Lesson 3: Critical Thinking

Arizona Science Standards

6.4U2.5 – Analyze how humans use technology to store (potential) and or use (kinetic) energy.

Crosscutting Concepts: Motion energy is properly called kinetic energy; It is proportional to the mass of the moving object and grows with the square of its speed. A system of objects may also contain stored (potential) energy, depending on their relative position.

Background Information: Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. A system of objects may also contain stored (potential) energy, depending on their relative positions.

Hello, welcome to Engineers of the Future remote learning. My name is Janet Yeow with AECOM. I am going to be your mentor for today's lesson.

Our program is going to teach you about science, technology, engineering, and math. It is called STEM learning.

We will get to the fun project we are going to build a **BALLOON CAR**, but first I want to tell you more about **CRITICAL THINKING**.

What is Critical Thinking?

- "Critical Thinking refers to the ability to analyze information objectively and make a reasoned judgment."

There are Five Critical Thinking Skills

1. **Analysis** - is breaking down the text or problem that you are examining to understand each individual part.
2. **Communication** - listen intentionally and deliver messages in the most optimal way.
3. **Creativity –** It is a way to develop solutions. You come up with some unique ideas. Think "outside the box."
4. **Open Mindedness –** is a willingness to try new things or to hear and consider new ideas.
5. **Problem Solving** - refers to the ability to use knowledge, facts, and data to effectively **solve problems**. You can **think** on your feet, assess **problems,** and find solutions.

Why is critical thinking important in the world of work?

- Critical thinking is critical to employers
    - Can you analyze situations?
    - Can you problem solve?
    - Can you communicate your position logically?
    - Can you make good decisions (based on data, not feelings)?

Why is critical thinking important to student learning?

- College-level learning is deeper than memorizing facts:
    - Science – analyzing results of experiments considering existing theories
    - Math – selecting appropriate problem-solving strategy for word problems
    - Engineering – Transforming ideas into design and concept– reacting correctly to simulations
    - Political science/sociology – analyzing others' points of view
    - Philosophy – The ability to look behind, underneath and beyond everyday issues

Critical Thinking and Your Future

- How critical thinking can help your future

    - Bring New Ideas – gets you noticed
    - Fosters Teamwork – learn to be a leader
    - Objectivity – think from a different perspective
    - Build Confidence – make confident decisions
    - Solve Problems – be the solution person
    - Get Promoted More Often
    - Become A CEO

BUILD A BALLOON CAR PROJECT

Alright let us get to our lesson today on motion.

Credit: Ben Finio, PhD, Science Buddies

We are going to learn things like:

Physics, Kinetic Energy, Potential Energy, Conservation of Energy, Newton's Law of Motion.

Materials:

- Plastic bottle
- Four plastic bottle caps
- Wooden skewer
- Two straws
- Balloon
- Tape
- Scissors or sharp knife

Preparation

- Cut one of the straws in half.
- Tape both pieces of the straw to one side of the water bottle.
- Cut the wooden skewer in half and push each piece through one of the straws. These will form your axles. (Have an adult help.)
- Have an adult help use the scissors to poke a “+”-shaped hole directly in the center of each plastic bottle cap.
- Press each bottle cap onto the ends of the wooden skewers. These will form your wheels.

Procedure

- Put your car down on a flat surface and give it a good push. Make sure the car rolls easily and coasts for a bit before stopping.
- If your car gets stuck or does not roll smoothly make sure: your axles are parallel to each other; the hole in each bottle cap is centered; and the straws are securely taped to the water bottle and do not wobble. You can add some glue if tape is not sufficient.
- Tape the neck of the balloon around one end of the other straw. Wrap the tape very tightly so the connection is airtight.
- Cut a small hole in the top of the water bottle, just big enough to push the straw through.
- Push the free end of the straw through the hole and out the mouth of the bottle.

- Use tape to secure the straw to the bottle.
- Blow through the straw to inflate the balloon, then put your finger over the tip of the straw to trap the air. *What do you think will happen when you put the car down and release your finger?*
- Put the car down on a flat surface and release your finger. *What happens?*
- See what adjustments you can make to make the car go farther.
- *What happens if you inflate the balloon more?*
- *What happens if you adjust the direction the straw is aimed? Does it work best if the straw is aimed straight back?*

Observations and results

- When you inflate a balloon and let it go, it zips randomly around the room.
- When you tape the balloon to a straw and attach it to the body of your car, however, you can control the direction of the escaping air.
- When the end of the straw is aimed backward, the air pushes your car forward, as described by Newton's third law of motion.
- Your design will be most efficient if the straw is pointed straight back and not downward or to the side.

- The more you inflate the balloon the more potential energy it stores, which in turn is converted to more kinetic energy, according to the law of conservation of energy—so the car will go faster.

Thanks for watching today's lesson.

- Remember to keep studying.
- Maybe one day you could become an engineer.
- We will have even more cool STEM lessons and project builds coming up, right here on the Engineers of the Future YouTube channel.