USDA
United States Department of Agriculture

NIFA
National Institute of Food and Agriculture

https://nifa.usda.gov/program/4-h-positive-youth-development

NASA
National Aeronautics and Space Administration

EXPEDITIONARY SKILLS FOR LIFE
A FEDERAL PARTNERSHIP FOR **STEM** EDUCATION

LESSON PLAN: TEAMWORK ACTIVITY 2.9
ROCKET POWER CHALLENGE I

LESSON DETAILS

AGE/GRADE LEVEL
Middle School

LEARNER OUTCOMES
Youth will identify ways to effectively communicate with members of a team, recognize there are many different solutions to solving problems, and define teamwork.

SUCCESS INDICATORS
Youth will encourage each other in team activities, be able to accomplish a task with limited resources, and demonstrate cooperation.

LIFE SKILLS
Critical thinking and innovation, collaboration, social skills.

NATIONAL STANDARDS
CCSS.ELA-Literacy.CCRA.SL.1
Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

21st Century Learning and Innovation Skills: Learning and innovation skills increasingly are being recognized as the skills that separate students who are prepared for increasingly complex life and work environments in the 21st century, and those who are not. A focus on creativity, critical thinking, communication and collaboration is essential to prepare students for the future.

PREP TIME
15 minutes for room set up

ACTIVITY TIME
60 minutes

MATERIALS LIST
• 1 lb. dry spaghetti
• 10 oz. small marshmallows
• 20 oz. gum drops
• yard stick or tape measure
• countdown clock or other timing device
  More supplies may be needed depending upon the size of the group

HANDOUTS
Learner Assessment Questions

SUGGESTED SPACE
Indoors, one table or other flat surface for each team

SUGGESTED GROUP SIZE
4 youth per team, any number of teams can be involved.

REFERENCES
Engineering Design Process
http://www.eie.org/overview/engineering-design-process

Building Your Programs 20 Minutes at a Time — Leadership and Reflection Activities You Can Use !
www.extension.umn.edu/youth/research/quality/docs/building-your-programs-book-one.pdf

4-H Engineering Project
http://4h.ucanr.edu/files/183847.pdf

NASA Teamwork
https://science.nasa.gov/science-news/science-at-nasa/2005/10jan_teammeup

INTRODUCTION

The engineering design process is a series of steps that engineers follow to come up with a solution to a problem. Many times the solution involves designing a product (like a rocket) that meets certain criteria and/or accomplishes a certain task.

Engineering is a planned and repeated approach to addressing a need by designing, building, and testing tools, processes, and systems.

The five steps of the engineering process are:
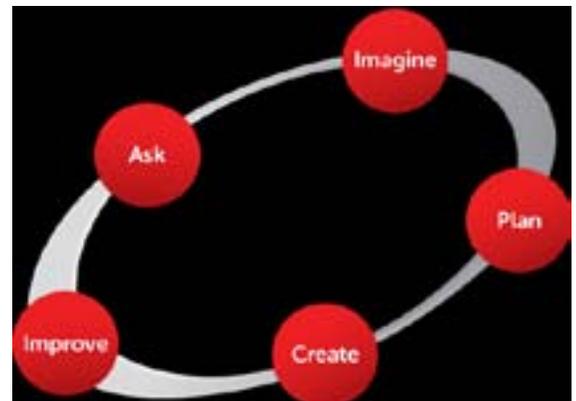
ASK: What is the problem? How have others approached it? What are your constraints?

IMAGINE: What are some solutions? Brainstorm ideas. Choose the best one.

PLAN: Draw a diagram. Make lists of materials you will need.

CREATE: Follow your plan and create something. Test it out!

IMPROVE: What works? What doesn't? What could work better? Modify your design to make it better. Test it out!
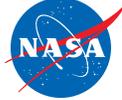
ROCKET POWER CHALLENGE I, CONTINUED

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ACTIVITY INSTRUCTIONS

INTRODUCTION ACTIVITY (10 MINUTES)

Ask and discuss with youth:

1. Why do people work on teams?

2. What makes a good team member? What are some examples of how people work together on teams?

3. What is NASA? Do you know what the people do at NASA? What does teamwork have to do with NASA?

4. What is engineering? Introduce the steps of the Engineering Cycle:
   - Ask
   - Imagine
   - Plan
   - Create
   - Improve

ACTIVTY PART 1: NO ASSIGNED ROLES (10 MINUTES)

Explain to the youth they will work on a team to complete an engineering challenge.

1. Assign youth into teams of 4 with each team at their own table or other level surface.

2. Hand out supplies. Give each team 12 pieces of spaghetti, 10 marshmallows and 10 gumdrops. Tell the youth not to touch or eat the supplies.

3. Tell the youth they will have to work together and build a model of a rocket. The goal is to make the rocket as tall as possible, and it has to stand on its own. When they're done building, it should not tip over.

4. Have the youth briefly discuss and make a plan for what their rocket may look like and how they might use the limited supplies they have. No other supplies may be used.

5. Tell the youth they have 7 minutes to work on their rocket. They can only use non-verbal communication (no talking). Each time someone uses verbal communication, their team loses one item from their building supplies.

6. Allow the teams 7 minutes to build their rockets. Display a countdown clock if possible

ACTIVITY PART 2: NO ASSIGNED ROLES (10 MINUTES)

1. Within their teams, allow each team member 15 seconds to share. Have each member answer one of the following questions:
   What is going well?
   What is not working?
   What could we do better?
   Are we working as a team? Why or why not?

2. Ask the group: What are the challenges of working together non-verbally? How would verbal communication be helpful in this situation?

3. Allow each team a chance to move about the room as a group for 1 minute to view the other teams' projects to get ideas. Have them discuss what is working and what is not working for the other teams' designs and how they might incorporate these ideas into their plan/model.

4. Give the teams 1 minute for continuation planning. Allow them to choose any three additional building materials of their choice. They can have three of the same item if they choose.

5. Give teams 5 minutes to finish their rocket model. Remind them to use their plan and what they have learned so far about how their team has been functioning.

6. When time is up, have the youth step away from their table and have each team showcase their final model design. Use the yardstick to measure the final rocket model height. Use class applause to celebrate all of the teams' efforts!

7. If time allows, have each team give a 20 second showcase report of what worked well and/or what did not in the building of their rocket model.

ROCKET POWER CHALLENGE I, CONTINUED

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DISCUSSION QUESTIONS (10 MINUTES)

1. What was challenging about working as a team?

2. Can you identify different ways in which you communicated with your team members to complete the task?

3. Did you follow the engineering process steps? If yes, how did that help guide your process? If no, why not? Would it have helped?

4. Why is it necessary for engineers at NASA to apply teamwork principles in their work?

5. Would your group have worked better together if you each had a specific job (role) in building the rocket model? Why? Would this have helped you be more efficient?

DEBRIEF ACTIVITY: WHAT'S MY REFLECTION QUESTION? (5 MINUTES)

MATERIALS LIST
Reflection question notecards (see questions below).

1. Hand each youth a card face down so they cannot see the question.

2. Ask them to hold their card up to their forehead with the question visible to all but themselves.

3. Instruct youth to move around to individuals answering the question the other person is holding. Remind them not to read the question out loud.

4. Each youth should hear answers from a minimum of 3 people before guessing what their reflection question is. After most or all have discovered their reflection question, ask a few to share the responses they received and how those answers helped them determine what their question was.

Sample Reflection Questions

- What are some ways you like to lear?
- What have you learned about making decisions?
- How did others help you?
- Why was this an important/useful thing to do?
- What surprised you about this activity?
- What was most challenging?

APPLY CHALLENGE: HUMAN KNOT (10 MINUTES)

1. Divide the group into teams of 6 to 10 youth. Have each team stand in a tight circle.

2. Ask the youth to reach their right hand into the middle of the circle and grasp the hand of someone that is not directly next to them.

3. Then tell the youth to reach their left hand into the middle of the circle and grasp the hand of someone else that is not directly next to them.

4. After they are all holding hands, ask the teams to try to untangle the knot (while still holding hands).

SAFETY NOTE

Teams should be closely monitored to ensure that the untangling process is done safely. Remind youth not to pull anyone over and to be careful not to accidently step on or kick anyone.

Discuss:

1. Can anyone share a feeling they had during the activity (i.e. happy because it was fun, frustrated because you could not get untangled, mad because people would not listen, proud because you were able to untangle the knot, etc.)?

2. How did this activity require teamwork? What could your team have done better?

3. How can you use teamwork during your daily lives at school, at home, in extra-curricular activities, etc.?

FUN FACTS

- There is no set number of people in an astronaut candidate class; NASA selects candidates on an as-needed basis.

- Lonnie Johnson, the man who invented the Super Soaker was a NASA engineeer. He also helped develop the Stealth Bomber.

DID YOU KNOW

NASA will send you a text message whenever the International Space Station (ISS) passes over your location.
https://spotthestation.nasa.gov/signup.cfm

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ACTIVITY 2.9: LEARNER ASSESSMENT

These questions are about things you learned during this activity. Please check the circle that best describes you.

Q1 I know how to express myself in different ways.

○ Not at all like me
○ A little like me
○ Somewhat like me
○ A lot like me

Q2 I can explain the steps in the engineering process.

○ Not at all like me
○ A little like me
○ Somewhat like me
○ A lot like me

Q3 If my team wants to accomplish a goal, we can find many different solutions.

○ Not at all like me
○ A little like me
○ Somewhat like me
○ A lot like me