Quality Element 1: Programming and Youth Development

Engaging Youth through STEAM Activities

Helping young people learn science, technology, engineering, arts, and math – the subjects collectively known as STEAM – is key to building a prosperous, thriving economy in Georgia.

Nationwide, states and schools are engaging diverse partners like afterschool and summer learning programs, libraries, museums, universities, and businesses to ensure that all students, no matter where they grow up, have access to high-quality STEAM learning experiences. In Georgia, business leaders cannot find the STEAM talent they need to stay competitive. The good news is that utilizing the hours outside of school can help narrow the STEAM skills gap and build a skilled workforce equipped with the necessary knowledge and competencies to tackle the challenges of the future.

Why Out-of-School Time?

- **Extra Exposure:** Children spend less than 20% of their waking hours in formal classroom learning. Afterschool and summer learning can almost double the amount of time some students have to learn, question and explore STEAM topics and career.
- **Engaging Opportunities:** Afterschool engages students in hands-on, real world projects that offer innovative ways to practice authentic STEAM skills in an informal, accessible space.
- **Career Preparation:** Afterschool cultivates interest, builds real STEAM skills and helps connect students to diverse STEAM career pathways and internships that develop the foundational skills, such as critical thinking, problem solving, and communication, which employers seek out.
- **Opportunity for All:** Afterschool STEAM programs are a promising opportunity to address inequities in access to and participation in these fields as girls and African American and Hispanic children, who are traditionally underrepresented in engineering and technology fields, are at least two times more likely to participate than White children.

Source: The LIFE Center's Lifelong and Lifewide Diagram. FInd it here.

Why STEAM?

Students in afterschool and summer learning STEAM-based programs gain interest and stay engaged in STEAM learning and careers.

- A study of 1,600 youth participating in 160 STEAM afterschool programs found:
  - 73% have a more positive STEAM identity
  - 80% increased their STEAM career knowledge due to their afterschool experience
- Of youth served by an afterschool program in 140 locations worldwide:
  - 80% of alumni reported the program was the most important source of support for pursuing a career
  - 97% said it taught them to set high goals and expectations for themselves

Curriculum and Activities

Finding low-cost, quality resources for curriculum and activities to incorporate STEAM into your programming can be a daunting task, but you don't need to be an expert or have a huge budget to have great STEAM activities. The following pages highlight some of the many great STEAM resources available and can be conducted by staff with any level of STEM experience.

OUTRAGEOUS OOZE – EXPLORATORIUM

Grades PreK – 2 | Low to Medium Cost | Download

Young people will learn that all matter can exist in either a solid, liquid or gas, but observe that sometimes matter acts strangely as in the case of Ooze. Students will make Ooze and observe how when they bang on it with a spoon or quickly squeeze a handful of Ooze, it freezes in place, acting like a solid. But when they open their hand and let the Ooze ooze, it drips like a liquid. Begin by engaging students with the following questions: What are some examples of liquids we see in the classroom/in our lives? What are some examples of solids we see in the classroom/in our lives? What are the properties of water or how does water behave? What are the properties of solids or how do solids behave?

Materials: *Each pair of students need newspaper, measuring cups, 1 cup of dry cornstarch, large bowl or pan, food coloring (if you want), and ½ cup of water.*

SHAPE UP – NATIONAL AFTERSCHOOL ASSOCIATION

Grades PreK – 2 | Low to Medium Cost | Download

Young people will learn that any object can be described by its properties including size, weight, color, texture or shape. They will use inexpensive materials to help them master simple shapes including rectangles, squares, triangles and parallelograms. Begin by engaging students with the following questions: What words can be used to describe some of the objects that you see in this room? What is a shape? Look around the room and name some of the shapes you see? What is the difference between a circle and a square?

Materials: *Each student needs colored craft sticks, Velcro fastener circles, two balls (one larger than the other), five sheets of paper, and drawing utensils.*

REMOTE CONTROL ROLLER – EXPLORATORIUM

Grades PreK – 2 | Low Cost | Download

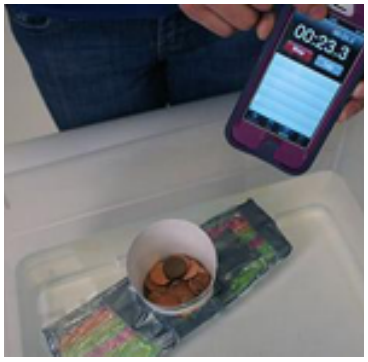
Young people will learn that everything in the universe is made up of tiny particles: protons, neutrons and electrons and observe how these particles interact with one another. Begin by having students rub a balloon on their hair or arm hair and observe what happens. Then ask the following questions: What is happening to their hair/arm hair? Why?

Materials: *Each student needs one empty soda can, balloon, your hair (dry, not-too short hair with no hair products in it works best), and a flat surface.*

Curriculum and Activities

WATERCRAFT CHALLENGE – PBS KIDS DESIGN SQUAD

Grades 2 – 4 | Low Cost | Download



Young people will learn about buoyancy, the force pushing back up onto an object in water, and the more buoyancy something has, the higher it floats in water. They will design and build a boat that is very buoyant so that it holds 25 pennies for ten seconds before sinking. Begin by engaging students with the following questions: If you take two empty, capped soda bottles - one big and one small - and push them underwater, which one will be harder to keep down? Why? How do you think you can make a boat that's very buoyant (can float)?

Materials: *Each pair of students need a container filled with water (e.g., bucket, sink, plastic, tub), duct tape, paper cups (8-ounce or larger), 10-inch strip of plastic wrap, 10 straws, towels (paper or cloth), and 25-50 pennies.*

PAPER TABLE CHALLENGE – PBS KIDS DESIGN SQUAD

Grade 2 – 5 | Low to Medium Cost | Download

Young people will learn that in engineering, triangles are stronger than squares, by using paper to design a strong table that is at least eight inches tall and strong enough to hold a heavy book. Begin by engaging students with the following questions: When you see bridges or construction around the city, what do you notice about the structure? Looking at our materials, how can we make a strong tube out of a piece of paper? How can we arrange the tubes to make a strong, stable table? Download the activity to continue the lesson.

Materials: *Each pair of students need 1 piece of cardboard or chipboard (approximately 8.5 x 11 inches), heavy book (e.g., a textbook or telephone book), masking tape, and 8 sheets of newspaper.*

SPAGHETTI MARSHMALLOW CHALLENGE – EGFI AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Grades 3 – 6 | Low Cost | Download

Young people will be engineers and work in a team to design, build and test the tallest free-standing spaghetti structure that can support a marshmallow. At the conclusion of the activity, facilitate a reflection and further learning by asking the following questions: How did your team decide on the design of your structure? What worked well in the design of your structure? How would you improve the design of your structure for next time?

Materials: *Each pair of students need 20 pieces uncooked spaghetti (regular, not angel hair or thin spaghetti), 3 ft. of string that can be easily broken by hand, 1 fresh marshmallow (standard fluffy variety, not mini or jumbo size, and not stale or hard), 3 ft. of masking tape, and paper bags – standard lunch size – or manila envelopes to contain above materials.*

Curriculum and Activities

BALLOON POWERED RACING CAR – PBS KIDS DESIGN SQUAD

Grades 4 – 8 | Medium to High Cost | Download

Young people will about learn physics concepts including Newton's law of motion and kinetic and potential energy by designing a rocket-powered racing car and experiment with ways to increase the distance and speed of the car. Begin by engaging students with the following questions: Do you think you could build a car powered by nothing but air? Can you imagine what you would want your own balloon-powered racing car to look like? How can you design a racing car that will go as far as possible?

Materials: *Each pair of students need a balloon, flexible straw, rubber band or tape, water bottle, toilet-paper tube, juice box, disposable cup, ice cream container, milk carton, cardboard sheet, orange juice can, straws, barbeque skewers, chopsticks, bottle caps, CD's, and cardboard circles.*

SNEAKER CHALLENGE – PBS KIDS DESIGN SQUAD

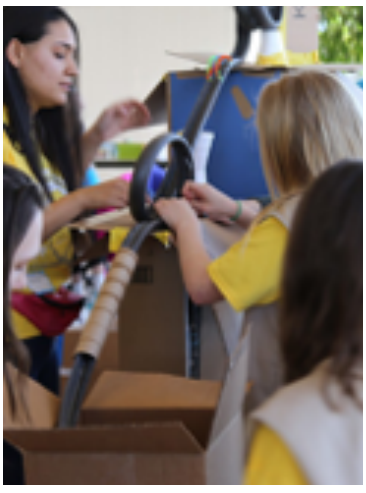
Grades 5 – 8 | Medium to High Cost | Download

Young people will be engineers and design an Earth-friendly sneaker, a shoe that does not harm the environment when it is created or thrown away. Students will test their sneaker by walking, running, and jumping around to see how they feel! At the conclusion of the activity, facilitate a reflection and further learning by asking the following questions: What worked well and what did not work well in your shoe design? Why not? What materials worked best? How would you change your design for next time?

Materials: *Each pair of students need duct tape, scrap of cardboard, scissors, pencil/pen and scrap paper, and household or classroom things that you can recycle or repurpose. The items could be natural materials, such as bamboo, straw, grass, and tree bark. The items could also be materials created by people, such as bubble wrap, rubber bands, tennis or rubber balls, sponges, rope, styrofoam, food packaging, plastic tubing, balloons, plastic shopping bags, old clothing, and binder clips.*

ROLLER COASTER – TEACH ENGINEERING

Grades 7 – 9 | High Cost | Download



Young people will learn about physics concepts including potential and kinetic energy and frictional effects by designing a roller coaster completely driven by gravity. Make it a competition using different marble types to represent different passenger loads that determines the most innovative and successful roller coasters. Begin by engaging students with the following questions: When designing a roller coaster, what might be some things that engineers have to take into consideration? When designing your roller coaster, what physics concepts will be helpful and important to apply? Why do you think the highest drop of the roller coaster is always the first drop? How do roller coasters run?

Materials: *Each group of four students needs 2-meter (6 foot) long foam tube (1/2" pipe insulation) cut in half lengthwise, glass marble, wooden marble, steel marble, paper or plastic cup, roll of masking tape, set of markers, crayons or pencils, blank sheet of paper, stopwatch, and Roller Coaster Specifications Worksheet.*