



artsNOW

Integrated learning solutions

ART BOTS

Grade Band: 9-12

Content Focus: STEAM & ELA



LEARNING DESCRIPTION

In this upper-level STEAM investigation, students conceptualize and build kinetic “Art Bots” that function as both machines and artistic collaborators. The lesson challenges students to understand and model energy transformations—how electrical energy from a battery is converted into mechanical energy and transferred into rotational motion that powers drawing behavior.

After iterative testing and design improvement, students explore the philosophical and conceptual dimension of their project by responding to the reflective prompt: “In what ways is your Art Bot a co-artist in your work? Write a reflection that explains your role as designer, the bot’s contribution, and what the final artwork expresses”.

This task deepens students’ critical thinking, creativity, and the fusion of art and science. Final presentations include both the Art Bot’s physical output and a reflective artist statement, shared in a class critique or gallery walk.

LEARNING TARGETS

Essential Questions	“I Can” Statements
How do energy transformations power machines?	I can design a functioning electrical circuit that powers a small motor.

What role do unbalanced forces play in robotic motion?	I can explain how force, motion, and energy interact in my Art Bot.
How can small design adjustments significantly impact a machine's behavior?	I can analyze how changes to mass, balance, and friction affect motion.
In what ways can humans and robots collaborate creatively?	I can collaborate with a robot to create original art and evaluate the process.

GEORGIA STANDARDS

Curriculum Standards	Arts Standards
<p>SCIENCE</p> <p>Physics: SPS8: Obtain, evaluate, and communicate information to explain the relationships among force, mass, and motion.</p> <p>SPS10: Investigate and explain the properties of electricity and magnetism.</p> <p>Physical Science: SPS7: Develop models to illustrate the transformation and conservation of energy.</p> <p>ELA</p> <p>Grade 9: 9.T.T.1.e Effectively apply a variety of narrative techniques to develop complex character(s) who change, use setting to create mood, develop an idea or theme across the text, achieve specific purposes, engage audiences, and enhance writing.</p> <p>Grade 10: 10.T.T.1.e Effectively apply a variety of narrative techniques to develop complex character(s) who change, use setting to create mood, develop an idea or theme across the text using metaphors, achieve specific purposes, engage audiences, and enhance writing.</p> <p>Grade 11: 11.T.T.1.e Effectively apply a variety of narrative techniques to develop complex character(s) who change, use setting to create mood, develop an idea or theme across the text using metaphors and symbolism, achieve specific purposes, engage audiences, and enhance writing.</p>	<p>VAHSAE.1: Incorporate elements and principles of design into artworks for intentional effects.</p> <p>VAHSCR.1: Apply creative thinking skills to develop ideas for personal expression.</p> <p>VAHSPR.1: Create original artworks using a range of materials, techniques, and processes.</p> <p>VAHSPR.2: Demonstrate proficient and safe use of tools, materials, and technology.</p> <p>VAHSAR.1: Analyze personal and others' artworks to evaluate meaning, intent, and technique.</p> <p>VAHSAR.3: Critique artwork using formal, contextual, and intuitive approaches.</p>

Grade 12:

12.T.T.1.e Effectively apply a variety of narrative techniques to develop complex character(s) who change, use setting to create mood, develop an idea or theme across the text using metaphors and symbolism, achieve specific purposes, engage audiences, and enhance writing.

SOUTH CAROLINA STANDARDS

Curriculum Standards	Arts Standards
<p>SCIENCE Physics: P-PS2-4. Use mathematical representations of Newton’s law of gravitation and Coulomb’s law to describe and predict the gravitational and electrostatic forces between objects.</p> <p>P-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.</p> <p>P-PS3-2. Develop and use models to illustrate that energy can be explained by the combination of motion and position of objects at the macroscopic scale and the motion and position of particles at the microscopic scale.</p> <p>P-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.</p> <p>P-PS3-5. Develop and use a model to illustrate the forces between two objects and the changes in energy of the objects due to their interaction through electric or magnetic fields.</p> <p>ELA English I ELA.E1.C.2.1 Write informative texts to examine and convey complex information clearly and accurately through the analysis of multiple sources of information. When writing: a. introduce a topic and organize complex ideas and concepts to make important connections and distinctions; b. develop a topic with relevant and sufficient facts,</p>	<p>Anchor Standard 1: I can use the elements and principles of art to create artwork.</p> <p>Anchor Standard 2: I can use different materials, techniques, and processes to make art.</p> <p>Anchor Standard 7: I can relate visual arts ideas to other arts disciplines, content areas, and careers.</p>

definitions, details, quotes, examples, and/or other information appropriate for the audience; c. use varied transitions to link major sections of the text and clarify the relationships between ideas and concepts; d. use precise language and vocabulary appropriate to the complexity of the topic; e. use a tone and style appropriate to the task and audience; and f. provide a concluding statement or section that supports the information presented.

English II

ELA.E2.C.2.1 Write informative texts to examine and convey complex information clearly and accurately through the analysis of multiple sources of information. When writing: a. introduce a topic and organize complex ideas and concepts to make important connections and distinctions; b. develop a topic by selecting relevant and sufficient facts, definitions, details, quotes, examples, data, and/or other information appropriate for the audience; c. use varied transitions to link major sections of the text and clarify the relationships between ideas and concepts; d. use precise language and vocabulary appropriate to the complexity of the topic; e. establish and maintain a style and objective tone appropriate to the task and purpose; and f. provide a concluding statement or section that supports the information presented.

English III

ELA.E3.C.2.1 Write informative/expository texts to convey complex ideas and concepts while analyzing complex texts. When writing: a. introduce a topic and organize complex concepts and information; b. develop the topic by selecting relevant facts, definitions, details, quotations, statistics, data, and/or other information and examples appropriate to the audience's knowledge of the topic; c. use varied transitions and syntax to link the major sections of the text and clarify the relationships between complex ideas and concepts; d. use precise language and vocabulary appropriate to the complexity of the topic; e. establish and maintain a formal style and objective tone appropriate for the task, purpose, and audience; and f. provide a concluding statement or section that supports the information presented.

English IV

ELA.E4.C.2.1 Write informative/expository texts to analyze and explain complex ideas and information. Write informative/expository texts to convey complex ideas and concepts while analyzing complex texts. When writing:

- introduce a topic and organize complex concepts and information so that each new element builds on what precedes it;
- develop the topic thoroughly by selecting relevant facts, definitions, details, quotations, statistics, data, and/or other information and examples appropriate to the audience's knowledge of the topic;
- use varied transitions and syntax to link the major sections of the text and clarify the relationships between complex ideas and concepts;
- use precise language and vocabulary appropriate to the complexity of the topic;
- establish and maintain a formal style and objective tone appropriate for the task, purpose, and audience; and
- provide a concluding statement or section that supports the information presented.

KEY VOCABULARY

Content Vocabulary	Arts Vocabulary
<ul style="list-style-type: none">● <u>Electric circuit</u> – A closed loop through which electricity can flow. It includes a power source (like a battery), wires, and something that uses the electricity (like a motor or light)● <u>Current</u> – The flow of electric charge through a circuit, like water moving through a pipe● <u>Voltage</u> – The pressure that pushes the current through the circuit, like water pressure● <u>Unbalanced forces</u> – When the forces acting on an object are not equal, causing the object to start moving, speed up, slow down, or change direction● <u>Rotational motion</u> – Movement around a central point or axis, like a spinning top or a wheel	<ul style="list-style-type: none">● <u>Conceptual art</u> – Art in which the idea behind the work is more important than the finished product● <u>Intentionality</u> – The purposeful use of elements and design to express meaning● <u>Process art</u> – Artwork that emphasizes the act of making over the final product● <u>Rhythm</u> – The principle of design in an artwork that indicates a type of movement, often characterized by repeated shapes, lines or colors● <u>Gestural mark-making</u> – Marks that reflect movement or emotion, often expressive● <u>Experimental media</u> – Unconventional materials or techniques used in creative exploration

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| <ul style="list-style-type: none"> ● <u>Center of mass</u> – The point at which an object's mass is evenly distributed in all directions ● <u>Friction</u> – The resistance between two surfaces that slows things down ● <u>Energy transformation</u> – The process of changing energy from one form to another—for example, chemical energy in a battery turns into electrical energy, which becomes mechanical energy in the spinning motor ● <u>Vibration motor</u> – A small motor with an unbalanced weight attached to its shaft; as the shaft spins, it vibrates and shakes, which powers the Art Bot's movement | <ul style="list-style-type: none"> ● <u>Collaboration</u> – Co-creating with others or with tools (like Art Bots) in the creative process |
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MATERIALS

- Hobby motors
- Battery packs (with AA batteries)
- Pool noodles (cut into sections)
- Thin markers
- Electrical tape or masking tape
- Hot glue
- Off-center weights (washers, clay, coins)
- Switches (optional for advanced circuits)
- Scissors
- Image of the [Engineering Design Process](#)

INSTRUCTIONAL DESIGN

Opening/Activating Strategy

- **Engage:**
 - Show a short video of various Art Bots and kinetic sculptures.
 - Facilitate a class discussion around the following question: “What do you think makes them move the way they do?”.
 - Connect motion and circuits to previously learned physics principles.

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

- Have students use their sketchbooks or STEAM journals to record their process.
- **Ask:**
 - Where will you place the mass to make it wobble?
 - How do you ensure your 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:**
 - Provide time for students to create their bots.
 - If needed, show students one method to create their bots. Allow time for students to revise their designs as needed.
 - 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.
- **Improve and Extend:**
 - Students will test and record how their bots move by placing the bot on plain white paper and turning it on to observe its movement.
 - Students should reflect on the following:
 - Do they rotate, scoot forward, draw erratically?
 - What happens when the mass is adjusted?
 - How does surface friction affect performance?
- **Introduce design constraints and goals:**
 - Ask students, "Can you get your bot to move in a figure-eight?"
 - Have students find a partner and ask students, "Can your bot cover more surface area in one minute than your partner's?"
- **Have students respond to the following writing prompt:** In what ways is your Art Bot a co-artist in your work? Write a reflection that explains your role as designer, the bot's contribution, and what the final artwork expresses.
 - Reflection criteria:
 - Use vivid, sensory language to describe the bot's movement and its impact on the artwork.
 - Include a clear sequence of events (design, testing, outcome).
 - Demonstrate personal voice and insight into the collaborative process.
 - Use content vocabulary (e.g., unbalanced forces, rotational motion, center of mass).
 - Incorporate at least one quote or caption from your design partner to reflect collaboration or discovery.
 - Revise writing using peer and self-feedback.
- **AP Physics or Engineering classes:** Add formal motion data collection (speed, revolutions, force diagrams).
- **Technology Integration:** Challenge students to control bots with microcontrollers (Arduino, micro:bit).

Closing/Reflection

- Students will work with their partners to co-create an artwork with both of their bots.
- Each pair should give their piece a creative title and write a short "artist's statement" that explains:
 - Their bot's design
 - Its motion pattern
 - How they collaborated to create their artwork

- What they learned about forces and energy
- Gallery walk: Display art and artist statements; allow an opportunity for students to provide peer feedback.

ASSESSMENTS

Formative

- Assess students' learning through observations of building and testing, student questions and responses during discussions, and design STEAM journal/sketchbook entries with sketches, reflections, and improvements.

Summative

- Design Report (written or digital):
 - Sketches, circuit diagram, energy flow description
 - Data on motion (optional)
 - Explanation of what worked and what didn't
- Gallery Artist Statement that includes a creative title and explanation of motion concepts and energy transformations
- Writing prompt responses

DIFFERENTIATION

Accelerated:

- Students can choose how to present their final work:
 - A short video montage showing the bot's drawing in action.
 - A sketchbook spread combining bot photos, drawn output, and written reflection.
 - A conceptual artist statement exploring the bot as collaborator or tool.
- Students respond to one of these advanced prompts:
 - *"Is the Art Bot merely a tool—or something more? Explore how machines can challenge traditional ideas of authorship in art."*
 - *"If your Art Bot could 'speak,' what would it say about the marks it left behind? Write from the bot's point of view."*
 - *"Compare your creative process with that of a traditional artist. What new ideas about creativity have you discovered?"*
- Advanced Criteria:
 - Integrate a metaphor or analogy comparing the Art Bot to another creative collaborator (e.g., a dance partner, a jazz improviser).
 - Include evidence of revision—submit a first draft with feedback notes and a final version.
 - Use philosophical or conceptual language (aligns with *Anchor Standard 10*).
- Extension Option: Research an artist (e.g., Jean Tinguely, Harold Cohen, or Sougwen Chung) who worked with machines and compare their practice to your own.

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).
- Written reflection:
 - Provide structured prompts such as:

- “My Art Bot moved by _____ because _____.”
- “One thing I changed was _____, and it helped because _____.”
- “The artwork shows _____ because the bot _____.”
- Oral reflection option: Allow students to speak their reflection, then transcribe or record it.
- Divide the writing prompt: Break into daily parts (Day 1: Describe the bot. Day 2: Explain how it moves. Day 3: What does your artwork show?)
- Visual Supports: Use labeled diagrams and photo sequences of their bot's process to guide the writing.
- Modeling: Show mentor texts or completed reflections and model how to revise for detail or structure.

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.

Ideas contributed by: Shannon Green

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