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Cultivating a Scientific Mindset through Inquiry-Based Science Learning Utilizing NASA Resources for Educators

Leslie Huling
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"By partnering with NASA, both formal and informal educators can play a critical role in helping students learn to think critically and to cultivate the scientific mindset necessary to confront the many challenges of today and in the future.**"**

In the coming years the U.S. will need more STEM workers than ever before. It is estimated by the President's Council of Advisors of Science and Technology (PCAST, 2012) that the United States needs to produce one million additional STEM professionals in the next decade in order to retain its historical preeminence in science and technology. The National Academies of Sciences, Engineering, and Medicine, September 2017 report predicts a shortfall of nearly 3.4 million skilled technical workers by 2022. According to the U.S. Bureau of Labor Statistics report "Spotlight on Statistics" (2017), the computer occupational group alone is projected to yield over 1 million job openings from 2014 to 2024.

Further, specific groups (minorities, women, special needs individuals and those from economically disadvantaged backgrounds) have traditionally been underrepresented in STEM fields, resulting in tremendous untapped potential that is critically needed if the U.S. is to maintain its position as a global leader in STEM innovation (Enriquez, Lipe & Price, 2014; Kleist, 2015). In order to achieve these goals, it will be necessary to attract larger numbers of students from all backgrounds in STEM. These needs alone would be sufficient to merit increased STEM education opportunities for all students and the implementation of specific targeted efforts to promote the development of scientific mindset skills among students, however, it is the contention of these authors that the skills that comprise a scientific mindset are the same skills needed by all intelligent consumers of information in today's complex society and, for this reason, we believe these approaches are important for all students whether or not they ultimately pursue a STEM career.

Developing a Scientific Mindset: Not Just for Scientists

While there are many ways to conceptualize the scientific mindset, one approach is to use the analogy of the three-legged stool. In this analogy, the three legs of the scientific mindset stool include a 1) a reliance on data for decision making, 2) collaboration and communication skills, and 3) dispositions for a scientific mindset. Each of the three supports are critical to the integrity of the scientific mindset structure and, the absence of any one of the supports can destabilize the entire enterprise (see Figure 1).

Insert Figure 1.

One of the primary foundations of the scientific mindset is **a reliance on data for decision-making** (Slavin, 2007). Scientists aspire to be objective, make their decisions based upon an analysis of data, and judge the quality of data by applying a set of agreed upon scientific principles related to study design, sample selection, and data collection procedures (Fraenkel, Wallen & Hyun, 2019; Schreiber & Asner-Self, 2011). Most often, scientist rely on multiple data sources and frequently engage in a triangulation process (McMillan, 2012) through which they consider findings from multiple data sources to verify whether the findings are generally consistent with those of other respected researchers or rather is somehow an outlier that should be further scrutinized. Scientists typically give additional credence to research that has been peer-reviewed by those who are considered to have expertise in the field of study (McMillan, 2012). This process of verifying the reliability of sources of data is certainly necessary for scientists, but is also a general good practice for all information consumers as they consider the sources from which their data comes. In today's information-saturated society, critical thinking skills, coupled with a healthy dose of skepticism, is probably in order as one judges the merits of various arguments and assertions.

Other important data-based factors for the scientist include the ability to both interpret and to create data visualization tools to aid in data sense-making procedures (Fraenkel, Wallen & Hyun, 2019). These skills are important in developing understanding around complex ideas and important both to the scientist and to citizens in general engaged in everyday living in a complex society. Finally, scientific inferences and predictions are developed by extrapolating from the available data, taking into consideration relevant factors shown to be related to the phenomena under consideration (Johnson, 2002).

Collaboration and communication skills are also integral to the scientific mindset. A commitment to healthy, informed, respectful debate is also a critical component to the scientific mindset. Clear communication skills are necessary to develop logical arguments that are supported by evidence. Multiple perspectives elevate the discussion and frequently lead to an improved outcome (Fraenkel, Wallen & Hyun, 2019) and therefore, the ability to collaborate and work together toward a common goal in spite of personal differences is crucial both in the sciences and general day-to-day living. Many problems are so complex that a multi-disciplinary approach is not only desirable but is also essential in weighing the costs and benefits of various solutions on different aspects of our society (Turner & Reynolds, 2014).

Dispositions for a scientific mindset is the third leg that supports the critical work of scientists. A natural part of the scientific process is acceptance of uncertainty and the embracing of the fact that, as additional data become available, conclusions and recommendations may change. This evolution of understanding, in the view of the scientist, represents progress rather than failure on the part of previous investigators. In other words, uncertainty is a natural part of the scientific process and is to be embraced rather than denied.

Another critical aspect of the dispositions for scientific mindset is ethical in nature. A strong sense of ethics is vitally important to the scientific mindset. Scientists have an ethical responsibility to be truthful in reporting findings, to protect public health and to preserve the quality of life of future generations (Slavin, 2007). Science, and mankind in general, will be better served if educators can help students develop the practice of ethical decision-making, a commitment to global well-being, and a sense of responsibility to protect vulnerable populations.

The collective skill set that comprises the scientific mindset is essential for work in scientific disciplines, but they are equally helpful to the average citizen. Whether a teenager is trying to judge the truthfulness of an online claim, or a homemaker is deciding whether to buy organic produce, or a voter is trying to understand a drainage project included as a part of a community bond package, scientific mindset skills will be a useful approach. This being the case, investments made as a society in preparing the next generation of scientists will also pay dividends in preparing the next generation of responsible global citizens. Given the importance of this undertaking toward societal collective well-being, the authors propose that it be a shared responsibility rather than relegating it solely to classroom teachers. Although K – 12 teachers are the front-line providers in helping students develop a scientific mindset, there are also many other opportunities for learners to benefit from STEM engagement experiences through after-school programs, summer camps, home schooling, community events and other programming offered through public venues such as museums and libraries. Informal educators working in these settings are continuously seeking STEM related activities that are educationally worthwhile, engaging and enjoyable for students.

The NASA STEM Engagement and Educator Professional Development Collaborative is a valuable resource for both formal and informal educators providing a wealth of well-designed, inquiry-based, NGSS aligned, NASA classroom activities, free materials and resources to support student learning targeted at cultivating a scientific mindset.

In order to illustrate examples of cultivating scientific mindsets utilizing NASA education resources, three case examples are presented: Case Example 1-with pre-service teachers and their university professors: Case Example 2 with practicing teachers; and Case Example 3 with community organizations. Each case example illustrates how NASA EPDC provided professional development and the teaching resources for educators to guide students through investigations of real-life issues such as global climate change, engineering design challenges, rocket forces, water studies, etc. while simultaneously assisting students in developing their scientific mindset through inquiry-based learning. The specific links that educators can use to access these free NASA resources are included. The chapter concludes with a general discussion of the advantages of the inquiry-based instructional approach utilized in the NASA activities and will discuss ways in which these activities incorporate specific tasks that help learners develop scientific mindset skills.

Three Case Examples Utilizing NASA Resources

In each of the following three examples, NASA instructional resources provided the bulk of the STEM content that was included in the professional development and STEM engagement events. NASA has an abundance of educational resources from which event organizers can select and combine into an event tailored to meet the needs of their participants, along with suggested amount of time available, and the specific learning objectives being addressed. In the examples, the event organizers integrated some of their own activities combined with NASA activities to create the professional development event. The examples presented are not intended to be pre-packaged stand-alone events, rather they are offered as sample events of differing durations and for different audiences to demonstrate the flexibility and utility of NASA activities and resources in planning and delivering professional development for educators and STEM engagement events for students. For each case presented, a sample agenda or activity list is provided to supplement the description and links to available NASA resources. Following a brief description of three case examples, there is a discussion of how specific activities support the development of the STEM skills that comprise the scientific mindset.

Case 1: Professional Development for Preservice Teachers and University Faculty

NASA has made a unique professional development opportunity, MUREP Educator Institutes (MEIs), available to university students enrolled in teacher preparation programs and their faculty sponsors from Minority Serving Institutions (MSIs) across the nation. MSIs are designated by the U.S. Department of Education and typically serve a student population that is comprised of at least 25% of a specific underserved population. Among the types of MSI classifications are Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), Tribal Colleges and Native-American Serving Non-Tribal Colleges, and various other classifications involving Asian American and Pacific Islander student populations.

MEIs were conducted during the summers of 2016, 2017, and 2018 leveraged existing resources in place through the ten NASA Centers and the NASA EPDC and capitalized upon the existing infrastructure to ensure that the resources invested in the Institutes generate the greatest benefits possible for the professional learning of preservice teachers and their faculty sponsors across the U.S. A total of 36 MEIs were conducted during this three-year period, serving 1,077 pre-service teachers and 236 faculty sponsors. One of the goals of MEI was to familiarize participants with the work occurring within each of NASA's four Mission Directorates (Science; Space Technology; Aeronautics; and Human Exploration). Several activities representing each mission directorate were included in the 5-day professional development institute.

The MEI experience consisted of a one-week onsite experience at one the nation's 10 NASA Centers, coupled with 8 hours of online professional development prior to the Institute and 8 hours of post-Institute online professional development. MSIs eligible to attend MEI were invited to send a team of up to five participants, accompanied by a STEM Education faculty member from the institution.

The one-week Institute experience was grounded in research-based principles of teacher development and provided rich inquiry-based science learning experiences upon which teachers could scaffold their content knowledge and further develop their content-specific pedagogical practices, while developing their scientific mindset. MEI learning experiences were fully integrated with tours of Center facilities and opportunities for participants to interact with the Center content specialists. Prior to coming to the Institute, participants were introduced via webinar, to the Center, the Center's EPDC educational specialist who helped facilitate the on-site experience, and to various other NASA EPD resources. The Institute covered the costs of four nights of lodging, and daily breakfasts and lunches. Upon successful completion of the Institute experiences and follow-up activities, student participants and their faculty sponsors earned a $500 stipend.

Table 1 shows a 5-day agenda from one MEI and the weblinks where many of the activities can be accessed. An explanation of how these activities contributed to the development of specific skills that comprise the scientific mindset is included in the discussion section of this chapter.

Insert Table 1

Case 2: Professional Development for K-8 Teachers

In this example, EPDC collaborated with an urban area university to provide a 5-hour professional development event for K-8 teachers and administrators. Such an event allows additional time during the day for educators to tour or visit a related facility or to engage in collaborative planning about how to integrate and utilize the content and resources included in the event. In this particular collaboration, the university provided the facility and communicated with area school districts to advertise the event and recruit educator participants. EPDC staffed the event, provided facilitators and materials for training, and contributed NASA promotional materials that were given to participating educators.

The opening keynote at this particular university was presented by several of their nationally-recognized scholars who presented their work in studying the process that children progress through in developing their identity as emerging mathematicians and scientists. This topic integrated well with EPDC's focus on culturally relevant pedagogy and its commitment to serving disadvantaged student populations that have typically been under-represented in STEM fields. The remainder of the morning was devoted to two NASA-based hands-on inquiry activities--one related to science and engineering practices focused on the earth science content of the importance of soil and water, and a second activity using an engineering design challenge related to NASA's missions of returning to the Moon and traveling to Mars. Lunch was served as a part of the event, followed by a third activity involving a NASA-provided activity that entailed an Entry, Descent and Landing Engineering Design Challenge.

Table **2** depicts the list of activities delivered at the various learning stations included in the Community STEM Day and weblinks where the activities can be accessed. In the Discussion section of this chapter, an explanation is provided illustrating how these activities contribute to the development of specific skills that comprise the scientific mindset and equip educators to promote the development of these skills in their students.

Insert Table 2

Case 3: STEM Engagement Though a Community-Based Organization

A Saturday Community STEM Day event was co-sponsored by the Chicago Pre-College Science and Engineering (ChiS&E) Program and the NASA STEM Engagement & Educator Professional Development Collaborative (EPDC). In this particular collaboration, ChiS&E worked with the school district to provide the facility, to advertise the event, and recruit students, parents and community members to attend. EPDC staffed the event, provided facilitators and materials for the learning stations, and contributed NASA promotional materials that were provided to attendees free of charge. The event, held from 9 am to 3 pm at a local elementary school, was organized into seven hands-on learning stations, each staffed by 1-3 adult facilitators. Learning stations were set up in the school's gymnasium, library, and the sport-court area of the playground.

As students and parents checked in to the event, they were greeted by event organizers and were given a "passport" that listed all of the stations. Students could complete the activities in any order and at their own pace, allowing them to spend additional time at the station(s) in which they were most interested (see Table 3). Most students spent between 3-5 hours at the event.

As students completed each activity, the station facilitator stamped the passport indicating that the student had participated in that learning activity. After students had participated in each activity, they returned to the registration desk with their completed passports, and event organizers checked the passport and gave the student a clear plastic NASA backpack that had been donated by EPDC. Students and their parents were also able to choose a free NASA poster and were given other NASA and space-related promotional materials such as stickers, bookmarks, and pamphlets featuring other NASA opportunities such as engineering design challenges and internships.

Insert Table 3

The following section provides a rationale for the inquiry-based approach utilized in activities provided by NASA. In addition, specific examples are used from the activities to explain how they contribute to the development of specific skills that comprise the scientific mindset.

Discussion of Inquiry-Based Learning Approach and the Scientific Mindset Skills Being Developed

Developing a scientific mindset requires a shift from instruction focusing on students' ability to recall content toward instructional approaches that provide opportunities for students to solve real-world problems and participate in tasks reflective of work engaged in by professionals in STEM fields (Friesen & Scott, 2013). The constructivist inquiry-based learning approach fits well into a learning sequence designed to cultivate and sustain the developing scientific mindset. This approach can be especially helpful in meeting diverse learning needs of students who can benefit greatly from authentic learning experiences.

Inquiry-based science challenges students' thinking by engaging them in investigating scientifically orientated questions where they learn to give priority to evidence, evaluate explanations in the light of alternative explanations and learn to communicate and justify their decisions. Inquiry-based science adopts an investigative approach to teaching and learning where students are provided with opportunities to investigate a problem, search for possible solutions, make observations, ask questions, test out ideas, and think creatively and use their intuition. (Cairns, 2019).

In order to analyze specific NASA activities and how they contribute to skill development, it is helpful to review the three components, and their requisite skills, that collectively comprise the scientific mindset. Recall that **Data-Based Decision-Making** encompasses the reliance on data-based evidence for purposes of making decisions, inferences and predictions, as well as skills related to the triangulation of data, judging the accuracy and validity of data sources, and the ability to interpret and create graphic representations that enhance data sense-making. **Collaboration and Communication Skills** include the ability to work with others, respectful communication, acceptance of diverse viewpoints, and recognition of the value of multi-disciplinary approaches to problem solving. **Dispositions for Scientific Mindset** encompass the acceptances of uncertainty as a part of the scientific process, an understanding that science is advanced by both successful and unsuccessful experiments, openness to changing understandings and conclusions as new findings emerge, and the embracing of the ethical responsibilities associated with scientific work.

The majority of NASA activities are aligned with Next Generation Science Standards (NGSS) and are presented in a 5E format (Engagement, Exploration, Explanation, Extension/ Elaboration, Evaluation) that promotes hands-on learning and engages students in critical thinking and analysis (Susilowati & Anam, 2017; Ying-Chih Chen, Mineweaser, Accetta & Noon, 2018). In addition, the vast majority of the activities are structured to allow students to work in groups to collaboratively problem-solve and provides them with opportunities to develop group and communication skills. NASA's engineering design challenges (case 1, 2 and 3) advocate the use of the engineering design cycle (Baker & Reeve, 2019). Briefly this cycle consists of: 1) Ask (What are the problems and constraints?); Imagine (Brainstorm ideas and chose the best one.); 3) Plan (Draw a diagram and gather needed materials.); 4) Create (Follow the plan and test it out.); and 5) Improve (Evaluate your results and make plans to repeat steps 1-5.). For example, the activity Moor to Mars: Design a Stomp Rocket (case 3) allows students to design a rocket, test it, record their data, make modifications and re-test it until they perfect their design.

Many of the NASA's earth science activities such as Mission Geography (case 1) and The Importance of Soil and Water (case 2) engage students in discussions about the conservation of natural resources, climate change issues, and the responsibilities each generation has to the well-being of future generations. Many NASA activities integrate numerous skills that cut across data-based decision-making, collaboration and communication, and dispositions for the scientific mindset. For example, Maker Mars (case 1) asks students to brainstorm the requirements that humans will need to live and work on Mars and to identify one specific issue to address. They begin by researching this issue, identifying whether their sources are primary or secondary sources, and then judging the credibility of the source using rubrics which specify Criteria for a Credible and Non-Credible Sources. Students then work as a group to come up with a design and sketch it for presentation to their classmates. Based on feedback they get from the group, they refine their design and build the prototype using materials from the classroom such as pipe cleaners, soda can, foil, plastic cups, cardboard, etc. The groups then peer evaluate the projects using a rubric focused on the engineering design cycle including prototyping the design, designing reflection and thinking reflection.

Many of the NASA activities are single lessons from a collection of lessons focused on a central theme. For example, the Human Body in Space (case 1) is from a learning module titled Mission X: Train Like an Astronaut. All of the activities in this module are hands-on explorations designed to help the student understand more about how physical activity and nutrition affect the human body. Because the module relates in many ways to the International Space Station, it is, interestingly, available in 19 languages. There are 26 activities in this learning module, each of which has its own lesson plans and student materials. As one example, in the activity titled Energy of an Astronaut, students use the science processing skills of predicting, observing, comparing, gathering and recording data while they investigate the food pyramid and the basic foods that make up a balanced diet and their daily energy needs. They examine Nutrition Facts labels for serving size, calories, protein, calcium and vitamins and determine their own daily energy needs. As a culminating activity, students create a five-day menu based on Food Pyramid recommendations and their own dietary needs.

Field Trip to the Moon (case 1) is a similar type of learning module that consists of six different investigations focused on ecosystem, geology, habitat, engineering, navigation, and medical. The Field Trip to the Moon program uses an inquiry-based learning approach that fosters team building and introduces students to careers in science and engineering. The educator can select which investigations are best suited for their students and learning context, knowing that each activity will provide students with the opportunity to use their cooperative learning skills to design a self-sufficient lunar station. Working in teams, students develop critical thinking skills, problem-solving techniques, and an understanding of complex systems as they discuss solutions to the essential questions they are presented.

Both formal and informal educators can explore a wealth of other NASA educational resources grouped by topic area and by grade level at: https://www.nasa.gov/stem/foreducators . All NASA educational resources are free and activities can easily be tailored for specific student groups and learning contexts. When it comes to NASA educational resources, literally "the sky is the limit."

Concluding Thoughts

By making STEM educational resources readily available to educators for use with learners in multiple settings, NASA is helping to build a diverse future STEM workforce. In addition, by providing the resources needed to engage students in authentic learning experiences, NASA is helping form more responsible citizens who are better prepared to function effectively in the information-rich environment we face in the 21st century. The use of these readily available NASA resources can greatly reduce the amount of time that classroom teachers and informal educators typically spend researching and planning authentic STEM learning activities.

By partnering with NASA, both formal and informal educators can play a critical role in helping students learn to think critically and to cultivate the scientific mindset necessary to confront the many challenges of today and in the future. By making these resources readily available, NASA has not only strengthened public understanding and appreciation of the value of STEM, they are also helping build to build the future by engaging students in authentic learning experiences with NASA people, content, and facilities that extend far beyond the classroom walls.

Reflective Questions

1. In what types of learning settings are appropriate for inquiry-based authentic learning activities and what challenges can be anticipated in implementing inquiry-based instruction in each type of setting?

2. What challenges can be anticipated in partnering with an outside entity and how might these challenges be mitigated?

4. In what ways can educators empower and inspire students to envision a STEM career as a viable option in their futures?

5. How might an educator respond to parent or administrator concerns about using an inquiry-based approach as opposed to a traditional direct instructional approach?

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Appendix

Tables

Table 1. **NASA MEI Institute Sample 5-Day Agenda**

Activity	Duration	Source
Day 1 Afternoon		
Welcome, Introductions & Logistics	45 mins.	Facilitator Training Guide & Developed and Arranged by Center Instructional Team
How NASA Fits Into STEM Education & What Participants Can Expect from this Institute	45 mins.	Instructional Team Developed Activity
State and National STEM Curriculum Standards	1 hr.	Instructional Team Developed Activity
Making STEM Relevant for Diverse Student Populations: Factors to Consider	45 hr.	Instructional Team Developed Activity and Resources from Facilitator Training Guide
Center Immersion Activity	45 mins.	Instructional Team Developed Activity
Day 2 Morning		
Center Immersion Activity.	1.25 hrs.	Developed and Arranged by Center Instructional Team
Marsbound!	1.5 hrs.	http://marsed.asu.edu/lesson_plans/marsbound
Field Trip to the Moon.	1.25 hrs.	https://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Field_Trip_to_the_Moon_Educator_Guide.html
Day 2 Afternoon		
Solar System in my Neighborhood	1.5 hr.	http://www.lpi.usra.edu/education/explore/solar_system
Center Immersion Activity. Debrief, teacher insights and reflections.	2 hrs.	Developed and Arranged by Center Instructional Team
Day 3 Morning		
Science and Engineering Practices: "Planning & Carrying out Investigations"	1 hr.	Instructional Team Developed Activity
Mass vs. Weight.	1 hrs.	http://education.ssc.nasa.gov/massvsweight.asp
Field Trip to NASA Visitor Center.	2.5 hrs.	Developed and Arranged by Center Instructional Team
Day 3 Afternoon		
Maker Mars	1.5 hrs.	http://marsed.asu.edu/lesson-plans/makermars
NASA's BEST Students Debrief, teacher insights and reflections.	2 hrs.	http://www.nasa.gov/audience/foreducators/best/index.html

Day 4 Morning		
Science and Engineering Practices: "Analyzing and interpreting data using mathematics and computational thinking "	1 hr.	Instructional Team Developed Activity
Smart Skies	1 hr.	http://smartskies.nasa.gov/flyby/
Learning to Fly: The Wright Brothers Adventure	1 hr.	http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Learning.to.Fly-The.Wright.Brothers.Adventure.html
Demonstration Lesson Planning	1 hr.	Developed and Arranged by Center Instructional Team
Day 4 Afternoon		
Mission Geography	1 hr.	http://missiongeography.org/
Astroventure Biology Training	1.5 hrs.	http://astroventure.arc.nasa.gov/teachers/bio_train.html
Presentation from Space Grant Consortium. Debrief, teacher insights and reflections.	1.5 hrs.	Developed and Arranged by Center Instructional Team
Day 5 Morning		
Center Immersion Activity	1.5 hrs.	Developed and Arranged by Center Instructional Team
Human Body in Space	2 hrs.	http://www.nasa.gov/audience/foreducators/spacelife/topics/humans/index.html
Looking Ahead: The Post-Institute Experience. Debrief, teacher insights and reflections	1 hr.	Facilitator Training Guide

Table 2. A 5-Hour PD Event for K-8 Educators

Time	Topic	Resource Link
8:30	Registration	
9:00	Welcome & Introductions	
9:15	Opening Address: Identity Construction in Mathematics and Science	
10:00	NASA STEM Earth Science: The Importance of Soil and Water	https://www.globe.gov/web/elementary-globe
11:00	NASA Best (Beginning Engineering, Science & Technology) Moon to Mars: Engineering Design Challenge	https://www.nasa.gov/audience/foreducators/best/activities.html
12:00	Group Discussion & Lunch	
12:30	Apollo to Orion, Small Steps to Giant Leaps, Entry, Descent and Landing Engineering Design Challenge	https://www.nasa.gov/stem-ed-resources/on-the-moon-guide.html
1:30	Group Discussion and Close	

Table 3. NASA Community STEM Day

Activity Stations	Resource Link
Humans in Space: The Radiation Challenge with UV Beads	https://sdo.gsfc.nasa.gov/assets/docs/uv_beads_museum.pdf
Moon to Mars: Design a Stomp Rocket	https://www.jpl.nasa.gov/edu/teach/activity/stomp-rockets/
Engineering Design: Simply Circuits	https://www.nasa.gov/stem-ed-resources/paper-circuits-light-up-exploded-stars-and-constellations.html
Aerospace Engineering: Design an Aircraft	https://www.nasa.gov/glenn-edcs-spacecraft-safety
Mars exploration: Make a model of the Orion: Launch Abort System	https://www.popularmechanics.com/space/a11639/build-this-paper-model-of-nasas-next-spacecraft-17392321/
Rocket Science: SLS Art Activities	https://informal.jpl.nasa.gov/museum/content/space-launch-system-activity-sheets
High School Engineering Design Challenge: Return to the Moon	https://www.nasa.gov/pdf/473107main_MoonMod%20Teach.pdf

Figures

Figure 1. Scientific Mindset Three-Legged Stool