Ideas with IMPACT

idea packet

Copy That, Mission Control!

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2019-2020

mission control!
Copy That, Mission Control!

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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.

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


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