Meaning** | | | |
| **Understandings**  *Students will understand that…*  \* Science assumes objects and events in natural systems occur in consistent patterns understandable through measurement and observation.  \* Engineering advances have led to important scientific discoveries that further build related industries.  \* We use patterns to identify cause-and-effect relationships.  \* We study time, space, and energy phenomena using scale models of systems large and small.  \* We use models to represent systems and their interactions.  \* We use models to observe, describe, predict, and explain motion patterns of the sun, moon, and stars. (NGSS Lead States, 2013) | | **Essential Questions**  *Students will keep considering…*  \* How do we learn about space from Earth?  \* What could we learn from a space mission that we cannot learn here on Earth?  \* How does light from space influence our world?  \* How does light from space influence our daily lives?  \* What makes our solar system?  \* What happens in our solar system? | |
| **Acquisition** | | | |
| *Students will know…*  \* Solar system components and terminology (e.g., *sun, planets, moons, asteroids; orbit, gravitational pull*)  \* Other disciplinary concepts and terminology (e.g., *galaxies, Milky Way galaxy, universe*)  \* Formation of the solar system from dust, gas, and gravity  \* Sun and moon eclipses  \* Seasons and connection to Earth’s tilt  \* Informational text features (e.g., *tables, graphs, models, diagrams, illustrations*)  \* Compare/contrast sentence frames  \* Related idioms (e.g., *over the moon, everything under the sun*, *starry eyed*)  \* Nominalization (e.g., *infer/inference observe/observation, predict/prediction*) | | *Students will be skilled at…*  \* Describing the formation and components of solar system.  \* Reading and evaluating two- and three-dimensional models.  \* Reading and following sequential, multistep procedures.  \* Writing explanations of scientific phenomena using domain-specific vocabulary.  \* Explaining scientific phenomena integrating information from models, observations, and numerical data.  \* Comparing and contrasting objects to describe changes using sentence frames. | |
| **Stage 2 – Evidence** | | | | |
| **Evaluative Criteria** | | **Assessment Evidence** | | |
| \*Thorough analyses  \*Accurate assertions  \*Innovative design  \*Detailed model  \*Precise language | | **Performance Task(s)**  **MARS Rover Team**  Your task is to design and send a rover safely to Mars to collect additional data about the red planet. You are a member of a team of NASA scientists exploring Mars. You will present your findings to your colleagues at NASA. The challenge involves analyzing and interpreting data to determine when to send the solar-powered rover to Mars, designing a way to keep equipment safe as it lands on Mars, and using a scale-relief map to send directions to the rover on where it should travel after landing. You will produce an interactive presentation on the computer that includes data tables demonstrating the best time to land the rover, design for a rover casing that could survive the landing, and a scale map to identify the travel distance for the rover. | | |
| \*Thorough narrative  \*Detailed displays  \*Cross-disciplinary language (e.g., science, math, engineering) | | **Supplementary Evidence**  \* Space mission notebook (maintained individually by students; includes journal prompts and personal glossary)  \* Various student artifacts (e.g., models, displays, graphic organizers) | | |
| **Stage 3 - Learning Plan** | | | | |
| *Pre-assessment*  \* Prompted pairings to glean background knowledge from math (e.g., *data collection, measurement, ratios, proportions*) and social studies (e.g., *ancient architecture, history of telescopes and space travel*). | | | | |
| **Learning Events**  \* Starting our space mission: Review class goals and set personal learning goals. Students design and share mission patches that represent their goals for the school year and unit of study.  \* Hook: Read aloud *The Librarian Who Measured the Earth* (Lasky, 1994) and simulate Eratosthenes’ experiment (whole group and small groups) with toothpicks in cardstock paper and flashlight.  \* Start space mission notebooks (and continue regular use with each lesson), including observe-infer-predict tables, disciplinary language (e.g., vocabulary and sentence stems with illustrations and L1 translations), and responses to formative assessment prompts.  \* Earth model comparison: Spherical versus flat using light source (realia and video examples).  \* Small-group exploration of light’s effects on transparent, translucent, and opaque objects in stations.  \* Earth-and-sun model simulation: Light source, shadows, and illumination (realia and video examples).  \* Seasons exploration: Students compare seasons in Chicago and places they have lived (e.g., Mexico, Ecuador, Iraq, India) doing *Walk and Talk Dots* with *Reason for the Seasons* agree/disagree statements.  \* Seasons exploration: Use realia (e.g., globe, rubber band, flashlight) and city-specific temperature and daylight tables to observe patterns in different regions (e.g., Chicago, Mexico City, Melbourne).  \* Earth-sun-moon models in small groups: Use realia (sphere on a stick, flashlight) and Galileo’s drawings of the moon to investigate moon patterns (e.g., shadow, illumination) and eclipses.  \* Solar system photograph observations (L1 groups): Students discuss, sort, and categorize cards by characteristics (graphic organizer, sentence stems for compare/contrast). Use observations to build understandings and reinforce vocabulary (e.g., planets, asteroids, comets, moons, atmosphere).  \* Solar system exploration: Model how to collect and arrange data in tables; have groups make claims about temperature, size of planets, compositions, length of year, number of moons, atmospheres, etc.  \* Modeling of gravity, followed by gravity exploration in expert groups: jigsaw different gravitational scenarios in expert groups, then move to mixed groups to explain the solutions to others.  \* Scale exploration using various historical models of the solar system (see Library of Congress), as well as student scale drawings using distances between planets (compare/critique among students).  \* Performance task: Prepare and put students into teams for Mars rover task; time to plan and carry out.  \* Extension: Ongoing compilation of multilingual word wall with related terminology for the unit and classroom moon journal (i.e., what the moon looks like each day and the time it “rises” with pictures).  \* Extension: Providing book bins in classroom for students to independently read and explore, including (a) star stories (fiction), (b) space myths, legends, and folktales, and (c) related informational texts. | | | | *Formative Assessments*  \* Formative assessment probes (used to begin each daily lesson; Keeley, Eberle, & Dorsey, 2008)  \* Checks for understanding (following each learning event)  \* Observations with WIDA rubrics and anecdotal note-taking, particularly during small-group activities |

Source: Bridget Heneghan, *Using* *Understanding by Design in the Culturally and Linguistically Diverse Classroom* (pp. 233-235), by A. Heineke and J. McTighe, 2018, Alexandria, VA: ASCD. Copyright © 2018 by ASCD.