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FOR EXCELLENCE IN MIAMI-DADE PUBLIC SCHOOLS
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Ideas with IMPACT

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Copy That, Mission Control!

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Ideas with IMPACT

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Goals and Objectives

- Students will learn to communicate effectively.
- Students will use team work to engineer a physical object.
- Students will learn to utilize time management skills.

Subject Areas

Science, Engineering

Overview

In each project activity, students create from simple to complex buildings using analog and digital technology through the engineering design process. Students listen, build, test and redesign components to complete their project. The students solve problems, work collaboratively with peers, and communicate with each other. Each activity project allows for the possibility of extending the lessons into more complex applications and testing.

Florida Common Core Standards

SC.3.N.1.In.4: Recognize that scientists share their knowledge and results with each other.

SC.3.N.1.Su.2: Work with a partner to make observations.

SC.3.N.3.2: Recognize that scientists use models to help understand and explain how things work.

SC.3.N.3.Pa.2: Recognize a model of a real object.

Standards

NS.K-12.1 Science as Inquiry

Abilities necessary to do scientific inquiry

Understanding about scientific inquiry

NL-ENG.K-12.4 Communication Skills

Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and strategies, and for different purposes.

Timeline

One class period

Background

Nasa must have efficient and effective communication between multiple teams and organizations when completing important and risky missions. One mistake could be the difference between failure and success. Capcom is the person that pays close attention to detail and is able to communicate with multiple people and pass on valuable information. Three to four students will combine and collaborate to NASA team that must use communication, attention to detail and teamwork to complete a mission effectively and efficiently.

Materials

1 tri-fold board

5 styro-foam cups

5 small paper cups

5 popsicle sticks

5 paper plates

5 popsicle sticks (each one was a different color)

5 straws

5 pipe cleaner (difference colors)

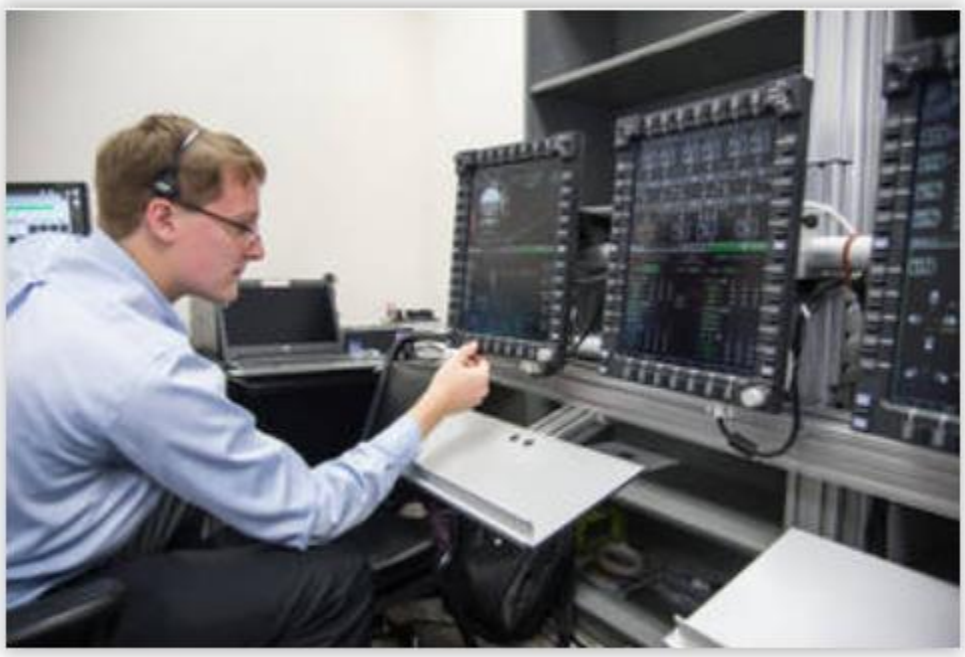
*** Any set of random material to design instruction.

Roles of the Mission Control

Four member for each group.

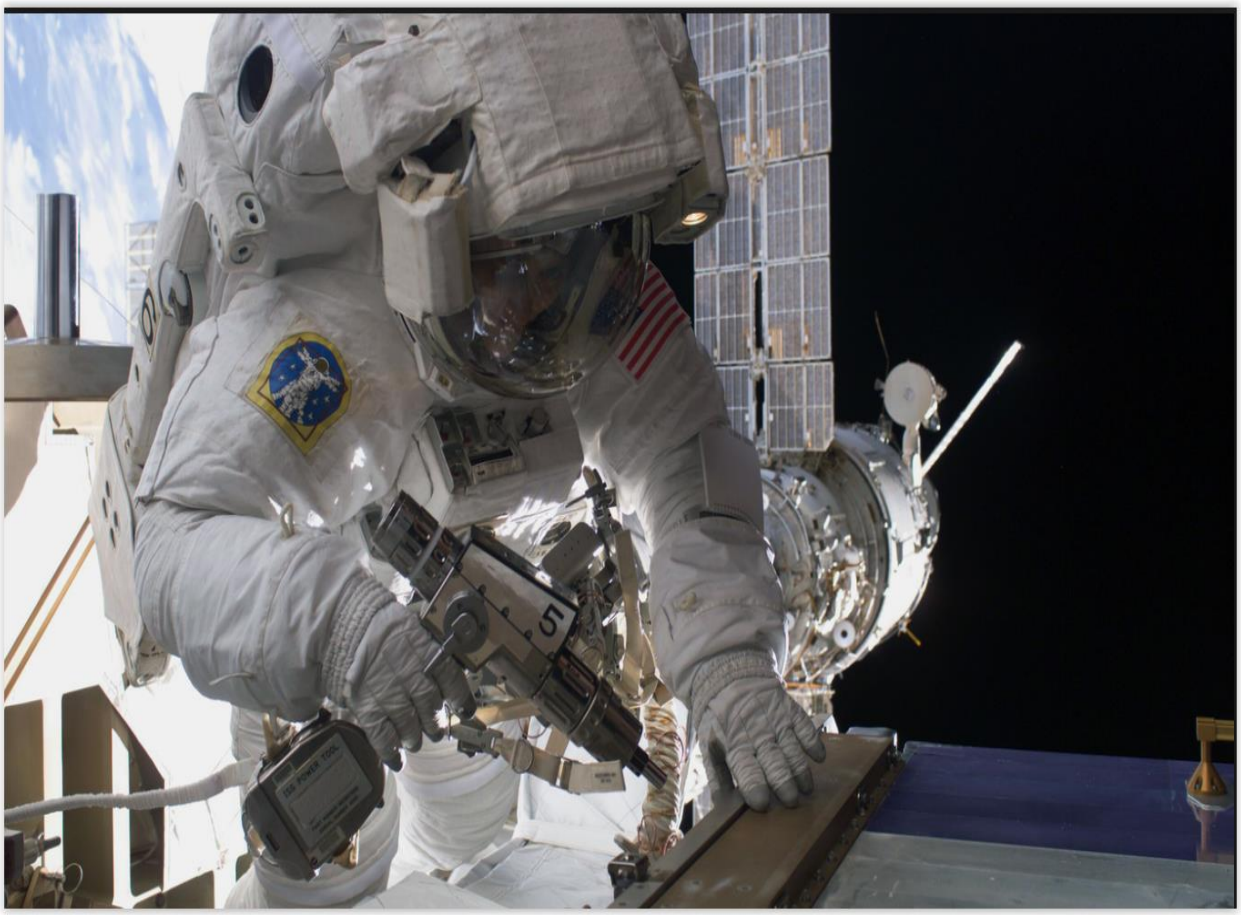
1.- Flight Director (FLIGHT) - Builds the instruction.

2.- Engineer - Observes the instruction and communicates it to the Capcom. Never touches the instruction.



3.- Spacecraft Communicator (Capcom) - Walk to the Astronaut to communicate step by step of the instruction. The Capcom may return at any time to the Engineer to receive more information about the instruction.

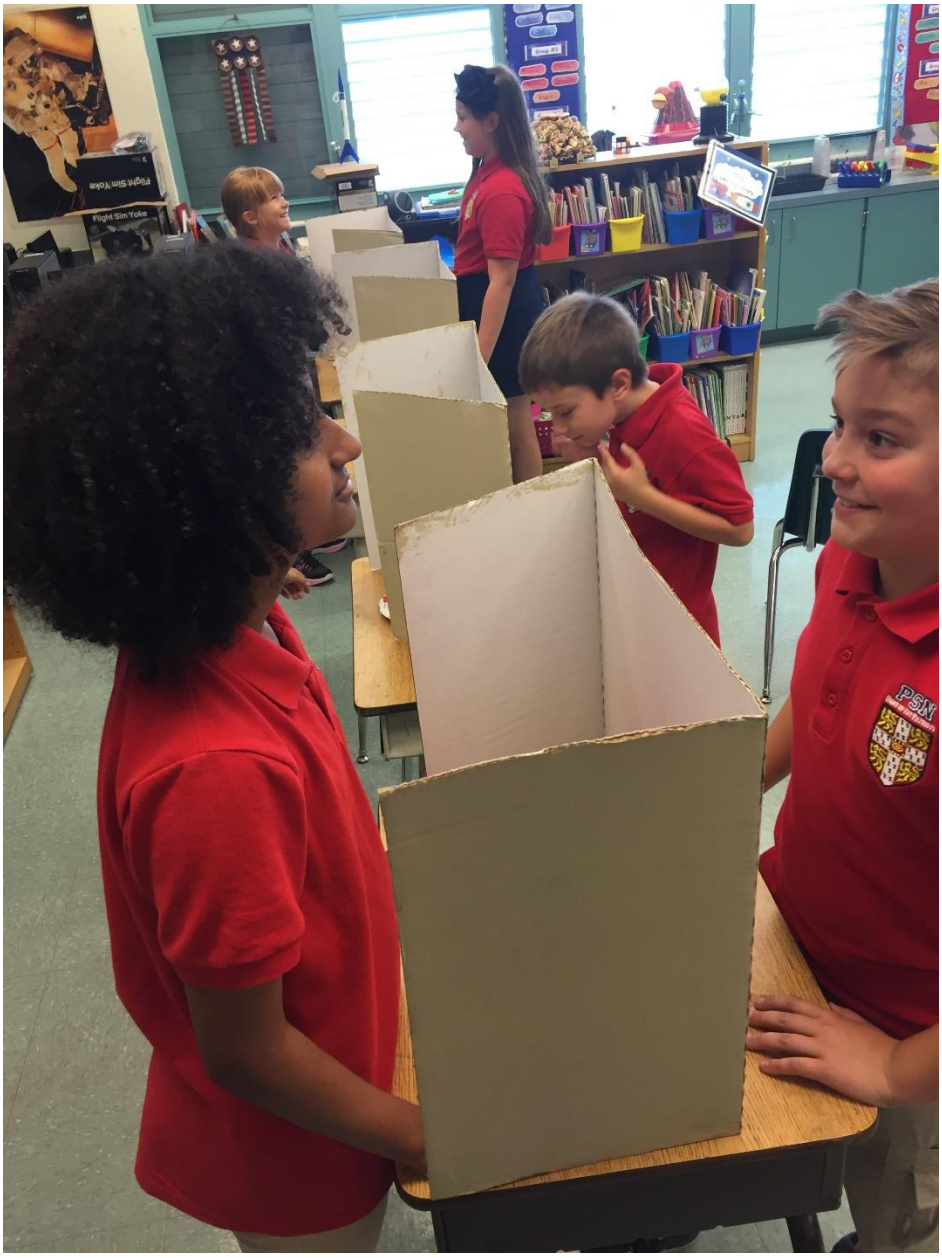
4.- Astronaut - Builds the instruction explained by the Capcom.



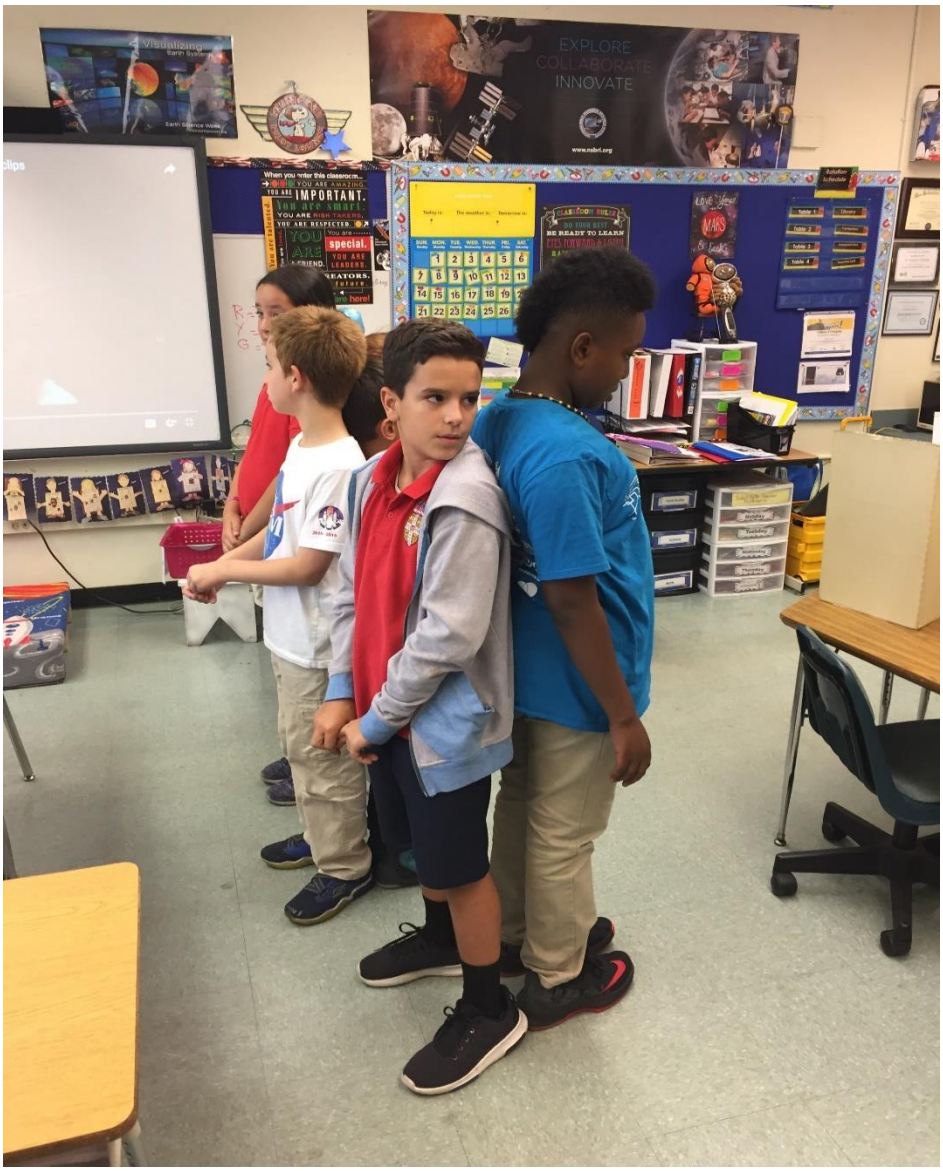
Explanation of the roles

1.- Flight Director (FLIGHT) - Responsible to build a instruction behind the tri-fold board. They will build the instruction using the materials listed before from simple to complex instruction. This is an educator or STEM coach.

2.- Engineer - The student will observe Mission Control's structure, in detail, and then describe that structure to Capcom by whispering. The Engineer is the only person that can see Mission Control's structure. The Engineer is not allowed to talk to the Astronaut and not allowed outside the Engineer's area. The Engineer must accurately describe the structure to the Capcom.



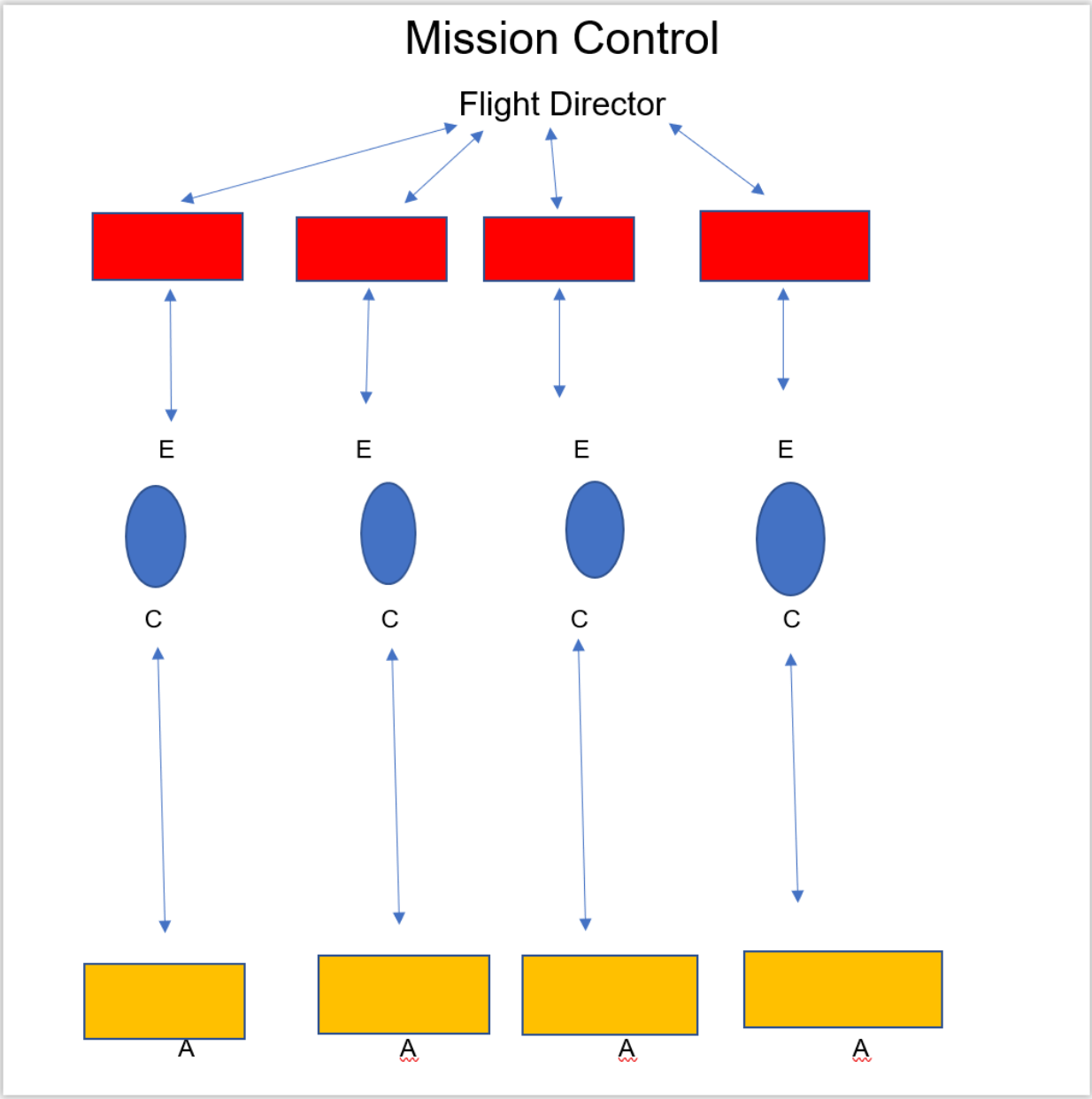
3.- Spacecraft Communicator (Capcom) - Communications link between Flight Control and Astronauts. The acronym was created when the spacecraft were referred to as "capsule." This person is in direct contact with both the Engineer and the Astronaut. The Capcom can freely move from the Engineer to the Astronaut and be at the team's station. The Capcom is not allowed to touch or manipulate any of the objects at their station. The Capcom is responsible for relaying accurate information from the Engineer to the Astronaut.



4.- Astronaut - This person is the only one that can touch the objects and construct at their station. They are not allowed to leave their team's station and cannot directly communicate with the Engineer. They can only talk to Capcom. They must use the information from Capcom to recreate the mission control's structure.

TITLE:	ACRONYM:	ROLE:
Flight Director	FD or FLIGHT	Responsible for overall Shuttle mission and payload operations
Spacecraft Communicator	CAPCOM	Communications link between flight control and astronauts. Acronym was created when spacecraft were referred to as "capsules."
Flight Dynamics Officer	FDO	Pronounced "fido" -- plans maneuvers and monitors trajectory
Guidance Procedures Officer	GPO	Monitors onboard navigation and guidance computer software
Data Processing System (Engineer)	DPS	Monitors the data processing system of computers
Surgeon	Surgeon	A medical doctor on staff
Booster Engineer	Booster	Monitors the main engine, Solid Rocket Boosters and External Tank from pre-launch to ascent phases of missions
Payload Deploy Retrieval System	PDRS	Monitors operation of the remote manipulator system
Propulsion Engineer	PROP	Monitors reaction control and orbital maneuvering propellants
Guidance, Navigation and Controls System Engineer	GNC	Monitors vehicle guidance and navigation systems
Electrical, Environmental and Consumables Manager	EECOM	Responsible for passive and active thermal controls of the vehicle, cabin atmosphere, supply systems and fire detection
Electrical Generation and Illumination Engineer	EGIL	Monitors electrical systems
Instrumentation and Communications Officer	INCO	Monitors in-flight communications and instrumentation systems
Russian Interface Operator	RIO	Liaison between U.S. and Russian Control teams
Ground Controller	GC	Responsible for telemetry and command in the MCC and directs maintenance and operation activities
Flight Activities Officer	FAO	Plans crew activities
Payloads Officer	PAYLOAD	Coordinates activities involving the payload
Maintenance, Mechanical, Arm and Crew Systems	MMACS	Monitors the Orbiter's structural and mechanical system
Public Affairs Officer	PAO	Provides commentary and mission information to the media and public
Mission Operations Directorate Manager	MOD	Link from the Flight Control Room to top NASA and JSC mission operations directorate management

Classroom Set Up



F: Flight Director

E: Engineer

C: Capcom

A: Astronaut

Lesson Plan

1. Separate the students into groups of 4.
2. Explain the roles to the class.
3. Hand out material so that each group gets one of every item.
4. Arrange groups so that the engineers start in the Engineering Area (blue), the Capcom in front of the engineer and the Astronauts standing at the station.
5. In a location (Red area) from direct site of the class, the flight director will construct a structure at mission control using the same materials provided each group.
6. The flight director may choice an appropriate amount of time for groups to complete their task (for example: 5 minutes).
7. Engineers must observe the structure at mission control then describe that structure to Capcom(whispering). Engineers may go to mission control as many times as needed.
8. The Capcom will then relay that information to the Astronaut.
9. The Astronaut will then construct the object as described by the Capcom.
10. Goal is to construct the same structure as Mission Control. Either give a time limit or have groups raise their hands when they believe they have completed the mission. After each mission, have students switch roles. Every student should have a turn at each of the 3 roles.

Extensions of the activity

The flight director will create more complex designs or shorten the amount of time given for students to complete each mission.

This activity also worked to practice other languages, which helps especially for students who are fluent in different languages.

This activity can be applied from K-12 using grade level adaptations as the activity develops to including math to identify the next steps.

Internet Resource Sites:

https://www.youtube.com/watch? v=ry55--J4_VQ

https://www.nasa.gov/sites/default/files/atoms/files/ccp_capcom_coloring_508.pdf

https://balettie.com/mcc/

https://nasa.tumblr.com/post/172318636044/5-myths-about-becoming-a-flight-director

Engineering: Simple Machines

https://www.teachengineering.org/lessons/view/cub_simple_lesson01

https://storytimefromspace.com/

Field Trips:

Discovery Center Space Foundation CO

https://www.discoverspace.org/education/field-trips-and-classes

https://www.frostscience.org/

https://mods.org/

Apps

https://www.lpi.usra.edu/AR/

Evaluation/assessment

- Were students successful at recreating each structure?
- What improvements in communication were made over the course of the activity?

References

How NASA Builds Teams: Mission Critical Soft Skills for Scientists, Engineers, and Project Teams by Charles J. Pellerin

How NASA Builds Teams: Mission Critical Soft Skills for Scientists, Engineers, and Project Teams Hardcover by Charles J. Pellerin

Leadership from the Mission Control Room to the Boardroom: A Guide to Unleashing Team Performance Hardcover by Paul Sean Hill

The International Space Station Operating an Outpost in the New Frontier https://go.usa.gov/xQbvH by Robert Dempsey