SCIENCE NORTH SCIENCE NORD
SUDBURY, ONTARIO, CANADA

Electronic Gadget | Grade 9 Electricity

Lesson Plan

Cross Curricular	French as a second language
Safety Notes	Avoid short-circuiting your battery. This can occur when the positive and negative terminals are connected with a low-resistance conductor (e.g. wire)

Big Ideas

- Electricity is a form of energy produced from a variety of non-renewable and renewable sources
- Static and current electricity have distinct properties that determine how they are used

Overall Expectations

- Investigate, through inquiry, various aspects of electricity, including the properties of static and current electricity, and the qualitative relationships between potential difference, current, and resistance in electrical circuits

Specific Expectations

E2.5 design, draw circuit diagrams of, and conduct series and parallel circuits

E3.4 identify the components of a simple DC circuit (e.g., electrical source, load, connecting wires, switch, fuse), and explain their functions

E3.5 explain the characteristics of electric current, potential difference, and resistance in simple series and parallel circuits, noting how the quantities differ in the two circuits

Description

In this lesson, students will plan, build and market an electronic gadget of their choosing. Students will be encouraged to get creative and invent a simple gadget that can perform a task. As part of the process, students will have to make a project proposal to first gain approval. Once they've done so, they will have to build their gadget using a battery, wires and multiple loads, requiring them to use a parallel circuit. Finally, students will have to makes a sales pitch to present their product. The planning and marketing of the electronic gadget will support FSL learners while the lesson in its entirety will support the grade 9 science curriculum.

Materials

Introduction

- Conductive dough
- LEDs
- 9V batteries
- Battery clips

Accommodations/Modifications

- To simplify the activity, provide students with hints or steps to build the submarine
- To expand the activity, get students to build a hook and provide them with a weight they have to lift with their submarine.

Action	FSL Activities
• Batteries (9V or AA) • Battery clips • Wires • Lights • Buzzers • Motors • Switches • Conductive dough • Various conductors and insulators (paperclips, coins, etc.) • Various building materials (wheels, popsicle sticks, fans, etc.)	• Talking Drawings • Frayer Model • Written and oral component of the electrical gadget project

Introduction

FSL Activity: Talking Drawings (Part 1)

Before starting the science portion of the lesson, complete a circuits talking drawing. To do this, students are required to close their eyes and reflect on what they know about circuits. Once they have reflected on the topic, students will draw what they saw in their mind when they thought about circuits. They will come back to this activity once they've done both the introduction and action portions of the lesson. This activity is effective for FSL learners as it allows them to recognize what they know about a topic, builds comprehension and provides a simple entry point that all students can achieve regardless of their writing level in French. (Macceca & Brummer, 2010)

Science Activity

Students will be introduced to simple circuit building by working through the '*Squishy Circuit'* activity. To complete this activity, provide the students with the required material and the corresponding handout that will guide them through the steps. The steps are designed to introduce students to electricity, covering topics such as the components of a circuit, open and closed circuits, short circuits, conductors and insulators.

Discuss some of the **key concepts** from the squishy circuit activity if need be:

- It is possible to use the conductive dough to complete the circuit because its conductive nature allows an electrical current to flow through it. The dough gets its conductivity from the dissolved salt used in making it.
- The insulating dough can't be used to complete the circuit because without the presence of dissolved salt, it does not allow the flow of an electric current. Insulators have a greater resistivity than conductors.

- The squishy circuits have three of the basic parts of a circuit: the power source (battery), a conducting path (conductive dough) and a load (the LEDs). A switch is the fourth component typically included in a simple circuit.
- A circuit must be closed for it to work. A closed circuit allows the flow of electrons. Contrarily, an open circuit will not allow the flow of electrons. This occurs when there is a break in the continuity of the circuit.
- A short circuit occurs when a current flows through an unintended path with very little electrical resistance. When the conductive dough is pushed together, the electrons are flowing through the dough rather than the LED so the LED won't light.

Action

FSL Activity: Frayer Model

Now that students have done the introduction activity, they should be more knowledgeable about electricity and circuits. Use this base knowledge as a starting point for the Frayer model which allows students to expand what they know by using research or a dictionary to complete this graphic organizer. Students will choose one of the words listed on their sheet and fill in the boxes using the information they've gathered. This is a good activity for FSL students as it helps enrich their understanding of the vocabulary by defining the word in a number of different ways. Students can work in partners for this activity and it is recommended that students share their Frayer models with other students so that they get a deeper understanding of all the different vocabulary terms. (Macceca & Brummer, 2010)

Science Activity

The goal of this activity is for students to conceive, build and market an electrical gadget that has a defined purpose. Some examples of inventions that can be made with the materials provided for this activity include a doorbell, a motorized cat toy, or a mixer. There are an endless amount of possibilities for what can be made, it's up to the students to come up with the next big idea. This activity is completed in three portions.

1. Project Proposal

Students will first have to conceive an idea. Using the *'Electrical Gadget'* handout, they will be given the opportunity to brainstorm some idea, name their gadget, draw a diagram of their gadget, define its purpose, identify the required materials and estimate a building and selling cost. Once their project proposal is approved by their teacher, they can start building. This activity will support FSL students in their writing as they can apply the vocabulary they are learning.

2. Building

Using the materials provided, students can build their gadget. Encourage student to try different iterations of their gadget. Their first time building it may not be the best version, it

may take some testing to get the gadget working perfectly. Once they have built their gadget, students will create a circuit diagram of its electronic components.

3. Sales Pitch

Students have to sell create a sales pitch for their gadget that they believe will help sell their product. The sales pitch should take no more than a minute and highlight some key features of the gadget such as what it's used for, why it's unique, what it costs or why you couldn't possibly live without it. Some prompts are included on the *'Electrical Gadget'* handout. This portion of the activity will support FSL learners as they will be required to make a short oral presentation in French.

Consolidation/Extension

FSL Activity: Talking Drawings (Part 2)

Once students have completed both the introduction and the action, they will come back to the talking drawings activity. At this point, they will close their eyes and once again think about what they know about circuits. As with before, they will draw what they envisioned. Having done the activity, their drawings should be more detailed and accurate. Finally, they will reflect on the differences between their two drawings in the final box. By writing their reflection, students are required to think about their learning and apply some of the vocabulary they learned by completing the activity. (Macceca & Brummer, 2010)

Assessment

Use the "*Electrical Gadget*" rubric to assess the science components of this project.

Teachers can also evaluate French with this same project so long students are informed on what they're being evaluated on. Ensure that the French component is assessed as a French mark and that the science component is assessed as a science mark. Students should not lose science marks for improper use of French or vice-versa.

Additional Resources

The following documents are required for this lesson:

- Squishy Circuit handout
- Squishy Circuit Dough recipe
- Electrical Gadget handout
- Electrical Gadget rubric

Works Cited

Macceca, S., & Brummer, T. (2010). *Stratégies de lecture en mathématiques, en sciences et en sciences sociales.* Montréal, Québec, Canada: Chenelière éducation.