



# INNOVATION AT PLAY

The natural sparks of creativity and curiosity inside every student are key to empowering the next generation of bold thinkers, leaders, and skilled STEM professionals. Innovation At Play provides equitable learning resources celebrating the power of play to engage students from every background in the life-changing careers of tomorrow.

## INNOVATION AT PLAY FACILITATOR GUIDE

This guide was created to help educators implement Innovation at Play activities in after-school and out-of-school spaces. It provides a brief overview of the activities, required materials as well as alternative options, and video resources to complement these activities.

## ACTIVITIES

All of the following activities are designed for students in grades 9–12. Each activity has an expected duration of 30–45 minutes and includes an overview, materials list, procedure, and lesson plan with guiding questions.

### FORCES AND MOTION

#### [Ready, Set, Goal](#)

Students will learn how an object’s motion can change if the object is spinning via the Magnus Effect. The introductory phenomenon will center around how soccer players can score a goal from a corner kick.

This activity is composed of 3 smaller activations. Students will start with Flying Cups to explore the Magnus Effect and how it works. Then students will apply their knowledge to soccer and will try to use the Magnus Effect to improve their penalty kicks. Finally, students will see how the Magnus Effect is harnessed in transportation via a Flettner rotor.

#### MATERIALS NEEDED (BY ACTIVITY)

##### Flying Cups

- Disposable Cups
  - Can be plastic, Styrofoam, or paper
- Printed targets

##### Magnus Effect in Soccer

- Soccer Ball

##### Flettner Rotor

- Tape
- Rubber Bands
- Empty 20 oz. plastic bottle with cap
- 4 plastic bottle caps
- Matchboxes
- Scissors
- Thumbtack
- Hot glue or super glue
- Straws
- Wooden Skewers
  - Must be longer than the width of the matchbox
- Something that can provide a continuous source of wind
  - Vacuum cleaner with hose attachment, shop vac, fan, etc.

## VIDEO RESOURCES

[Forces and Motion | Virtual Topic Series](#)

[Top 10 Best Corner Kick Goals in Football](#)

## STABILITY AND INSTABILITY

### [Stabilize Yourself](#)

Students will learn how stability and center of gravity affect performance in different sports. Students will test themselves in a variety of balance exercises to see how changing positions or adding weight affects overall balance.

Two balance activities are described in this lesson: the 8-Point Clock Drill and the Balance Board.

### MATERIALS NEEDED (BY ACTIVITY)

- 8-Point Clock Drill
  - Cones or other visual markers
- Balance Board
  - Cylindrical object, approximately 3" diameter x 15" length  
*PVC pipe, foam roller, log, etc.*
- Board, approximately 18" length x 12" width
  - Wooden board, skateboard deck, etc
  - Should be slightly longer than shoulder width and allow for the whole foot to fit on it

### VIDEO RESOURCES

[Stability and Instability | Virtual Topic Series](#)

[Defying Gravity with Korea's Premier Balance Artist](#)

[Balance Drills for Footballers/Soccer Players](#)

[High Wire Act from Kooza](#)

## TYPES OF INTERACTIONS

### [Electric Train](#)

Students will explore the idea of a motor that does not include electrical connections to better understand how electricity is transferred wirelessly. Students will explore direct current (DC) and alternating current (AC) and how they differ.

### MATERIALS NEEDED

- 14–18 gauge bare copper or aluminum wire
  - Enamel-coated wire may be modified for use. Enamel can be burned off and the wire can be sanded down for smoothness.
  - Insulated wires can also be modified for use. Insulated wires can be stripped with a blade, scissors, wire cutters, or wire strippers.
- Scissors or wire cutters
- 3mm LED
- Iron rod or nail
- AA or AAA battery
- Strong disc magnets (diameter must be larger than the battery being used)
  - Ideally neodymium or rare earth
  - A minimum of 2 is required to have one on each side of the battery, but having up to 6 (for 3 on each side) will allow more experimentation.
- Dowel (approximately 1mm larger than the disc magnets)
  - Any cylindrical object can be used to wrap the wire into a coil. For example, dowel, thick marker, broom handle, etc.

### VIDEO RESOURCES

[Types of Interactions | Virtual Topic Series](#)

[World's Simplest Electric Train](#)

[Simple Electric Train. Race between AA Batteries](#)

## CONSERVATION OF ENERGY AND ENERGY TRANSFER

### Pocket Change to Power

Students will explore how batteries work to transform chemical energy into electrical energy while creating voltaic cell batteries to use with LEDs. Students will also see how the power generated changes with the number of voltaic cells and how different LEDs require different power thresholds.

### MATERIALS NEEDED

- Dish soap
- 10 pennies
- 10 nickels
- Small bowl or cup
- Vinegar
- Salt
- ¼ cup measuring cup
- 1 tbsp measuring cup
- Aluminum foil
- Scissors
- Pen or pencil
- Paper towel
- Insulated test leads with alligator clips
  - Ensure that both ends of the wire have an alligator clip. Here is an [example](#) of what these look like. They can be in any colors, though black and red are most common.
- 3 mm LED
  - Red is required for all student groups but other colors should be provided for students to test at the end of the activity. Here is an [example](#) of what these look like.
  - All LEDs should have a clear cap. The color that shows when lit will be determined by the material inside the LED.

## VIDEO RESOURCES

[Conservation of Energy and Energy Transfer | Virtual Topic Series](#)

[What's INSIDE an AA alkaline battery](#)

[How Does A 9V Battery Work?](#)

## RELATIONSHIP BETWEEN ENERGY AND FORCES

### SENSING AND COMMUNICATING

Students will use their knowledge of circuits to implement different types of switches that work to sense certain environmental changes. The sensors can be used to sense moisture, position, or touch.

### MATERIALS NEEDED

- Clear plastic bottle
- Water
- Tape
- Insulated test leads with alligator clips
  - Ensure that both ends of the wire have an alligator clip. Here is an [example](#) of what these look like. They can be in any colors, though black and red are most common.
- 3mm LED
  - Red is recommended as it requires the lowest voltage to light. Here is an [example](#) of what these look like.
- Battery holder (for 2 AA) with leads
  - Here is an example of what these look like.
- AA batteries
- Soil
- Potting soil, dirt, etc.
- Salt
  - This can be used to enhance the function of the tilt sensor and the moisture sensor.

- Cardboard
  - Other recyclable materials can be utilized for the construction of the sensor. For example, newspaper, plastic bottles, aluminum cans, etc.
- Aluminum foil
- Popsicle sticks
- Rubber bands
- Hot glue gun and sticks
  - Glue sticks and school glue can also be used.

## VIDEO RESOURCES

[Relationship Between Energy and Forces | Virtual Topic Series](#)

[4 Types of Sensors in Manufacturing, Explained](#)