

Linking Motion

ACTIVITY OVERVIEW

STEM Focus Area: Engineering

Learning Goal: To understand the basics of mechanical engineering.

Youth Learning Targets

- "I understand how moving one thing can move another."
- "I can change things to make them work better."

LEARNING ENVIRONMENT

Activity Duration: 45min

Class Size: Any Size

Type of Space: Indoor

Age of Youth: Grades K-2

Guiding Question: What is the question to explore OR the problem or challenge to solve?

What are mechanics? How do mechanics work?

Through this activity, youth will:

- Develop a design that includes a series of linkages.
- Learn how different types of linkages can be used to redirect motion.
- Design their linkages before building.
- Explore different material properties.
- Assemble linkages to explore basics of mechanical engineering

Facilitator Prep

Facilitators will need to prepare materials before the activity and develop an understanding of what linkages are and how they work. Facilitators will need to drill holes for the pipe cleaners that will connect the pop-sickle sticks.

Literacy Connection: Great books to get youth support learning about Engineering (*available on Amazon*).

- Rosie Revere, Engineer by by Andrea Beaty (Author), David Roberts (Illustrator)

DoS: Authentic Stem Practices

- | | |
|---------------------------|--|
| ✓ Predict and hypothesize | ○ Share and communicate data |
| ✓ Develop and use models | ○ Interpret data |
| ○ Measure materials | ○ Test and revise |
| ○ Observe | ✓ Draw conclusions and relationships |
| ✓ Investigate | ○ Have voice and agency, make decisions and guide their own learning |
| ○ Record observations | |
| ○ Analyze and infer | |

PREPARATION

Materials

- Pop-sickle sticks (predrilled holes on ends)
- Pipe cleaners
- Assorted foam pieces

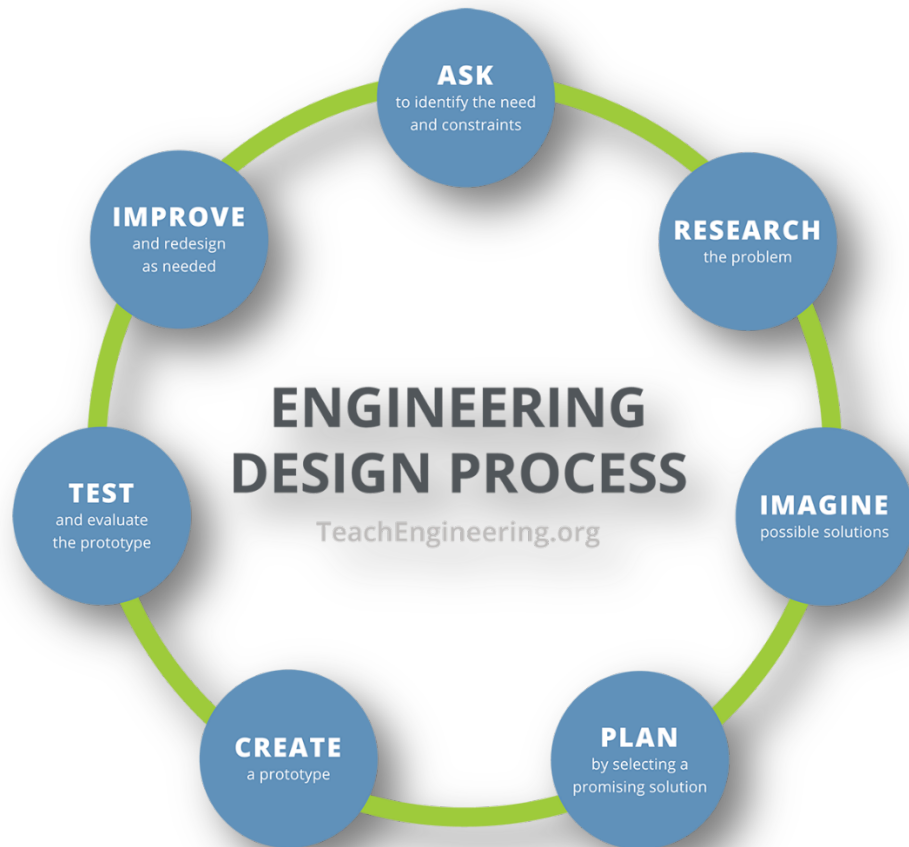
- Assorted craft materials
 - o Glue
 - o Paper
 - o Scissors
 - o Googly eyes
 - o Etc

Room

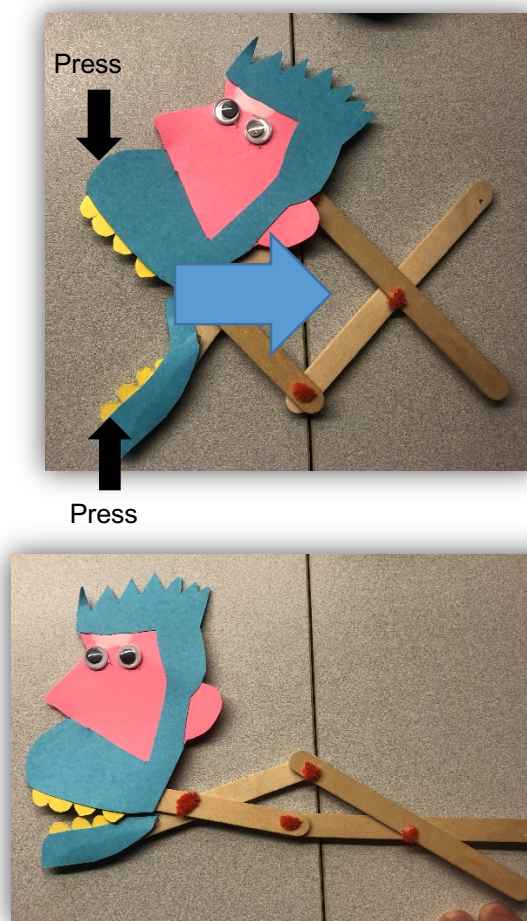
An informal setup would be best suited for this activity, ensuring each individual has enough space to access the materials and build their linkages.

Content

- **Engineers** use what they understand about math and science to solve clearly defined problems.
- The **engineering design process** is a sequence of steps that offers engineers guidance as they try to solve problems. The process is designed to repeat particular steps as many times as needed, making improvements along the way.



- **Learning from failure** is a key part of the engineering design process.
- **Motion** is caused by **force**.
- **Linkages** are a combination of **simple machines** called **levers** that are connected and move at pivot points.



Inquiry

Your primary goal as facilitator is to encourage youth to explore and observe what causes motion and how to use the engineering design process. You can prompt those discussions with questions like the following:

- How do things move? What is motion?
- What causes the linkage to move?
- What will adding more linkages accomplish?
- If you another linkage to the beginning, what how will that affect the end?
- If their linkage isn't working: Where does the linkage seem to be broken? What would an engineer do? How can you improve it?

DoS:

- ✓ Organization: I practiced the activity/technology, prepared materials/extras/place to record youth ideas, and completed an activity (including timings).
- ✓ Materials: Materials are appropriate for teaching the learning goals; youth will be able to use them and will think they are appealing.
- ✓ Space Utilization: The space is set up appropriately for the activity and there will be no safety issues or distractions.
- ✓ Relevance: I have researched why the content matters to youth's everyday lives.
- ✓ Content Learning: I have become familiar with the content.
- ✓ Inquiry: I have become familiar with how authentic, age-appropriate inquiry practices look in this activity.

INTRODUCTION TO ACTIVITY (15 MINUTES)

Start with a conversation about the youths' experience with motion.

- How do things move? What is motion?
- Motion is when an object moves. Motion doesn't happen by itself. Something needs to get the object to move. The thing that gets the object to move is called force.

Review simple machines with the youth.

- Inclined plane
- Wheel and Axle
- Pulley
- Screw
- Wedge

Explain what linkages are

- A linkage is a combination of levers that are connected and move at their pivot points.
- Review levers
- Introduce the engineering design process – if a white board is available, draw it out as you describe it. You can also use a projector with a pre-made image of an engineering design process.
- Explain that working backwards is often the best way to design something. First, start with the end. Ensure the last thing the product does is done well. Then build backwards until you have the beginning built.

DoS:

- ✓ Space Utilization: I will use the space informally avoiding the lecture hall format.
- ✓ Purposeful Activities: This intro section gets youth on track for the learning goal.
- ✓ Content Learning: If age appropriate, I will accurately present content.
- ✓ Inquiry: In this or another section of the activity, youth carry out one or more inquiry practices.
- ✓ Relationships: I will make each youth feel welcome.
- ✓ Relevance: In this or another section, I will guide the youth in a sustained discussion of how the activity relates to their everyday lives.
- ✓ Youth Voice: In this or another section, I will allow youth the opportunity to make decisions about their learning experiences.

ACTIVITY ENGAGEMENT (15 MINUTES)

- Have each youth think of a problem they might be able to solve with a linkage. An example might be a "Grabber"
- Pass out the materials to the youth.
- Have them work backwards; starting with the end. "What will your linkage do?" They can use this opportunity to decorate two pop-sickle sticks and determine what it will do.
- Once they have built the end, they can continue adding linkages.
- Ask throughout the activity: "Where in the engineering design process are we right now?"
- If their linkage isn't working the way they want, ask these questions: Where does the linkage seem to be broken? What would an engineer do? How can you improve it?

DoS:

- ✓ Space Utilization: I will use the space informally avoiding the lecture hall format.
- ✓ Participation: All youth will have access to the activity.
- ✓ Purposeful Activities: This core section helps youth to move toward the learning goal.
- ✓ Engagement: This activity has youth physically engaged with their hands and their minds.
- ✓ Inquiry: In this or another section of the activity, youth carry out one or more inquiry practices.
- ✓ Reflection: If appropriate, I will ask youth questions during the core activity that will help them make sense of what they are learning.
- ✓ Relationships: I will take steps to share my enthusiasm and create a nurturing, safe learning environment.
- ✓ Relevance: In this or another section, I will guide the youth in a sustained discussion of how the activity relates to their everyday lives.
- ✓ Youth Voice: In this or another section, I will allow youth the opportunity to make decisions about their learning experiences.

FINAL REFLECTION AND RELEVANCE (5 MINUTES)

Once everyone's linkages are completed, have a conversation about the engineering design process:

- What was the problem you were trying to solve with your linkage?
- Where in design process are we now?
- What are some ways that we can improve our linkages?
- Where are examples you see linkages in our daily lives?

DoS:

- ✓ Space Utilization: Again, I will use the space informally.
- ✓ Participation: I will prompt youth who do not have access to the activity to participate.
- ✓ Purposeful Activities: The closing section helps youth to reach the learning goal.
- ✓ Content Learning: I will help youth make connections between different ideas. I will create opportunities for youth to ask questions/provide ideas that show a deeper level of understanding.
- ✓ Inquiry: In this or another section of the activity, youth carry out one or more inquiry practices.
- ✓ Reflection: I will provide youth with a sustained opportunity to make sense of their learning.
- ✓ Relevance: In this or another section, I will guide the youth in a sustained discussion of how the activity relates to their everyday lives.
- ✓ Youth Voice: In this or another section, I will allow youth the opportunity to make decisions about their learning experiences.