

Coding for Electricity	Grade 6 Understanding Matter and Electricity
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<h2 style="margin: 0;">Lesson Plan (Offline)</h2>	Coding Tool	Algorithm Design
	Cross-curricular	Language

<p><b>Big Ideas</b></p> <p>Electrical Energy can be transformed into other forms of energy</p> <p><b>Overall Expectation:</b> 2. Investigate the characteristic of static and current electricity and construct simple circuits</p> <p><u>From Curriculum Overview:</u> Building of Circuits should further strengthen students’ understanding of how electrical systems work</p>	<p><b>Specific Expectations</b></p> <p><b>Science:</b> <b>2.2</b> Design and build series and parallel circuits, draw labelled diagrams identifying the components uses in each, and describe the role of each component in the circuit.</p> <p><b>2.6</b> Use appropriate science and technology vocabulary, including current, battery, circuit, transform, static, electrostatic, and energy in oral and written communication</p> <p><b>3.6</b> Explain the functions of the components of a simple electrical circuit (eg the battery is the power source, a length of wire is the conductor that carries the electrical current to the load, a light bulb or motor is the load)</p> <p><b>Physical Education:</b> <b>B1.2</b> perform a wide variety of locomotor movements, in combination, at different speeds, in different directions, and using different pathways, while moving around others and/or equipment</p>
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**Description**  
In this lesson, students will deeper their understanding of electricity and circuits, while being introduced to the idea of algorithm design (specifically if/then statements), through creating representations of circuits using groups of peers and a range of physical education equipment in the gymnasium.

<p><b>Materials</b></p> <ul style="list-style-type: none"> <li>• Gymnasium space</li> <li>• Chart paper</li> <li>• Markers</li> <li>• Variety of physical education equipment that students can use to represent conductors, loads, and batteries in their created circuit representation.</li> </ul>	<p><b>Computational Thinking Skills</b></p> <ul style="list-style-type: none"> <li>• Algorithm design (specifically conditional statements)</li> </ul>
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**Introduction**

- Play a game of *Simon Says* with the class, first introducing the rules with an conditional statement:
- “**IF** Simon says, **THEN** follow the instructions and complete the task. **ELSE**, do not complete the task”
- Start the game with general tasks that get the students active and their heart rates increased (i.e. Simon says jump 10 times, Simon says do 5 burpees, Simon says do 10 jumping jacks)

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**Action**

**New Concept: What is Algorithmic design?**

- Explain that in coding, algorithms are the clear steps that are used to define a problem, similar to the clear steps needed in procedural writing. “Coding” is the process of writing these steps, something that we can call “writing code” or “coding”
- As a class, review the coding blocks below. Write/post the blocks on wall in the gym for students to refer to upon explanation. This lesson will discuss: **move, turn, repeat, the “make a command” option, and a conditional statement (if/then)**
- Coding Blocks:
- Move: Indicate where to move (specific distance, steps etc.)
- Turn: Indicate which direction to turn (left/right and degrees, i.e. 90 degrees to the left)
- Repeat: Indicate a command to complete again
- Make a Command: Students create a command specific to the task (i.e. pick up toothbrush)

Reintroduce the concept of a **Conditional Statement/ If/Then Statement:**

- A Conditional statement is a set of rules performed if a certain condition is met. It is sometimes referred to as an If-Then statement, because **IF** a condition is met, **THEN** an action is performed. <https://www.computerhope.com/jargon/c/constat.htm>
- This video can be used to support student understanding of this definition:
- <https://www.youtube.com/watch?v=6C25zY1H0iU>
- Example: IF Simon says, THEN follow directions, ELSE ignore directions

Introduce the concept of a Repeat, or Loop Command:

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- A loop is a programming structure that repeats a sequence of instructions until a specific condition is met. <https://techterms.com/definition/loop>
  - Ex. Repeat 10 times, or repeat until

Refresh students' understanding of Electricity by reviewing the components of a circuit, through a class review, including:

- Conductor
- Load
- Power Source
- Switch

**Task:**

- Students will work as a group to build a pathway for students to travel through in the gym that represents electrons moving through an electrical circuit, and will write a script for this circuit, using the blocks introduced, including a conditional statement (if/then) regarding the switch and the flow of energy.
  - **Learning Focus:** Electricity is converted energy. As humans, we harness energy from the sun, to plants, to our bodies, to movement to new energy. Students must demonstrate physical activity and movement in the completion of their task to represent this conversion of energy.
  - Students will work in small groups, and each group must use gym equipment of their choosing to represent:
    - conductors (wires) for the electrons (students) to travel along
    - a load
    - a renewable source (represented by a student being physically active),
    - and a switch.
  - Teachers will challenge the students to use a Design Model, remembering that a design is never finished and can always be changed or improved, and that all learners are striving to be problem-solvers and collaborative group members. Connect this learning challenge to challenges in life, where we have to try, and try again, building grit and resilience. (See resources for links to more information for teachers regarding the Design Process)
  - Teachers will allow students time first as a group with chart paper and markers to plan how they will create their circuit. *This time is important for a range of reasons – collaboration, empathy and understanding the ideas of peers etc. Ensure enough time is*
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given for student to outline an initial plan. Have students create a list of materials they will need for their project.

- Students must include a script, using Algorithm Design to write code for their gym circuit

Success Criteria to Share with Students:

- ✓ Students work as team
- ✓ Students include all elements of a series circuit including:
  - Load
  - Power Source
  - Conductor
  - Switch
- ✓ Students include a conditional statement regarding circuit/loop when presenting
- ✓ Students clearly communicate their understanding of an electrical circuit

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**Sample Work**

**Sample Gym Circuit:**

- Skipping ropes, lying connected end to end to represent the wires
- A pool noodle that swings open and closed, connecting to the skipping ropes, to represent a switch
- A student completing continuous jumping jacks to represent the power source
- A student hula hooping continuously to represent the load

**Sample Coding Algorithm:**

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If switch is closed, repeat forever
  Electrons move 15 steps straight
  Turn left
  Move 15 steps straight
  Do 15 Jumping Jacks (Power Source)
  Turn left
  Move 15 steps straight
  Turn left
  Hoola-Hoop 15 times (Load)
  Move 15 steps straight
  Turn left
Else
  Do not continue path of electrons
```

### **Consolidation**

Each group will present their circuit to the class, ensuring that they've included all aspects from the success criteria

Possible Extensions:

- Have students create and present a series and parallel circuit.
- Have students present with multiple loads
- Have students create circuits with limited equipment

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### **Assessment**

Students can be assessed for learning skills such as collaboration and initiative, in addition to their knowledge and understanding of the electricity unit.

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### **Additional Resources**

Design Thinking Model:

- <http://www.spencerauthor.com/why-design-thinking/>
  - <http://www.spencerauthor.com/>
  - <https://www.youtube.com/watch?v=PE3HUudpYeA>
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