NASA Educational Materials Review

Final Report

Prepared for:
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Pasadena, CA 91109

September 2014

RMC RESEARCH

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EXECUTIVE SUMMARY

The Science Mission Directorate (SMD) has developed an education section within the NASA Solar System website, which includes the *Year of the Solar System*. The website currently houses 272 educational resources of varying levels of quality. These resources have been well received by teachers, but many of the materials have never been vetted for quality, usefulness, and alignment to national standards. Additionally, the website requires updating to become more useful and responsive to teacher needs. In June through August, 2014, RMC Research conducted an evaluation of these educational materials for quality, usefulness, and alignment to the Next Generation Science Standards (NGSS). The information from the evaluation will be used to create a standards-based search tool for teachers to find the best planetary science-based lessons.

RMC Research selected *The Educators Evaluating the Quality of Instructional Products (EQuIP) Rubric for Lessons and Units: Science* to use to evaluate the quality of each of the Long Lessons, Units, and Interactive Lessons. This rubric was designed specifically to address alignment to NGSS and quality of lessons. After examining each resource, four categories were established: Short Activities, Long Lessons, Units, and Interactive Lessons. The Short Activity category includes visuals, PowerPoints, and activities lasting less than a full class period. The Long Lesson category contains lesson plans or activities that are designed to last an entire 50-minute class period. The Units category includes units of lesson plans or lessons with multiple activities designed to last more than one class period. Finally, the Interactive Lessons category contains computer-based lessons. Two resources were unable to be located and were thus removed, bringing the total of reviewed resources to 270. After closer review, it was discovered that 10 resources were duplicates; one resource was a lesson within one of the Interactive Lessons; and 10 lessons were parts of other Units. These discoveries resulted in a final number of 251 reviewed resources.

RMC Research determined that 41% (103) of the materials were of sufficient quality and proper alignment to NGSS to be considered acceptable for a revised NASA education website. These materials, as a whole, align to all of the NGSS Earth and Space Science Disciplinary Core Ideas, along with the eight NGSS Practices and the seven NGSS Crosscutting Concepts.

RMC Research recommends the following for maintaining the website:

- Locate or develop more lessons in each resource category, with a stronger focus on lessons that feature interactive activities.
- Locate or develop lessons that meet the NGSS Practices of planning and carrying out investigations; constructing explanations and designing solutions; obtaining, evaluating, and communicating information; asking questions and defining problems; and, engaging in argument from evidence.
- Locate or develop lessons that meet the NGSS Crosscutting Concepts of systems and system models, cause and effect, stability and change, energy and matter, and structure and function.
- Locate or develop lessons that meet the NGSS Earth and Space Science and Physical Science Disciplinary Core Ideas, with a focus on Earth and Space Science 2 and 3.
- Hire a resource manager to locate, develop, and/or update the lesson collection.

INTRODUCTION

PROJECT BACKGROUND

The Science Mission Directorate (SMD) has developed an education section within the NASA Solar System website (http://solarsystem.nasa.gov), which includes the *Year of the Solar System*. The website currently houses 272 educational resources of varying levels of quality. These resources have been well received by teachers, but many of the materials have never been vetted for quality, usefulness, and alignment to national standards. Additionally, the website requires updating to become more useful and responsive to teacher needs.

In June through August, 2014, RMC Research conducted an evaluation of these educational materials for quality, usefulness, and alignment to the Next Generation Science Standards (NGSS). The information from the evaluation will be used to create a standards-based search tool for teachers to find the best planetary science-based lessons. This search tool will be housed on the newly designed NASA Solar System website.

NEXT GENERATION SCIENCE STANDARDS

The NGSS were developed through a collaboration between the National Research Council (NRC), the National Science Teachers Association, the American Association for the Advancement of Science, Achieve, and 26 lead partner states. These K-12 standards are based on the NRC's *Framework for K-12 Science Education.*[1] The NGSS are based on the three dimensions from the NCR's Framework: Practices, Crosscutting Concepts, and Disciplinary Core Ideas.

The dimension of Practices, as shown in Exhibit 1, covers behaviors that scientists and engineers use in their work. The NGSS use practices to "emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice." [2]

Exhibit 1. NGSS Practices

1: Asking questions (for science) and defining problems (for engineering)
2: Developing and using models
3: Planning and carrying out investigations
4: Analyzing and interpreting data
5: Using mathematics and computational thinking
6: Constructing explanations (for science) and designing solutions (for engineering)
7: Engaging in argument from evidence
8: Obtaining, evaluating, and communication information

Student scientists at work.

[1] National Research Council (2011). A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas can be found at: http://www.nextgenscience.org/final-print-version-framework-k-12-science-education-now-available
[2] Next Generation Science Standards Executive Summary, p. 2 found at: http://www.nextgenscience.org/next-generation-science-standards

As can be seen in Exhibit 2, The NGSS crosscutting concepts are seven links across the domains of science that the NRC Framework stresses should be explicitly presented to students in order to provide a way of organizing and relating knowledge across the different scientific fields.

Exhibit 2. NGSS Crosscutting Concepts

1: Patterns
2: Cause and effect: mechanism and explanation
3: Scale, proportion, and quantity
4: Systems and system models
5: Energy and matter: flows, cycles, and conservation
6: Structure and function
7: Stability and change

Disciplinary Core Ideas (DCIs) are designed to "focus K-12 curriculum, instruction, and assessments on the most important aspects of science".[3] The DCIs are placed in four domains: physical sciences; life sciences; earth and space sciences; and engineering, technology and applications of science. The criteria for the NGSS Core Ideas are presented in Exhibit 3. A complete listing of all DCIs can be found in the Appendix.

Exhibit 3. NGSS Core Ideas Criteria

- Have **broad importance** across multiple sciences or engineering disciples or be a **key organizing concept** of a single discipline;
- Provide a **key tool** for understanding or investigating more complex ideas and solving problems;
- Relate to the **interests and life experiences of students** or be connected to **societal or personal concerns** that require scientific or technological knowledge; and
- Be **teachable** and **learnable** over multiple grades at increasing levels of depth and sophistication.

(NGSS, accessed May 21, 2014)

Alignment Tool

RMC Research selected *The Educators Evaluating the Quality of Instructional Products (EQuIP) Rubric for Lessons and Units: Science*[4] to evaluate the quality of each of the Long Lessons, Units, and Interactive Lessons. This rubric was designed specifically to address alignment to NGSS and quality of lessons. According to the NGSS website, the rubric was developed due to the lack of high-quality lessons aligned to the new standards. The rubric, which can be found in the Appendix, contains three elements:

1. alignment to NGSS;
2. instructional supports; and
3. monitoring student progress.

For the Short Activities and materials, an abbreviated rubric based on the EQuIP rubric was created to assess alignment to NGSS only. A copy of the rubric for Short Activities or materials can be found in the Appendix.

[3] NGSS found at: http://www.nextgenscience.org/next-generation-science-standards
[4] Found at: http://www.nextgenscience.org/equip-rubric-science-released

METHODOLOGY

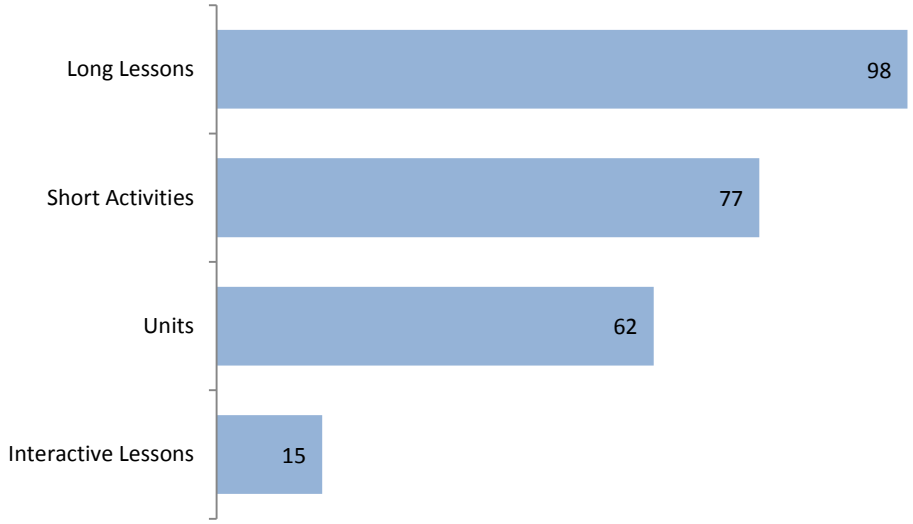
EDUCATIONAL RESOURCES FOR REVIEW

RMC Research was provided with a spreadsheet containing links to 272 educational resources that are currently housed on two NASA websites: the main solar system site (solarsystem.nasa.gov) and the *Year of the Solar System* site (solarsystem.nasa.gov/yss). After examining each resource, four categories were established: Short Activities, Long Lessons, Units, and Interactive Lessons. The Short Activity category included visuals, PowerPoints, and activities lasting less than a full class period. The Long Lesson category contained lesson plans or activities that are designed to last an entire 50-minute class period. The Units category included units of lesson plans or lessons with multiple activities designed to last more than one class period. Finally, the Interactive Lessons category contains computer-based lessons. Two resources were unable to be located and were thus removed, bringing the preliminary total of resources to be reviewed to 270. After closer review, it was discovered that 10 resources were duplicates; one resource was a lesson within one of the Interactive Lessons; and 10 lessons were parts of other Units. These discoveries resulted in a final number of 251 reviewed resources.

The Units category represented over 600 individual lesson plans, with several of the units containing as many as 58 lessons. Therefore, approximately 800 individual lessons or activities were in the review pool. Exhibit 4 displays the number of resources in each category and shows that the majority of resources were Long Lessons, followed by Short Activities and Units. Only 15 of the resources were Interactive Lessons. The tracking sheet categorizing all resources can be found in the Appendix.

Exhibit 4. Number of Resources per Resource Category

The majority of resources were long lessons and short activities.



Reviewing Process

Reviewers

Five RMC Research personnel and five outside consultants served as reviewers. Reviewers had extensive experience with educational research, classroom curriculum, science content knowledge, and classroom teaching experience.

Training

One- to two-hour training sessions were held with each member of the review team either during the last week of May or the first week of June. The training consisted of: (1) a review of the structure of the NGSS and the EQuIP rubric, (2) examination of several lessons in the review pool, (3) collaboratively filling out a rubric for one example lesson, and, (4) collaborative review of a second lesson. This calibration technique helped to ensure that all reviewers interpreted the rubric in the same way.

Resource Distribution and Tracking of Reviews

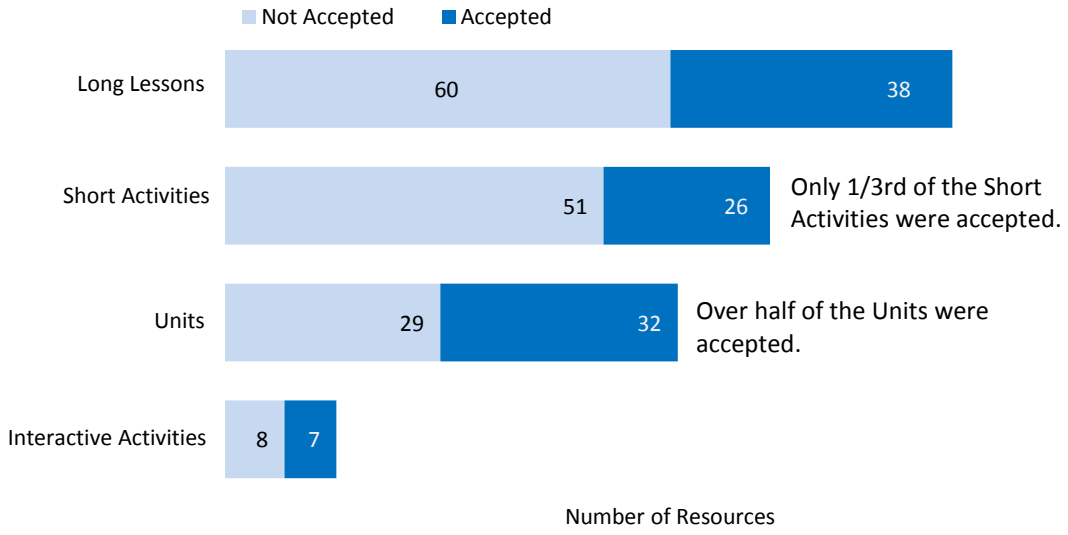
The resources were split between the reviewers in the following manner: (a) two reviewers completed all of the Short Activities; (b) the Units of study were equitably split between the remaining eight reviewers based upon number of lessons within the unit; and (c) the Long Lessons and Interactive Lessons were split equally between all eight reviewers. Each resource was reviewed by only one reviewer. The project director examined each completed rubric and provided feedback to reviewers as needed to maintain consistency. Resources that were recommended (based upon the EQuIP rubric) for inclusion onto the NASA website were noted.

FINDINGS

After reviewing the 251 resources, **103 (41%) were deemed effectively aligned with NGSS and of high educational quality**. A listing of all accepted resources is included in the Appendix. Exhibit 5 displays the breakdown of the accepted and unaccepted resources by category and reveals that the highest acceptance rate was for Units and the lowest rate was for the Short Activities. The main reason for non-acceptance was poor alignment to NGSS, followed by outdated information.

Exhibit 5. Distribution of Resources

The units were of higher quality than the other categories.

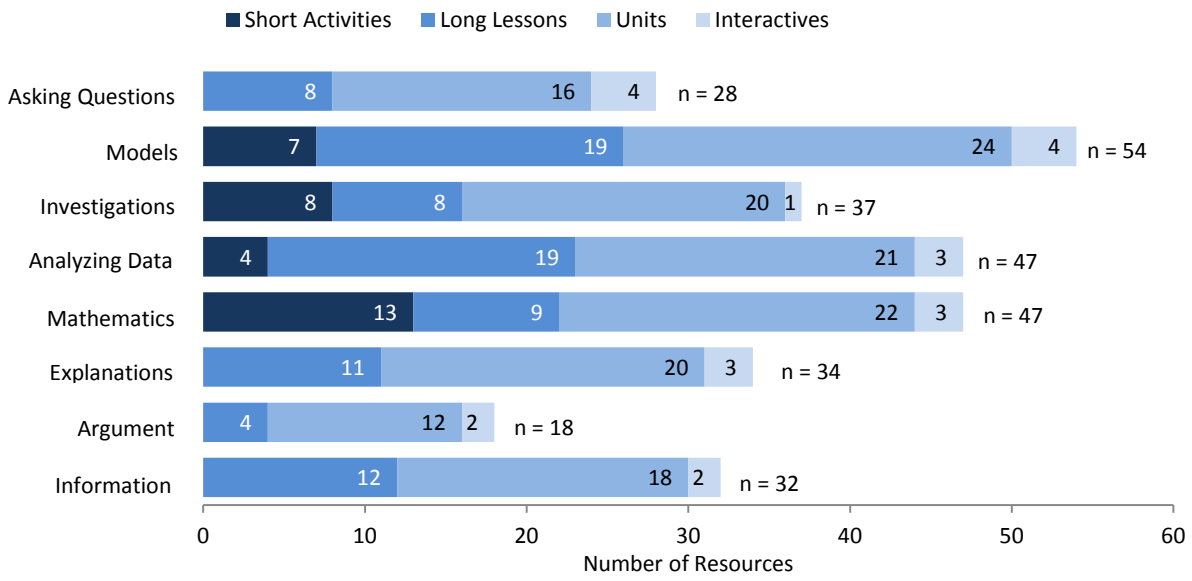


In the following section, we examine how these accepted resources align with NGSS Practices, Crosscutting Concepts, and Disciplinary Core Ideas.

Exhibit 6 reveals that 54 of the accepted resources address the second NGSS Practice of ***developing and using models*** and 47 address the fourth and fifth NGSS Practices of ***analyzing and interpreting data*** and ***using mathematics and computational thinking.*** The first NGSS Practice of ***asking questions and defining problems*** and the seventh NGSS Practice of ***engaging in argument from evidence*** were addressed in less than 30 resources.

Exhibit 6. Number of Accepted Resources by Type and Practice

Models, analyzing data, and mathematics were the most common practice.



Practices:

1: Asking questions (for science) and defining problems (for engineering).
2: Developing and using models.
3: Planning and carrying out investigations.
4: Analyzing and interpreting data.
5: Using mathematics and computational thinking.
6: Constructing explanations (for science) and designing solutions (for engineering).
7: Engaging in argument from evidence.
8: Obtaining, evaluating, and communicating information.

The percentage of resources aligned to the eight practices is presented in Exhibit 7. While NGSS Practices 2, 4, and 5 are met by nearly 50% of the 103 resources, the remaining 5 NGSS Practices are underrepresented.

Exhibit 7. Percentage of Resources Aligned to Each NGSS Practice

Only 1/3rd or fewer resources aligned with Practices 1, 3, 6, 7, and 8.

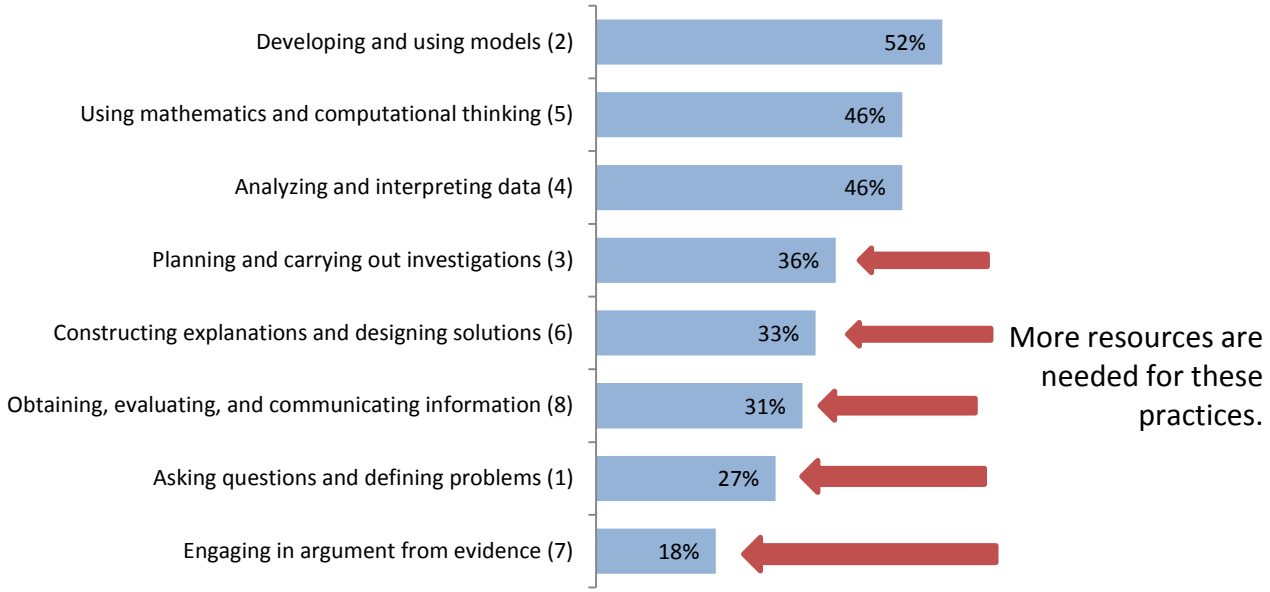
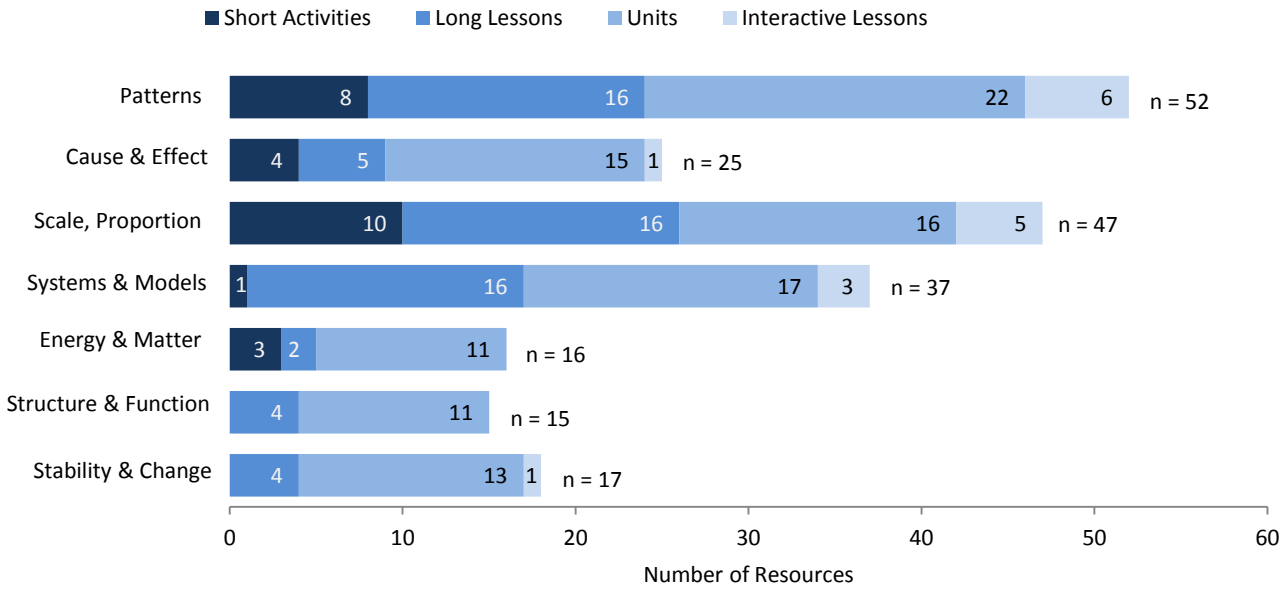


Exhibit 8 displays the number of resources in each grouping category that address the seven Crosscutting Concepts. The first Crosscutting Concept of ***patterns*** was addressed in 52 of the resources and the third Concept of ***scale, proportion, and quantity*** was addressed in 47 resources. However, the fifth, sixth, and seventh Concepts of ***energy and matter***, ***structure and function***, and ***stability and change*** were addressed in 18 or fewer resources.

Exhibit 8. Number of Accepted Resources by Type and Crosscutting Concept

52 resources aligned with the Crosscutting Concept of patterns.



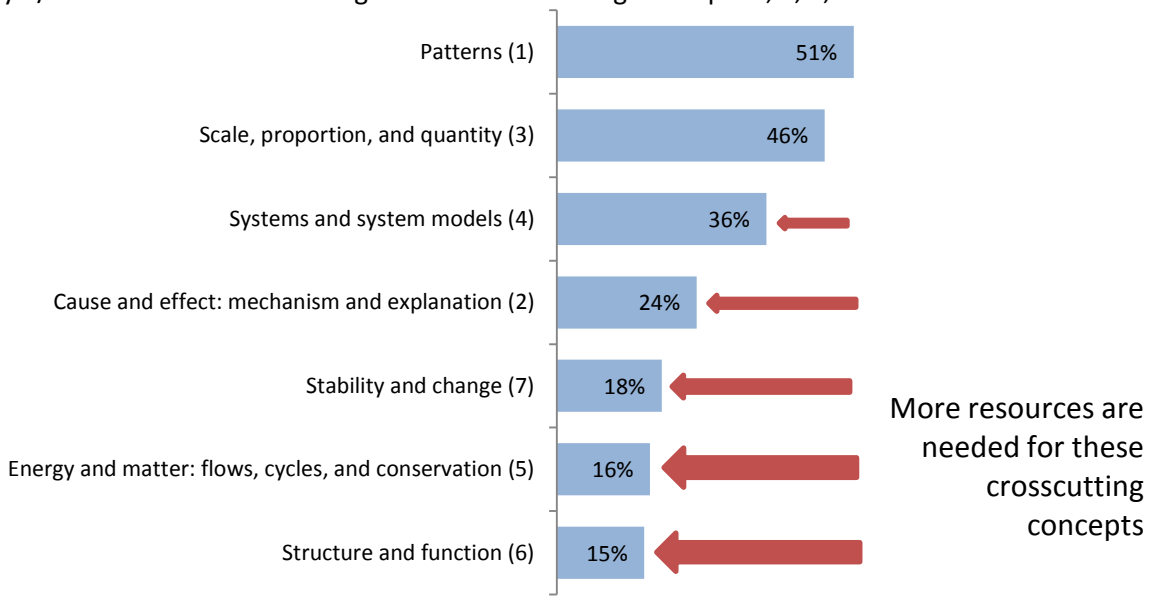
Crosscutting Concepts:

1: Patterns
2: Cause and effect: mechanism and explanation
3: Scale, proportion, and quantity
4: Systems and system models
5: Energy and matter: Flows, cycles and conservation
6: Structure and function
7: Stability and change

As shown in Exhibit 9, an adequate number of resources are available that meet the crosscutting concepts of ***patterns*** and ***scale, proportion and quantity***, but more are needed for the remaining five concepts.

Exhibit 9. Percentage of Resources Aligned to Each NGSS Crosscutting Concept

Only 1/3rd or fewer resources aligned with Crosscutting Concepts 2, 5, 6, and 7.



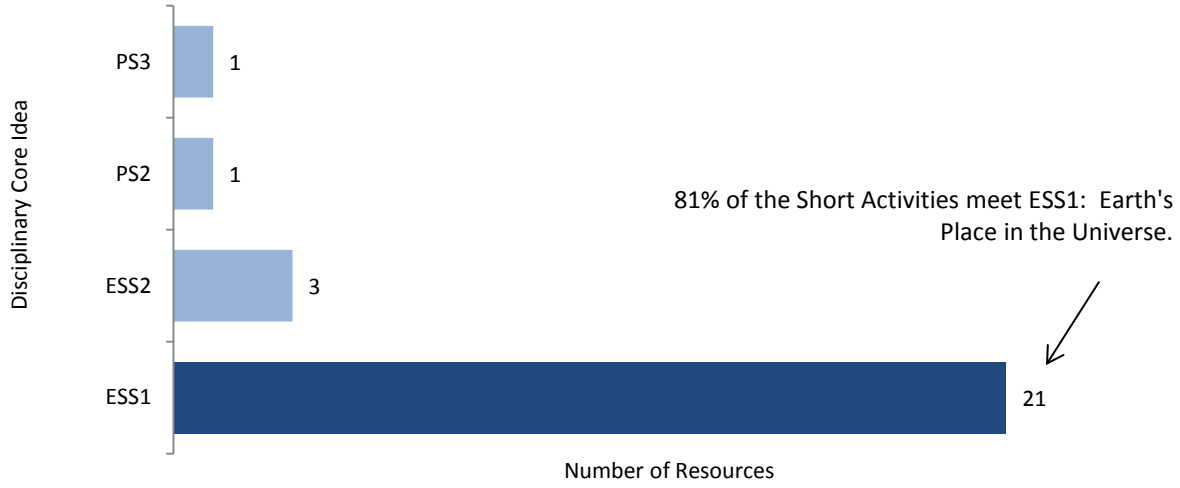
The 103 resources that were selected for inclusion on the NASA website align to one or more of the 11 Disciplinary Core Ideas shown below. On the following page, Exhibits 10 and 11 provide the distribution of DCI alignment by resource category.

Disciplinary Core Ideas:

Earth and Space Science 1 (ESS1): Earth's Place in the Universe
Earth and Space Science 2 (ESS2): Earth's Systems
Earth and Space Science 3 (ESS3): Earth and Human Activity
Physical Science 1 (PS1): Matter and Its Interactions
Physical Science 2 (PS2): Motion and Stability: Forces and Interactions
Physical Science 3 (PS3): Energy
Physical Science 4 (PS4): Waves and their Applications in Technologies for Information Transfer
Life Science 1 (LS1): From Molecules to Organisms: Structures and Processes
Life Science 2 (LS2): Ecosystems: Interactions, Energy, and Dynamics
Life Science 4 (LS4): Biological Evolution: Unity and Diversity
Engineering, Technology, and Applications of Science 1 (ETS1): Engineering Design

Exhibit 10. Distribution of Disciplinary Core Ideas per Resource Category

The 26 Short Activities meet 4 DCIs.



The 38 Long Lessons meet 7 DCIs.

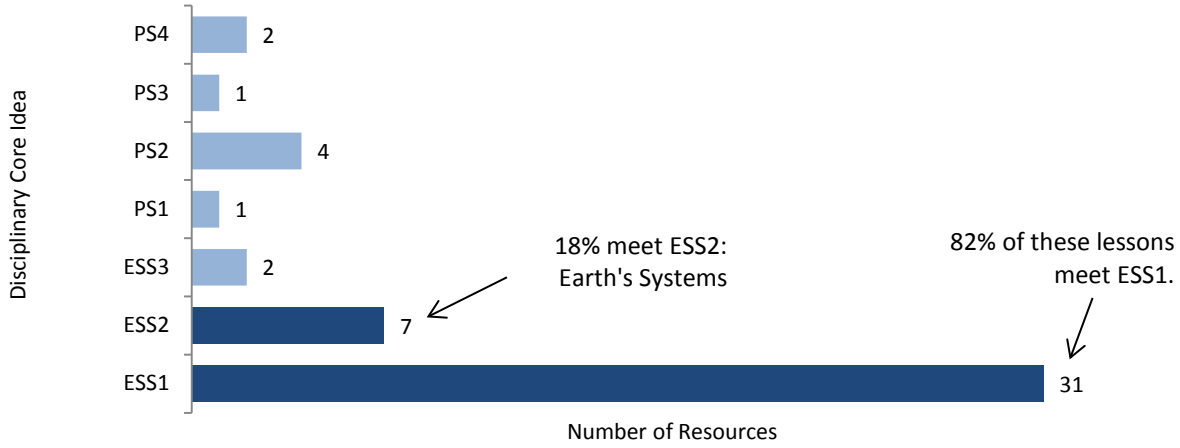
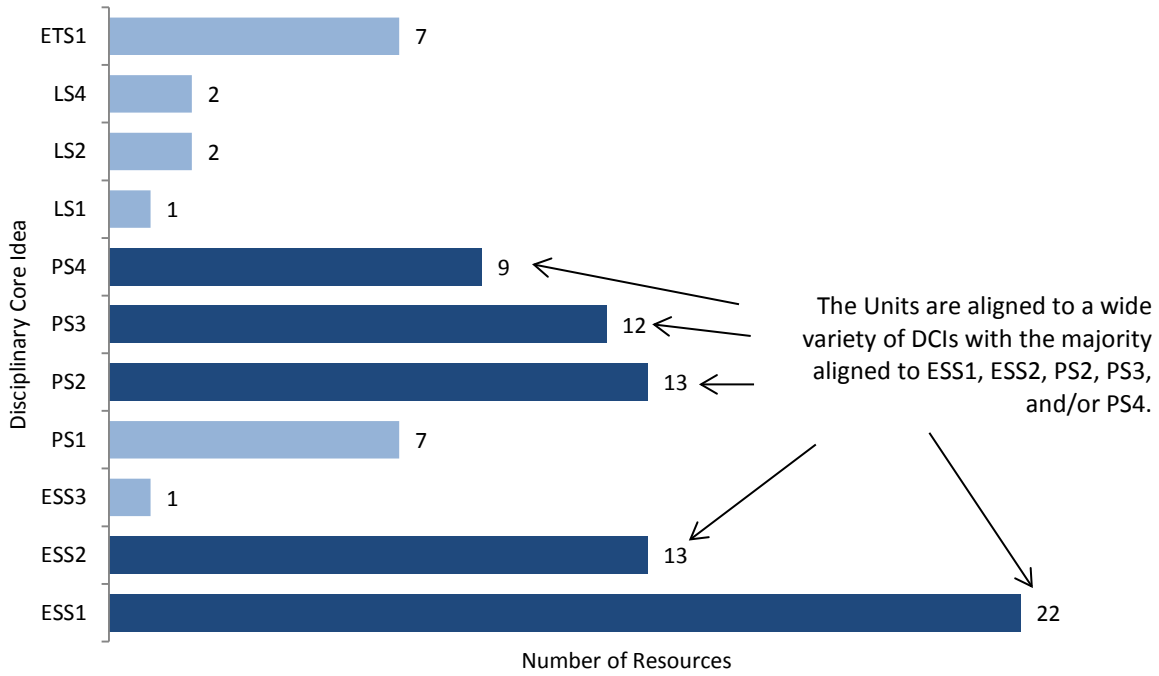


Exhibit 10. Distribution of Disciplinary Core Ideas per Resource Category (cont.)

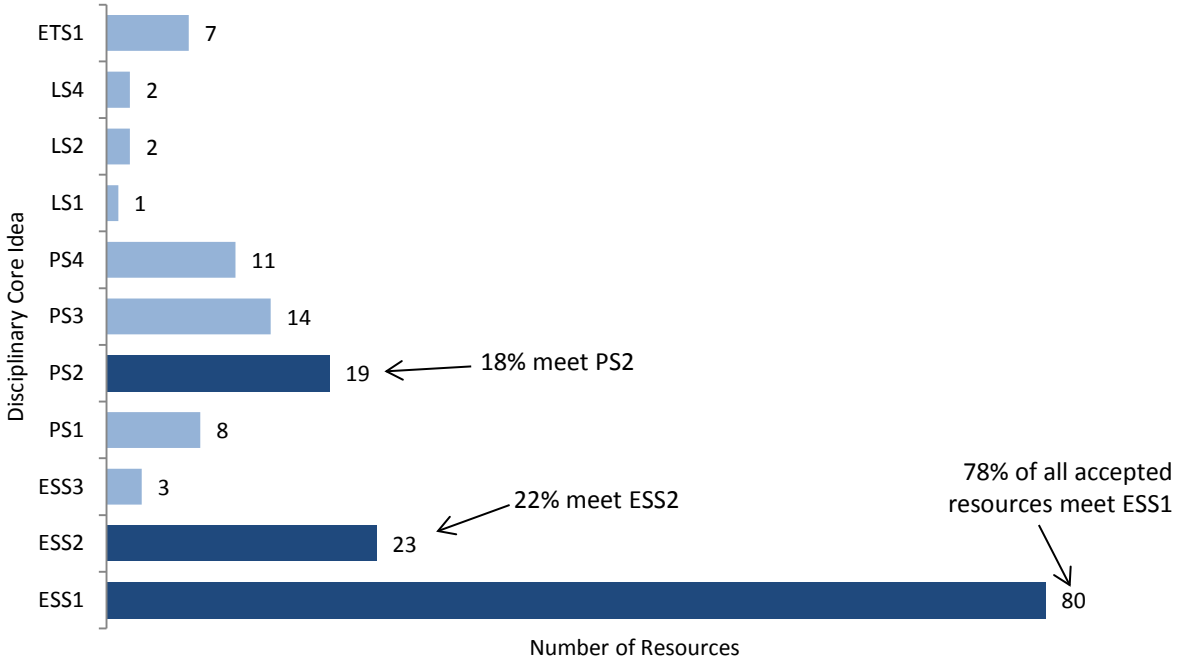
The 32 Units meet 11 DCIs.



The 7 Interactives meet 2 DCIs.

Exhibit 11. Overall Distribution of DCIs

The 103 accepted resources meet 11 DCIs.



Conclusions and Recommendations

Conclusions

RMC Research conducted a review of 251 educational materials that are currently housed on the NASA Solar System website and the *Year of the Solar System* website. It was determined that 41% (103) of the materials were of sufficient quality and proper alignment to NGSS to be considered acceptable for the new NASA education website. These materials, as a whole, align to all of the Earth and Space Science Disciplinary Core Ideas, along with the eight NGSS Practices and seven Crosscutting Concepts.

The 103 accepted resources are fairly evenly distributed among Short Activities, Long Lessons, and Units, but Interactive Lessons are underrepresented. While this is a great start for the website collection, more lessons in each category need to be located or developed with a focus on Interactive Lessons.

The collection of lessons is aligned with all eight NGSS Practices, but only the practices of developing and using models, using mathematics and computational thinking, and analyzing and interpreting data are adequately represented. Additional lessons are needed that meet the remaining five practices.

These lessons also align to all seven NGSS Crosscutting Concepts with 46% meeting the scale, proportion, and quantity concept and 51% meeting the patterns concept. Each of the remaining five Concepts is covered by 36% or fewer of the resources. Locating new lessons that meet these concepts should be a priority.

The alignment of these 103 lessons to the NGSS Disciplinary Core Ideas revealed several gaps that should be addressed. The vast majority (78%) of these lessons are aligned to the first Earth and Space Science DCI of Earth's Place in the Universe (ESS1). Only 22% align to ESS2 and only three lessons align to ESS3. As additional lessons are found or developed, the focus should be on alignment to ESS2 and ESS3.

Recommendations

- Locate or develop more lessons in each resource category, with a stronger focus on Interactive Lessons.
- Locate or develop lessons that meet the NGSS Practices of planning and carrying out investigations; constructing explanations and designing solutions; obtaining, evaluating, and communicating information; asking questions and defining problems; and, engaging in argument from evidence.
- Locate or develop lessons that meet the NGSS Crosscutting Concepts of systems and system models; cause and effect; stability and change; energy and matter; and structure and function.
- Locate or develop lessons that meet the NGSS Earth and Space Science and Physical Science DCIs, with a focus on ESS2 and ESS3.
- Hire a resource manager to locate, develop, and update the lesson collection.

Appendix

Exhibit

A1. Listing of Disciplinary Core Ideas A-1
A2. EQuIP Rubric for Science A-2
A3. Rubric for Short Activities A-6
A4. Tracking of Lessons Reviewed A-7
A5. Resources Accepted With Alignment to NGSS Practices A-13
A6. Resources Accepted With Alignment to NGSS Crosscutting Concepts A-17
A7. Resources Accepted With Alignment to NGSS Disciplinary Core Ideas A-21

Exhibit A1. Listing of Disciplinary Core Ideas

Domain	Disciplinary Core Idea	
Physical Sciences		
	PS1A:	Structure and Properties of Matter
	PS1B:	Chemical Reactions
	PS1C:	Nuclear Processes
	PS2A:	Forces and Motion
	PS2B:	Types of Interactions
	PS3A:	Definitions of Energy
	PS3B:	Conservation of Energy and Energy Transfer
	PS3C:	Relationship Between Energy and Forces
	PS3D:	Energy in Chemical Processes and Everyday Life
	PS4A:	Wave Properties
	PS4B:	Electromagnetic Radiation
	PS4C:	Information Technologies and Instrumentation
Life Sciences		
	LS1A:	Structure and Function
	LS1B:	Growth and Development of Organisms
	LS1C:	Organization for Matter and Energy Flow in Organisms
	LS1D:	Information Processing
	LS2A:	Interdependent Relationships in Ecosystems
	LS2B:	Cycles of Matter and Energy Transfer in Ecosystems
	LS2C:	Ecosystems Dynamics, Functioning and Resilience
	LS2D:	Social Interactions and Group Behavior
	LS3A:	Inheritance of Traits
	LS3B:	Variation of Traits
	LS4A:	Evidence of Common Ancestry and Diversity
	LS4B:	Natural Selection
	LS4C:	Adaptation
	LS4D:	Biodiversity and Humans
Earth and Space Sciences		
	ESS1A:	The Universe and its Stars
	ESS1B:	Earth and the Solar System
	ESS1C:	The History of Planet Earth
	ESS2A:	Earth Materials and Systems
	ESS2B	Plate Tectonics and Large-Scale Systems
	ESS2C:	The Role of Water in Earth's Surface Processes
	ESS2D:	Weather and Climate
	ESS2E:	Biogeology
	ESS3A:	Natural Resources
	ESS3B:	Natural Hazards
	ESS3C:	Human Impacts on Earth Systems
	ESS3D:	Global Climate Change
Engineering, Technology, and Applications of Science		
	ETS1A:	Defining and Delimiting and Engineering Problem
	ETS1B:	Developing Possible Solutions
	ETS1C:	Optimizing the Design Solution

Exhibit A2. EQuIP Rubric for Science

EQuIP Rubric for Lessons & Units: Science

Response Form

Grade Level of Lesson:
Lesson/Unit Title:

I. Alignment to the NGSS

The lesson or unit aligns with the conceptual shifts of the NGSS:

Criteria	Specific Evidence From Materials Under Review	Suggestions for Improvement
Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions. o Provides opportunities to use specific elements of the practice(s) to make sense of the phenomena or design solutions. o Provides opportunities to construct and use specific elements of the disciplinary core idea(s) to make sense of phenomena or design solutions. o Provides opportunities to construct and use specific elements of the crosscutting concept(s) to make sense of phenomena or design solutions.		

A unit or longer lesson:

Criteria	Specific Evidence From Materials Under Review	Suggestions for Improvement
Lessons fit together coherently, build on each other, and help students develop proficiency on a targeted set of performance expectations.		
Develops connections between different science disciplines by the use of crosscutting concepts and develops connections between different science disciplines by using disciplinary core ideas where appropriate.		
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.		

Summary of Observations and Suggestions for Improvement:

II. Instructional Supports

The lesson or unit supports instruction and learning for all students:

Criteria	Specific Evidence From Materials Under Review	Suggestions for Improvement
Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world and that provide students with a purpose (e.g., making sense of phenomena or designing solutions). o Provides students with multiple phenomena (either firsthand experiences or through representations) that support students in engaging in the practices. o Engages students in multiple practices that blend and work together with disciplinary core ideas and crosscutting concepts to support students in making sense of phenomena or designing solutions. o When engineering performance expectations are included, they are used along with disciplinary core ideas from physical, life, or earth and space sciences.		
Develops deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts by identifying and building on students' prior knowledge.		
Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning.		
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 to support student's three-dimensional learning.		
Provides guidance for teachers to support differentiated instruction in the classroom so that every student's needs are addressed by: o Connecting instruction to the students' home, neighborhood, community and/or culture as appropriate. o Providing the appropriate reading, writing, listening, and/or speaking modifications (e.g., translations, front loaded vocabulary word lists, picture support, graphic organizers) for students who are English language learners, have special needs, or read well below the grade level. o Providing extra support for students who are struggling to meet the performance expectations. o Providing extensions consistent with the learning progression for students with high interest or who have already met the performance expectations.		

A unit or longer lesson:

Criteria	Specific Evidence From Materials Under Review	Suggestions for Improvement
Provides guidance for teachers throughout the unit for how lessons build on each other to support students developing deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts over the course of the unit.		

Summary of Observations and Suggestions for Improvement:

III. Monitoring Student Progress

The lesson or unit supports monitoring student progress:

Criteria	Specific Evidence From Materials Under Review	Suggestions for Improvement
Assessments are aligned to the three-dimensional learning.		
Elicits direct, observable evidence of students' performance of practices connected with their understanding of core ideas and crosscutting concepts.		
Formative assessments of three-dimensional learning are embedded throughout the instruction.		
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.		
Assessing student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students.		

A unit or longer lesson:

Criteria	Specific Evidence From Materials Under Review	Suggestions for Improvement
Includes pre-, formative, summative, and self-assessment measures that assess three-dimensional learning.		
Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback.		

Summary of Observations and Suggestions for Improvement:

Overall Summary Comments:

Exhibit A3. Rubric for Short Activities

Rubric for Short Activity or Other Materials

Reviewer Name:
Name of Activity/Material (include tracking #):
Grade Level of Activity/Material:
Content Strand the Activity/Material Addresses:

Element	Specific Number or Label	Evidence to Support Inclusion of Element(s)	Suggestions for Improvement
Disciplinary Core Idea(s)			
Science and Engineering Practice(s)			
Crosscutting Concept(s)			
Overall Thoughts:			
Included in small activity/materials section (Yes or No and Why?):			

Exhibit A4. Tracking of Lessons Reviewed (*N* = 251)

Lesson Number	Name of Lesson/Unit	Type of Lesson S = Short; L = Long; U = Unit; I = Interactive	Include on Website
2	A Case of the Wobbles	U	No
3	Active Accretion	L	No
4	Air Quality at Earth Observatory	S	No
5	All About Ice	U	Yes
6	An Ocean Below Enceladus' Icy Crust	S	No
7	AstroVenture: Search for and Design a Habitable Planet	I	Yes
8	Auroral Magnetism from the Ground (Activity 7)	S	No
9	Best of the Solar System	L	No
10	Build a Solar System	I	No
11	Cake Batter Lava	S	Yes
12	Candy Gas Giants	S	No
13	Carbon Dioxide Increases	S	No
14	Changes Inside Planets (Differentiation and Breakup)	L	No
15	Changing Theories about Mars	S	No
16	Changing Theories for the Origin of the Moon	S	No
17	Cooling Planets	L	No
18	Cosmic Chemistry: Planetary Diversity	L	Yes
19	Counting Sunspots	S	No
20	Crash Landing!	L	No
21	Dance of the Moon and Oceans	L	Yes
22	Dancing Lights	L	No
23	Desert RATS Teacher Site Selection	L	Yes
24	Design Challenge: How do you keep things from getting too hot?	U	Yes
25	Detecting Planet Transits	L	No
26	Differentiation Demonstration: Moon	L	No
27	Dirty Ice or Icy Dirt	L	No
28	Discover Earth: Hands-on Activities	U	No
29/30	Discoveries in Planetary Science Slide Sets	S	No
31	Discovering Earth-like Worlds by their Color	S	No
32/33	Discovering Plate Boundaries	L	Yes
34	DPS Slide Set: A Sunlit Lake on Titan	S	No
35	DPS Slide Set: Venus May Have Active Volcanism	S	No
36	DPS Slide Set: Volcanos on Mercury	S	No
37/68/72/73/122	Jupiter's Family Secrets: 37. Dunking the Planets; 68. Investigating the Insides; 72. Jump to Jupiter; 73. Weather Stations; 122. Solar System in my Neighborhood	U	Yes
38	Dwarf Planets as a New Way of Thinking About an Old Solar System	L	Yes
39	Earth-sized Planets by the Score!	S	No
40	Eclipsing the Sun	S	No
41/42	Egg Drop Lander	S	No
43	Estimating the Temperatures of Exoplanets	S	No

Lesson Number	Name of Lesson/Unit	Type of Lesson S = Short; L = Long; U = Unit; I = Interactive	Include on Website
44	Evaporation Investigation	U	No
45	Exoplanet Orbits and the Properties of Ellipses	S	No
46	Exploring Crustal Materials from a Mystery Planet	L	No
47/271	Exploring Ice in the Solar System: Unit 1: Voyages	U	Yes
	Exploring Ice in the Solar System: Unit 2: The Voyage Continues	U	Yes
	Exploring Ice in the Solar System: Unit 3	U	Yes
48	Exploring Meteorite Mysteries: Lesson 10 – Building Blocks of Planets	U	Yes
49	Exploring Origins	L	Yes
50	Exploring the Earth's Magnetic Field	U	Yes
51	Exponential Functions and the Atmosphere	S	No
52	Finding the Distance to the Sun	L	No
53	Flexing Muscles and Moons	L	Yes
54	Fundamentals of Lunar Exploration: The Search for Lunar Ice	U	No
55	Gelatin Volcanoes	S	No
56	Getting a Feel for Gravity	L	No
57	Goldilocks and the Three Planets	L	Yes
58	Gravitation 3.8	I	Yes
59	Gravity Induced Tides: It's What Pushes Us Apart	S	No
60	Great Red Spot Pinwheel	L	No
61/144	Heavyweight Champion: Jupiter & The Pull of the Planets	U	Yes
62	How Low Can You Go	L	No
63	How Much Would You Weigh on Distant Planets	S	Yes
64	Ice in the Solar System	U	Yes
65	In the Footsteps of Galileo: Observing the Moons of Jupiter	L	Yes
66	Inside Mars – Puzzling Patterns – Where Does Volcanism Occur?	L	Yes
67	Investigating the Atmosphere of Super-Earth GJ1214b	S	No
69	Investigating the Martian Polar Caps	L	No
70	Invisible Collisions	U	No
71	It's Just a Phase: Water as a Solid, Liquid, and Gas	L	No
74	Kepler Spies Five New Planets	S	No
75	Kepler Star Wheel	L	No
76/77	Kepler's First Look at Transiting Planets	L	No
78	Live from the Hubble Space Telescope	U	No
79	Lunar Nautics: Designing a Mission to Live and Work	U	No
80	Magnetic Globe	S	No
81	Magnetic Math	U	Yes
82	Magnetic Sensor Measurements with a Graphing Calculator	L	Yes
83	Magnetism and Electromagnetism	U	Yes
84	Make a Mission	I	No
85	Make the Itty Bitty Radio Telescope	S	No
86	Making a Comet in the Classroom	L	No
87	Making a Sun Clock	L	No
88	Making and Mapping a Volcano	L	Yes

Lesson Number	Name of Lesson/Unit	Type of Lesson S = Short; L = Long; U = Unit; I = Interactive	Include on Website
89	Mapping Magnetic Influence	U	Yes
90	Mars Pathfinder Egg Drop and Landing	L	No
91	Mars Robotics Activities	U	Yes
92	Matching Magnetic Activity and Active Regions	S	No
93/94/95	Measuring the Diameter of our Star – Spreadsheet, Student Brief, and Teacher Notes	S	No
96	Microgravity in the Classroom	L	Yes
97	Mission Design	U	Yes
98	MoonKAM	I	No
99	Morning Star and Evening Star	S	Yes
100/156	My NASA Data Lessons	I	No
101	New Horizons: Orbit and Spin	U	No
102	Observing Where the Sun Sets	S	Yes
103	Observing, Describing, and Identifying Clouds	L	No
104	On the Moon	U	Yes
105	Orbits of Jupiter's Moons and Kepler's 3rd Law	L	No
106	Out of Sight Remote Vehicle Activity	U	No
107	Planetary Billiards	U	No
108	Plasma Wars	L	Yes
109	Possible Water World at 40 Light Years	S	No
110	Reading, Writing, and Rings	U	Yes
111	Remote Sensing Ices on Mars	U	No
112	Rivers on Mars	L	No
113	Rock Star Precipitation	I	No
114	Rockets	U	Yes
115	S'COOL Lesson Plans	U	No
116	Scale Model of Sun and Earth	S	No
117	Schoolyard Solar System	I	No
118	Scratching the Surface – Carving Channels	S	No
119	Search for Extrasolar Planets	S	No
120	Searching for Protoplanetary Disks	U	No
121	Solar Math	U	Yes
123	Solar System Math	U	No
124	Solarscapes Activities	U	No
125	Space Math: Ice on Mercury?	S	Yes
126	Space Math: LRO Makes a Temperature Map of the Lunar South Pole	S	Yes
127	Space Weather Action Center	U	Yes
128	SpaceMath: Planet Kepler – 10b: A Matter of Gravity	S	Yes
129	SpaceMath: The Transit of Mercury	S	Yes
130	Spinning Does More than Make You Dizzy	S	Yes
131	Strange New Planet	L	Yes
132	Structure and Properties of Matter: Ion Propulsion Module	U	Yes
133	Summit Up – Comparing Volcanoes on Mars and Earth	S	Yes
134	Tales of...Dust Storms Seen on Mars	S	No
135	Terrabagga Activity Using a Magnetometer	L	No

Lesson Number	Name of Lesson/Unit	Type of Lesson S = Short; L = Long; U = Unit; I = Interactive	Include on Website
136	The Changing Atmosphere of Pluto	S	No
137	The Classroom Magnetometer	L	No
138	The Dawn Mission – Ion Rockets and Spiral Orbits	S	No
139	The Earth-like Planet Gilese 518g	S	Yes
140	The Goldilocks Principle: A Model of Atmospheric Gases	L	Yes
141	The Magnetometer	U	No
142	The Orbit Simulator	I	Yes
143	The Period of Io and the Mass of Jupiter	Could not be located	
145	The Solar Wind Tunnel: A Comet Borrelly Interactive	I	No
146	The Thousand Yard Model	L	Yes
147	The Voyage Scale Model Solar System	L	No
148	The Water Cycle – Now You See it, Now You Don't	L	Yes
149	Time Lineup	L	Yes
150	Tracking a Solar Storm	L	No
151/152	Tracking Sunspots: Using Real Data from SOHO – English and Spanish version	S	No
154	Transit Math	U	No
155	Transit Tracks	L	Yes
157	Virtual Venus	I	No
158	Volcanos are a Blast: Working with Simple Equations	S	Yes
159/193	Water Found on the Moon	S	No
160	Water Quality at Earth Observatory	S	No
161	What are we Made Of? The Sun, the Earth, and You	L	Yes
162	What is a Planet?	U	Yes
163	What Makes Day and Night? The Earth's Rotation	L	Yes
164	What Makes Shadows? Observing and Drawing Shadows	L	Yes
165	What's the Difference?	I	Yes
166	Where are the Distant Worlds? Star Maps	L	Yes
167	Why Follow the Water?	L	No
168	Are we Related? Looking for Patterns in Planetary Diversity	S	No
169	3-2-1 Lift Off	U	No
170	A Grapefruit Saturn	L	No
171	Alka-Seltzer Rocket	S	Yes
172	Analyzing Elemental Abundances	L	No
173	Boiling Water Below its Boiling Point	L	No
174	Building Blocks of Planets (Accretion)	U	No
175	Can Photosynthesis Occur at Saturn?	L	No
176	Cassini Robot	L	No
177	Comet Cratering	L	No
178	Comet Lingo Bingo	L	No
179	Comet on a Stick	L	No
180	Comet Sisters	L	No
181	Comets: Very Eccentric Characters	L	No
182	Comparing Comets	I	Yes
183	Cooking Up a Comet	U	No

Lesson Number	Name of Lesson/Unit	Type of Lesson S = Short; L = Long; U = Unit; I = Interactive	Include on Website
184	Cosmic Chemistry: An Elemental Question	I	Yes
185	Creature Feature	L	No
186	Designer Genes for a Designer World	U	No
187	Designing Craters: Creating a Deep Impact	U	Yes
188	Detecting Extrasolar Planets	L	Yes
189	Does the Moon Rotate?	S	Yes
190	DPS Slide Set: Another Impact on Jupiter	S	No
191	DPS Slide Set: Asteroid Detected Before Impact	S	No
192	DPS Slide Set: One Moon (Phoebe) Coats its Neighbor (Iapetus) in Dust	S	No
194	Earth-Moon Activity	U	Yes
195	Earth, Earth's Moon, Mars Balloons	U	No
196	Edible Cassini Spacecraft	L	No
197	Exploring Comets and Modeling for Mission Success	U	Yes
198	Exploring Lunar Phases with a Daytime Moon	S	Yes
199	Exploring Meteorite Mysteries	U	No
200	Exploring the Moon	L	No
201	Follow the Falling Meteorite	U	Yes
202	Geologic Landforms Seen on Aerial Photos	L	Yes
203	Globe Visualization Student Activities – Atmosphere Unit	U	Yes
	Globe Visualization Student Activities – Soil Unit	U	Yes
204	Golfball Phases and Eclipses	S	Yes
205	Habitable Planets	L	No
206	How Much Rock is in an Icy Moon?	L	No
207	How to Make a Saturn Model	L	No
208	Impact Cratering	L	No
209	Interstellar Real Estate – Defining the Habitable Zone	U	Yes
210	Is there Liquid Water on Mars?	U	Yes
211	It's Just Right	L	No
212	Kinesthetic Lunar Rotation/Revolution	L	No
213	Lava Layering	L	No
214	Let's Investigate Mars Activity	L	Yes
216	Mars Activity Book	U	Yes
217	Mars Student Imaging Project	U	Yes
218	Mars Uncovered	L	Yes
219	Marsbound! Mission to the Red Planet	L	Yes
220	Measuring Solar Activity	U	No
221	Meteorite Investigators	S	No
222	Methane Lakes on Titan	S	Yes
223	Modeling Asteroid Vesta in 3-D	S	No
224	Mystery Planet	L	No
225	Observing Jupiter's Moons	I	Yes
226	Observing the Moon	L	Yes
227	Oreo Moon Phases	S	No
228/153	Paper Plate Education: Transit Frequency	L	Yes
229	People of the Cassini Team	L	No

Lesson Number	Name of Lesson/Unit	Type of Lesson S = Short; L = Long; U = Unit; I = Interactive	Include on Website
230	Planetary Geology #4 Impact Cratering	L	Yes
231	Planetary Geology #5 Comparative Cratering	L	No
232	Olay-Doh Venus Volcanoes	S	No
234/259	Quarter Earth and Penny Moon	S	Yes
235	Remote Sensing- What Can We See When We Can't Touch?	U	No
236	Rover Races	L	No
237	Sand or Rock	L	No
238	Scattering: Seeing the Microscopic Among the Giants	L	No
239	Seeing the Moon: Using Light to Investigate the Moon Educator Activities	U	No
240	Snow Goggles and Limited Sunlight	L	No
241	So…How big is it? – Asteroid Eros surface	S	Yes
242	Soda Straw Rockets	S	No
243	Solar System Lithograph Set	S	Yes
244	SpaceMath: Close Encounters of the Asteroid Kind!	S	Yes
245	SpaceMath: Meteorite Compositions: A Matter of Density	S	Yes
246	SpaceMath: NASA-funded research discovers life built with toxic chemical	S	Yes
247	Splat!	S	No
248	Stardust Mission #1 – think small in a big way	L	Yes
249	Summer Science Program	S	No
250	Tales of…the hunt for life on other worlds	L	No
251	Teaching with Story and Song	S	No
252	The Aster's Hoity Toity Belt	L	No
253	The Drake Equation – Estimating the number of civilizations in the Milky Way galaxy	U	No
254	The Goldilocks Planets – Not too hot or cold	S	Yes
255	The History and Discovery of Asteroids	U	Yes
256	The Hunt for Micrometerorites	L	Yes
257	The Moons of Jupiter	L	Yes
258	The Oldest Lunar Rocks	S	Yes
260	The Rare Earth – How Rare is Earth-like Life?	U	Yes
261	The Science Detectives	U	No
262/215/233	The SETI Academy Planet Project	U	Yes
263	Tricky Terrains	L	No
264	Unlocking the Mysteries: Science on the Edge of Our Solar System	L	Yes
265	Unveiling Titan's Surface	L	Yes
266	Using Spectral Data to Explore Saturn and Titan	Could not be located	
267	Vegetable Light Curves	L	Yes
268	Venus Topography Box	L	No
269	Vesta Flipbook	S	No
270	Virtual Microscope	S	No
272	Who Can Live Here: Life in Extreme Environments	U	No
273	Why do Eclipses Happen?	S	Yes

Exhibit A5. Resources Accepted With Alignment to NGSS Practices

		NGSS Practices							
Lesson Number	Name	1	2	3	4	5	6	7	8
5	All about Ice	X		X			X		X
7	AstroVenture: Search for and Design a Habitable Planet	X					X		
11	Cake Batter Lava				X				
18	Cosmic Chemistry: Planet Diversity				X				
21	Dance of the Moon and Oceans		X						
23	Desert RATS			X	X	X	X	X	X
24	Design Challenge: How do you keep things from getting too hot?	X	X	X	X	X	X		
32/33	Discovering Plate Boundaries				X				
37/68/72/73/122	Jupiter's Family Secrets		X						
38	Dwarf Planets				X				X
47	Exploring Ice in the Solar System	X	X	X	X	X	X	X	X
48	Exploring Meteorite Mysteries		X				X		X
49	Exploring Origins	X		X	X				X
50	Exploring the Earth's Magnetic Field		X	X	X	X			X
53	Flexing Muscles and Moons		X		X	X	X		
57	Goldilocks and the Three Planets				X	X		X	
58	Gravitation 3.8		X						
61/144	Heavyweight Champion: Jupiter/The Pull of the Planets		X	X	X	X	X		X
63	How Much Would You Weigh on Distant Planets				X				
64	Ice in the Solar System		X	X					X
65	In the Footsteps of Galileo	X	X						
66	Inside Mars – Puzzling Patterns		X		X		X		
81	Magnetic Math					X			
82	Magnetic Sensor Measurements with a Graphing Calculator			X	X	X			
83	Magnetism and Electromagnetism		X		X			X	X
88	Making and Mapping a Volcano		X		X		X		
89	Mapping Magnetic Influence		X	X	X		X		
91	Mars Robotic Activities	X	X	X	X	X	X	X	
96	Microgravity in the Classroom	X	X						
97	Mission Design	X	X		X	X	X	X	X
99	Morning Star and Evening Star			X					
102	Observing Where the Sun Sets			X					

		NGSS Practices							
Lesson Number	Name	1	2	3	4	5	6	7	8
104	On the Moon		X		X		X		
108	Plasma Wars		X	X					X
110	Reading, Writing, and Rings	X	X	X	X		X		X
114	Rockets	X	X	X	X	X	X		
121	SpaceMath: Solar Math				X	X			
125	SpaceMath: Ice on Mercury?					X			
126	SpaceMath: LRO Makes a Temperature Map of the Lunar South Pole					X			
127	Space Weather Action Center	X	X	X	X	X	X	X	X
128	SpaceMath: Planet Kepler – 10.b: A Matter of Gravity					X			
129	SpaceMath: The Transit of Mercury					X			
130	Spinning Does more than Make You Dizzy		X						
131	Strange New Planet	X	X	X					X
132	Structure and Properties of Matter: Ion Propulsion Module		X						X
133	Summit Up – Comparing Volcanoes on Mars and Earth		X						
139	The Earth-like Planet Gilese 518g				X	X			
140	The Goldilocks Principle: A Model of Atmospheric Gases		X		X	X			
142	The Orbit Simulator		X		X		X		
146	The Thousand Yard Model		X			X			
148	The Water Cycle – Now You See it, Now You Don't		X	X	X			X	
149	Time Lineup		X						
155	Transit Tracks		X		X	X	X		X
158	Volcanos are a Blast: Working with Simple Equations					X			
161	What are we Made Of? The Sun, the Earth, and You		X		X		X		
162	What is a Planet?				X			X	
163	What Makes Day and Night? The Earth's Rotation	X	X	X					
164	What Makes Shadows? Observing and Drawing Shadows	X							X
165	What's the Difference?					X			
166	Where are the Distant Worlds? Star Maps						X		X
171	Alka-Seltzer Rocket			X	X				
182	Comparing Comets	X					X		
184	Cosmic Chemistry: An Elemental Question	X	X		X	X		X	X
187	Designing Craters	X	X	X	X	X	X	X	X
188	Detecting Extrasolar Planets		X						
189	Does the Moon Rotate?		X	X					

		NGSS Practices							
Lesson Number	Name	1	2	3	4	5	6	7	8
194	Earth-Moon Activity		X				X		
197	Exploring Comets and Modeling for Mission Success		X						
198	Exploring Lunar Phases with a Daytime Moon		X	X					
201	Follow the Falling Meteorite					X			
202	Geologic Landforms Seen on Aerial Photos				X		X		
203	Globe Visualization – Atmosphere and Soil Unit	X		X	X	X	X	X	X
204	Golf ball Phases and Eclipses		X	X					
209	Interstellar Real Estate – Defining the Habitable Zone		X			X		X	X
210	Is there Liquid Water on Mars?			X					
214	Let's Investigate Mars Activity	X		X					
216	Mars Activity Book	X	X	X	X	X	X	X	X
217	Mars Student Imaging Project	X		X	X	X			
218	Mars Uncovered				X		X	X	
219	Marsbound! Mission to the Red Planet	X							X
222	Methane Lakes on Titan					X			
225	Observing Jupiter's Moons	X	X	X	X	X	X	X	X
226	Observing the Moon				X				
228/153	Paper Plate Education: Transit Frequency					X			
230	Planetary Geology #4: Impact Cratering					X	X		
234/259	Quarter Earth and Penny Moon		X	X					
241	So…How Big is it? Asteroid Eros Surface					X			
243	Solar System Lithograph Set				N/A				
244	SpaceMath: Close Encounters of the Asteroid Kind!					X			
245	SpaceMath: Meteorite Compositions					X			
246	SpaceMath: NASA-funded research discovers life built with toxic chemical					X			
248	Stardust Mission #1 – think small in a big way		X				X		X
254	The Goldilocks Planets – Not too hot or cold					X			
255	The History and Discovery of Asteroids					X			
256	The Hunt for Micrometeorites								X
257	The Moons of Jupiter				X				
258	The Oldest Lunar Rocks					X			
260	The Rare Earth – How Rare is Earth-like Life?					X			
262/215/233	The SETI Academy Planet Project	X	X	X	X	X	X	X	

		NGSS Practices							
Lesson Number	Name	1	2	3	4	5	6	7	8
264	Unlocking the Mysteries: Science on the Edge of Our Solar System								X
265	Unveiling Titan's Surface		X		X				
267	Vegetable Light Curves		X						
273	Why do Eclipses Happen?		X	X					

Practices: 1 = asking questions and defining problems; 2 = developing and using models; 3 = planning and carrying out investigations; 4 = analyzing and interpreting data; 5 = using mathematics and computational thinking; 6 = constructing explanations and designing solutions; 7 = engaging in argument from evidence; and 8 = obtaining, evaluating, and communicating information.

Exhibit A6. Resources Accepted With Alignment to NGSS Crosscutting Concepts

		NGSS Crosscutting Concepts						
Lesson Number	Name	1	2	3	4	5	6	7
5	All about Ice		X		X			X
7	AstroVenture: Search for and Design a Habitable Planet		X					
11	Cake Batter Lava			X				
18	Cosmic Chemistry: Planet Diversity	X						
21	Dance of the Moon and Oceans				X			
23	Desert RATS			X				
24	Design Challenge: How do you keep things from getting too hot?	X		X	X	X	X	
32/33	Discovering Plate Boundaries					X		
37/68/72/73/122	Jupiter's Family Secrets			X	X		X	
38	Dwarf Planets	X						
47	Exploring Ice in the Solar System	X	X	X	X	X	X	X
48	Exploring Meteorite Mysteries	X	X				X	
49	Exploring Origins	X						
50	Exploring the Earth's Magnetic Field	X	X	X				
53	Flexing Muscles and Moons		X		X			
57	Goldilocks and the Three Planets	X	X				X	
58	Gravitation 3.8	X		X	X			
61/144	Heavyweight Champion: Jupiter/The Pull of the Planets	X		X	X			
63	How Much Would You Weigh on Distant Planets		X					
64	Ice in the Solar System	X	X		X			X
65	In the Footsteps of Galileo	X			X			
66	Inside Mars – Puzzling Patterns	X	X				X	
81	Magnetic Math					X		
82	Magnetic Sensor Measurements with a Graphing Calculator		X					
83	Magnetism and Electromagnetism		X	X	X			
88	Making and Mapping a Volcano			X				X
89	Mapping Magnetic Influence	X	X				X	
91	Mars Robotic Activities		X	X	X	X		
96	Microgravity in the Classroom	X		X	X			
97	Mission Design	X	X					
99	Morning Star and Evening Star	X						
102	Observing Where the Sun Sets	X						

		NGSS Crosscutting Concepts						
Lesson Number	Name	1	2	3	4	5	6	7
104	On the Moon		X	X	X	X		
108	Plasma Wars	X		X	X	X		
110	Reading, Writing, and Rings			X	X			
114	Rockets		X		X		X	X
121	SpaceMath: Solar Math	X		X		X		X
125	SpaceMath: Ice on Mercury?			X				
126	SpaceMath: LRO Makes a Temperature Map of the Lunar South Pole			X				
127	Space Weather Action Center	X				X		X
128	SpaceMath: Planet Kepler – 10.b: A Matter of Gravity				X	X		
129	SpaceMath: The Transit of Mercury			X				
130	Spinning Does more than Make You Dizzy		X					
131	Strange New Planet				X		X	
132	Structure and Properties of Matter: Ion Propulsion Module	X					X	
133	Summit Up – Comparing Volcanoes on Mars and Earth	X						
139	The Earth-like Planet Gilese 518g		X					
140	The Goldilocks Principle: A Model of Atmospheric Gases			X	X			
142	The Orbit Simulator	X		X	X			
146	The Thousand Yard Model			X	X			
148	The Water Cycle – Now You See it, Now You Don't	X			X			
149	Time Lineup							X
155	Transit Tracks			X	X			
158	Volcanos are a Blast: Working with Simple Equations					X		
161	What are we Made Of? The Sun, the Earth, and You			X	X			
162	What is a Planet?	X					X	
163	What Makes Day and Night? The Earth's Rotation	X			X			
164	What Makes Shadows? Observing and Drawing Shadows				X			
165	What's the Difference?	X		X				
166	Where are the Distant Worlds? Star Maps	X		X				
171	Alka-Seltzer Rocket		X					
182	Comparing Comets	X						
184	Cosmic Chemistry: An Elemental Question	X		X				
187	Designing Craters	X	X			X		
188	Detecting Extrasolar Planets	X		X				
189	Does the Moon Rotate?	X						

		NGSS Crosscutting Concepts						
Lesson Number	Name	1	2	3	4	5	6	7
194	Earth-Moon Activity			X	X			
197	Exploring Comets and Modeling for Mission Success				X			
198	Exploring Lunar Phases with a Daytime Moon	X						
201	Follow the Falling Meteorite	X						
202	Geologic Landforms Seen on Aerial Photos	X	X					
203	Globe Visualization – Atmosphere and Soil Unit	X					X	X
204	Golf ball Phases and Eclipses	X						
209	Interstellar Real Estate – Defining the Habitable Zone			X				
210	Is there Liquid Water on Mars?	X						X
214	Let's Investigate Mars Activity							X
216	Mars Activity Book	X	X	X	X	X	X	X
217	Mars Student Imaging Project	X						
218	Mars Uncovered	X					X	
219	Marsbound! Mission to the Red Planet				X			
222	Methane Lakes on Titan			X				
225	Observing Jupiter's Moons	X		X	X			X
226	Observing the Moon	X						
228/153	Paper Plate Education: Transit Frequency			X				
230	Planetary Geology #4: Impact Cratering			X				
234/259	Quarter Earth and Penny Moon	X						
241	So…How Big is it? Asteroid Eros Surface			X				
243	Solar System Lithograph Set				N/A			
244	SpaceMath: Close Encounters of the Asteroid Kind!					X		
245	SpaceMath: Meteorite Compositions			X				
246	SpaceMath: NASA-funded research discovers life built with toxic chemical			X				
248	Stardust Mission #1 – think small in a big way			X				
254	The Goldilocks Planets – Not too hot or cold			X				
255	The History and Discovery of Asteroids				X			
256	The Hunt for Micrometeorites			X				
257	The Moons of Jupiter			X				
258	The Oldest Lunar Rocks			X				
260	The Rare Earth – How Rare is Earth-like Life?					X		X
262/215/233	The SETI Academy Planet Project	X	X	X		X		X

		NGSS Crosscutting Concepts						
Lesson Number	Name	1	2	3	4	5	6	7
264	Unlocking the Mysteries: Science on the Edge of Our Solar System				X			
265	Unveiling Titan's Surface			X				
267	Vegetable Light Curves				X			
273	Why do Eclipses Happen?	X						

Crosscutting Concepts: 1 = patterns; 2 = cause and effect: mechanism and explanation; 3 = scale, proportion, and quantity; 4 = systems and system models; 5 = energy and matter: flows, cycles, and conservation; 6 = structure and function; 7 = stability and change.

Exhibit A7. Resources Accepted With Alignment to NGSS Disciplinary Core Ideas

		NGSS Disciplinary Core Ideas										
Lesson Number	Name	ESS1	ESS2	ESS3	PS1	PS2	PS3	PS4	ETS1	LS1	LS2	LS4
5	All about Ice				X							
7	AstroVenture: Search for and Design a Habitable Planet	X										
11	Cake Batter Lava		X									
18	Cosmic Chemistry: Planet Diversity	X										
21	Dance of the Moon and Oceans	X										
23	Desert RATS	X	X									
24	Design Challenge: How do you keep things from getting too hot?				X		X	X	X			
32/33	Discovering Plate Boundaries		X									
37/68/72/122	Jupiter's Family Secrets	X			X	X						
38	Dwarf Planets	X										
47	Exploring Ice in the Solar System	X	X	X	X		X	X	X		X	
48	Exploring Meteorite Mysteries	X				X						
49	Exploring Origins	X										
50	Exploring the Earth's Magnetic Field		X			X	X					
53	Flexing Muscles and Moons					X	X					
57	Goldilocks and the Three Planets	X						X				
58	Gravitation 3.8					X						
61/144	Heavyweight Champion: Jupiter/ The Pull of the Planets	X										
63	How Much Would You Weigh on Distant Planets	X										
64	Ice in the Solar System		X				X	X				
65	In the Footsteps of Galileo	X			X	X						
66	Inside Mars – Puzzling Patterns		X	X								
81	Magnetic Math		X			X		X				
82	Magnetic Sensor Measurements with a Graphing Calculator					X						
83	Magnetism and Electromagnetism		X			X						
88	Making and Mapping a Volcano	X										
89	Mapping Magnetic Influence					X						

		NGSS Disciplinary Core Ideas										
Lesson Number	Name	ESS1	ESS2	ESS3	PS1	PS2	PS3	PS4	ETS1	LS1	LS2	LS4
91	Mars Robotic Activities		X		X			X	X			X
96	Microgravity in the Classroom	X										
97	Mission Design	X	X			X		X				
99	Morning Star and Evening Star	X										
102	Observing Where the Sun Sets	X										
104	On the Moon	X				X	X		X			
108	Plasma Wars	X										
110	Reading, Writing, and Rings	X										
114	Rockets					X	X		X			
121	SpaceMath: Solar Math	X					X	X				
125	SpaceMath: Ice on Mercury?	X										
126	SpaceMath: LRO Makes a Temperature Map of the Lunar South Pole	X										
127	Space Weather Action Center	X	X			X	X	X				
128	SpaceMath: Planet Kepler – 10.b: A Matter of Gravity	X										
129	SpaceMath: The Transit of Mercury	X										
130	Spinning Does more than Make You Dizzy	X										
131	Strange New Planet	X										
132	Structure and Properties of Matter: Ion Propulsion Module	X			X							
133	Summit Up – Comparing Volcanoes on Mars and Earth	X										
139	The Earth-like Planet Gilese 518g	X										
140	The Goldilocks Principle: A Model of Atmospheric Gases		X									
142	The Orbit Simulator	X										
146	The Thousand Yard Model	X										
148	The Water Cycle – Now You See it, Now You Don’t		X	X								
149	Time Lineup	X	X									
155	Transit Tracks	X										
158	Volcanos are a Blast: Working with Simple Equations		X									

Lesson Number	Name	NGSS Disciplinary Core Ideas										
		ESS1	ESS2	ESS3	PS1	PS2	PS3	PS4	ETS1	LS1	LS2	LS4
161	What are we Made Of? The Sun, the Earth, and You	X										
162	What is a Planet?	X										
163	What Makes Day and Night? The Earth's Rotation	X										
164	What Makes Shadows? Observing and Drawing Shadows	X										
165	What's the Difference?	X										
166	Where are the Distant Worlds? Star Maps	X				X		X				
171	Alka-Seltzer Rocket	X				X	X					
182	Comparing Comets	X										
184	Cosmic Chemistry: An Elemental Question	X										
187	Designing Craters	X				X	X					
188	Detecting Extrasolar Planets	X										
189	Does the Moon Rotate?	X										
194	Earth-Moon Activity	X										
197	Exploring Comets and Modeling for Mission Success		X		X							
198	Exploring Lunar Phases with a Daytime Moon	X										
201	Follow the Falling Meteorite	X										
202	Geologic Landforms Seen on Aerial Photos		X									
203	Globe Visualization – Atmosphere and Soil Unit		X									
204	Golf ball Phases and Eclipses	X										
209	Interstellar Real Estate – Defining the Habitable Zone	X										
210	Is there Liquid Water on Mars?	X										
214	Let's Investigate Mars Activity	X										
216	Mars Activity Book	X			X	X	X	X	X		X	X
217	Mars Student Imaging Project	X	X									
218	Mars Uncovered	X										
219	Marsbound! Mission to the Red Planet	X										
222	Methane Lakes on Titan	X										
225	Observing Jupiter's Moons	X										
226	Observing the Moon	X										

		NGSS Disciplinary Core Ideas										
Lesson Number	Name	ESS1	ESS2	ESS3	PS1	PS2	PS3	PS4	ETS1	LS1	LS2	LS4
228/153	Paper Plate Education: Transit Frequency	X										
230	Planetary Geology #4: Impact Cratering	X										
234/259	Quarter Earth and Penny Moon	X										
241	So…How Big is it? Asteroid Eros Surface	X										
243	Solar System Lithograph Set						N/A					
244	SpaceMath: Close Encounters of the Asteroid Kind!	X										
245	SpaceMath: Meteorite Compositions	X										
246	SpaceMath: NASA-funded research discovers life built with toxic chemical		X									
248	Stardust Mission #1 – think small in a big way	X										
254	The Goldilocks Planets – Not too hot or cold	X										
255	The History and Discovery of Asteroids	X										
256	The Hunt for Micrometeorites	X										
257	The Moons of Jupiter	X										
258	The Oldest Lunar Rocks	X										
260	The Rare Earth – How Rare is Earth-like Life?	X					X					
262/215/233	The SETI Academy Planet Project	X	X			X	X			X		
264	Unlocking the Mysteries: Science on the Edge of Our Solar System	X										
265	Unveiling Titan's Surface	X										
267	Vegetable Light Curves	X										
273	Why do Eclipses Happen?	X										

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