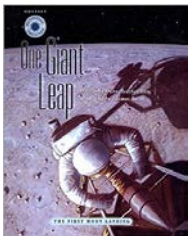
Astronaut Moon Lander STEAM Lesson



Suggested moon voyage book titles:
One Giant Leap by Dana Meachen Rau
If You Decide to Go to the Moon by Faith McNulty
Moonshot: The Flight of Apollo 11 by Brian Floca

Lesson duration: 90 minutes with Read Aloud, *Add more time depending on use of YouTube Videos
Suggested Age Range: 4-12

STEM Activity: Build a "marshmallow astronaut" moon/planet lander

***Objective*:** Children will design and build a model spacecraft lander carrying two model marshmallow astronauts inside the cabin (cup), when dropped from a height of 10 feet keeps the astronauts safely inside the cabin and the lander must land upright.

***Supplies/Resources/Tech*:** *[Offer children a variety of materials to create the "shock absorbing system' for the lander. Having a single design that every maker create is strongly discouraged. Encourage individual creativity and innovative ideas.]*
Suggested supplies for children: small plastic cups (8oz.), 2 large marshmallows per child, 1 bag mini marshmallows, pipe cleaners, straws, rubber bands, cotton balls, foam pieces, bubble wrap, rubber bands, cardboard, index cards, construction paper pieces, foil, plastic wrap, masking tape, clear tape, white glue, tacky glue, hot glue gun (optional), scissors, blueprint paper – *optional*, lined or blank paper, pencils or pens, measuring tape that stretches to at least ten feet, plastic tubs to organize all supplies

Read Aloud: Stop to discuss talking points, especially how astronauts survive in space and if a space craft is in the Read Aloud, any features about how it lands safely.

***Introduction*:** "In space there is no air, warmth, air pressure, feel of gravity, water, or food. Outer space is a harsh, dangerous place. Many scientists and engineers have imagined, invented, planned and designed tools, clothing and gear to keep people safe, and alive, when they explore and work in space. Spacecraft for astronauts to travel in are specially designed. SHOW part of VIDEO.

> **How it Works: The International Space Station 28:57** {Preview and show segments and/or play in full as children are designing}
> https://www.youtube.com/watch?v=SGP6Y0Pnhe4
> Documentary Tube July 2015

Discuss what children notice about what's different living and working in space than on Earth. (Prompt discussion including: food in packages so it doesn't float around; everything put away or velcroed onto something; all the equipment, supplies and experiments are on the floor, walls and ceiling – every inch of space on board is used; air is provided; water is stored in tanks; bathroom has a strong suction device to keep waste in a safe, healthy place; astronauts practice in no gravity situations {floating can cause nausea}

Children Ask Questions*:* Encourage children to ask questions about how a spacecraft can keep astronauts safe. Answer procedure questions directly but not creating questions. Record these, if able, to revisit later. (Some questions may be answered today and others another visit. You might have to read to find out an answer to your questions. You might look on the Internet or find a YouTube video answer. Some questions just can't be answered and that's okay.)

***Engineering Challenge*:** "Your challenge today is to create a miniature model of a moon or Mars lander that can get astronauts safely from the orbiting spacecraft down to the surface of the moon or planet. In your model you will have 2 large marshmallows, representing the astronauts. They must stay safely inside your lander and the lander must stay upright for the astronauts to survive. We will be dropping your lander 10 feet to test your 'bounce' and safety designs."

***Guided Practice*:**

1. Tell students that "one of the most important moments of the lander successfully getting the astronauts to the surface of the moon or planet is when the little space craft touches down on the ground. A real lander would be traveling very quickly and it's important to be careful not to crash! Do this mini experiment to see one thing you need to know about a real lander or a model lander "hitting the ground."
2. Choose a partner to watch jump up and down 5 times. Watch your partner's knees for how they bend a little when your partner's body "hits" the floor. This bending is a kind of shock absorption. When you your knees bend, they help control your fall back to the floor by taking some of the force of the energy and movement of your body. Devices have been engineered to be these "shock absorbers" (take on some of the energy and movement). There are shock absorbers in vehicle wheel systems, bicycles, in the bottom of your tennis shoes!, and some buildings designed to move with earthquakes.
3. Optional: Show a video recreation of the Apollo 11 Moon Lander. Tell children to focus on the "legs" and "foot pads" and how they look like they could easily break. So, how did the craft land safely? Prompt children to compare to their own legs when they jumped, as they watch. Ask them to look closely to find possible places where shock absorbers are attached or built in to the lander?

   NASA: Moon Landing - Apollo 11 Descent Film and LRO Imagery 4:51
   https://www.youtube.com/watch?v=tM3Bx6Mt8Dg
   Amazing Space July 2016
4. Have children discuss what they saw in the video to help them design their lander.
5. Encourage children to ask more questions about shock absorbers and record for later discussion.
6. Have children walk along the makers table with all the supplies to choose from. Ask them to start thinking about how they might design a model craft to land when dropped about 10 feet.
7. Remember the astronaut marshmallows need to stay inside and the lander must stay upright to keep the astronauts safely inside. Show a cup and two loose large marshmallows. Do not put the marshmallows in the cup. Encourage children to decide how to do this.
8. Have children brainstorm ideas with a partner and others around them.
9. Optional: have children draw a picture of their idea.
10. Next, have children go to the makers table groups at a time to begin to design their prototype.
11. Have children build a prototype lander. Circulate and support as appropriate and needed. Do not show a sample or even ideas about folding index cards as mentioned on one of the lessons in resources. However, encourage children to share their ideas with the rest of the group.
12. As children build their lander, encourage them to test how it's working. Children stand and drop their prototype from as high as they can reach or a family member can reach.
13. Children can make as many changes as they want to get their lander to try to meet the challenge.

***Independent Practice*:**

1. Give children a time limit of 10 minutes to complete their final design and test it 1-2 times.
2. Have children do a "mini clean-up." Return supplies and throw trash away.
3. Meet together in a large area.
4. Use a measuring tape pulled up to 10 feet by standing on a chair safely.
5. Have volunteer children come up one at a time to try out their prototype craft's landing.
6. Each child will have 2 chances to drop to achieve success.
7. Have each child share/present – see below.

Children answer questions posed as able or researched: Have children answer questions posed by kids, if appropriate and able.

***Children Share/Present*:**

- As each child attempt the final two tests, have them describe which kind of design they chose to try and why they think it worked so well. Also, if they had more time, what changes would they make and why?
- Have everyone applaud for each prototype.

Additional lesson resources:

[Not recommended to show only one kind of solution. Encourage children to come up with a variety of solutions to the challenge/problem.]
https://www.jpl.nasa.gov/edu/pdfs/touchdown.pdf
https://www.jpl.nasa.gov/edu/teach/activity/touchdown/
http://pbskids.org/designsquad/build/touchdown/

Developed by: Original idea shared by Joan Gillman, role The Calhoun School: New York, NY. "Meteoroids, Asteroids, and Moons, Oh My!" NSTA STEM Forum & EXPO. Summer 2017.
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