ART BOTS
Grade Band: 6-8
Content Focus: STEAM

LEARNING DESCRIPTION

In this hands-on STEAM lesson, students will explore the relationship between electricity, motion, and unbalanced forces by designing and building their own wobbling art bots. Using hobby motors, battery packs, pool noodles, and markers, students will follow the engineering design process (Ask, Imagine, Plan, Create, Improve) to construct a bot that moves and draws in unpredictable patterns.

Through experimentation, students will discover how unbalanced forces affect motion, how simple circuits power their bots, and how small design changes can alter movement. They will analyze their bots' performance, make modifications, and reflect on their design choices. By combining science, engineering, and art, this lesson fosters creativity, problem-solving, and critical thinking while reinforcing foundational physical science concepts.

LEARNING TARGETS

Essential Questions	"I Can" Statements
How do unbalanced forces affect the motion of an object? How does a motor convert electrical energy into motion? What design choices impact the movement and artistic output of an art bot?	I can build and test a simple circuit to power a motor. I can explain how unbalanced forces influence motion. I can describe how energy is transformed in my art bot.

How can the engineering design process help improve a design?	I can use the engineering design process to test and improve my design.

GEORGIA STANDARDS

Curriculum Standards	Arts Standards
Grade 6: S6P2: Obtain, evaluate, and communicate information about the relationship between force, mass, and the motion of objects. S6P3: Construct an explanation of the relationships among electric force, magnetic force, and motion. **Grade 7:** S7P2: Obtain, evaluate, and communicate information to explain the effects of forces on the motion of an object. **Grade 8:** S8P2: Develop models to illustrate the relationship between potential and kinetic energy.	VA.CR.1 Visualize and generate ideas for creating works of art. VA.CR.2 Choose from a range of materials and/or methods of traditional and contemporary artistic practices to plan and create works of art. VA.CR.2.b Produce three-dimensional artworks using a variety of media/materials (e.g. clay, papier-mâché, cardboard, paper, plaster, wood, wire, found objects, fiber). VA.CR.3 Engage in an array of processes, media, techniques, and/or technology through experimentation, practice, and persistence.

SOUTH CAROLINA STANDARDS

Curriculum Standards	Arts Standards
Grade 6: 6-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. **Grade 7:** 7-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. 7-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. **Grade 8:** 8-PS2-3. Analyze and interpret data to determine the factors that affect the strength of electric and magnetic forces.	**VISUAL ARTS** **Anchor Standard 1:** I can use the elements and principles of art to create artwork. **Anchor Standard 2:** I can use different materials, techniques, and processes to make art. **Anchor Standard 7:** I can relate visual arts ideas to other arts disciplines, content areas, and careers.

8-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.	

KEY VOCABULARY

Content Vocabulary	Arts Vocabulary
• Unbalanced force – A force that changes the motion of an object • Friction – A force that opposes motion • Circuit – A closed path through which electricity flows • Kinetic energy – Energy of motion • Potential energy – Stored energy that can be converted into motion • Energy transformation – The process of changing one form of energy into another	• Movement – This principle of design is associated with rhythm and refers to the arrangement of parts in an artwork that creates a sense of motion to the viewer's eye through the work. • Balance – This is a sense of stability in the body of work. Balance can be created by repeating the same shapes and by creating a feeling of equal visual weight. • Form – An object that is three-dimensional and encloses volume (cubes, spheres, and cylinders are examples of various forms) • Kinetic art – Art that incorporates real motion • Contrast – The arrangement of opposite elements in a composition (light vs. dark, rough vs. smooth, etc.) Similar to **variety**, which refers to the differences in a work, achieved by using different shapes, textures, colors and values. • Mark-making – The lines, textures, and marks made by tools or gestures • Negative space – The space around and between subjects in an artwork • Engineering Design Process – A problem-solving approach that involves identifying a need, researching, brainstorming possible solutions, developing and testing prototypes, and improving the design until the optimal solution is achieved; the steps are Ask, Imagine, Plan, Create, Improve

MATERIALS

- Hobby motors
- Battery packs (with AA batteries)
- Pool noodles (cut into sections)
- Thin markers
- Electrical tape or masking tape
- Small weights (washers, paperclips, clay, etc.)
- Switches (optional for advanced circuits)
- Scissors
- Image of the Engineering Design Process

INSTRUCTIONAL DESIGN

Opening/Activating Strategy

- **Engage:**
  - Hook: Show a short video of a scribble bot or demonstrate a pre-made art bot.
  - Discussion–Ask students:
    - What do you notice about how it moves?
    - What forces might be acting on it?
    - How does the energy from the battery turn into movement?

Work Session

- Introduce the Engineering Design Process and explain that students will follow these steps to create their own art bots.

Explore – Building the Art Bots

- **Ask:**
  - How can we design an art bot that moves unpredictably?
  - How do we make sure our bot stays powered and balanced?
- **Imagine:**
  - Students will brainstorm ideas and sketch potential designs for their bots.
- **Plan:**
  - Show students a list of materials that they have available to them to build their bots.
  - Students will create a sketch of their bot with materials labeled before beginning to build their bots.
- **Create:**
  - Show students how to create their bots.
    - Connect the battery pack to the motor, ensuring a working circuit.
    - Insert the motor into the pool noodle.
    - Attach markers as "legs" using tape.
    - Add weights off-center on the motor shaft to create an unbalanced force.
- Have students place the bot on plain white paper and turn it on to observe its movement.
- **Improve:** Elaborate – Improving the Design
  - Students will analyze their bot's movement and adjust:
    - Marker placement for different drawing effects.
    - Weight distribution to change speed and wobbling direction.
    - Motor positioning to alter how much it vibrates.
- Students will compare designs and discuss how small modifications affect motion.
- Optional: Students can add to their designs with markers.

Closing/Reflection

- Explain: Facilitate a discussion on the science behind the bots.
    - Discuss how unbalanced forces create movement.
    - Explain energy transformations (chemical → electrical → kinetic).
    - Relate movement patterns to force, friction, and weight distribution.
- Have students complete the following exit ticket:
    - What forces acted on your bot?
    - How did changes to your design affect motion?
    - How did energy transform from the battery to movement?
    - What worked well in your bot, and what would you improve if you could do it again?

ASSESSMENTS

Formative

- Assess students' learning through observations of student engagement, problem-solving, and questioning during discussions.

Summative

- Assess students' learning through the exit ticket questions and closing discussion.

DIFFERENTIATION

Accelerated:

- Introduce data collection by having students measure and compare drawing patterns.
- Use Micro:bit or Arduino to program bots to change motion patterns.

Remedial:

- Provide pre-made circuits.
- Provide extended time for building and reflecting.
- Offer verbal instructions paired with written guides.
- Allow for alternative methods of documentation (photos, audio).

ADDITIONAL RESOURCES

This integrated lesson provides differentiated ideas and activities for educators that are aligned to a sampling of standards. Standards referenced at the time of publishing may differ based on each state's adoption of new standards.

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