Ada Lace and Ham Radio Exploration Chapter 2

Objectives:

Students will:

- Apply Occam's razor to problem-solving scenarios.
- Explore how Morse code and radio signals encode and transmit information.
- Analyze how digital and analog signals impact communication.
- Identify circuit components and understand basic ham radio operation.

Suggested Grade Levels:

3rd-8th Grade

Subject Areas:

- Science (Earth & Space, Physics, Engineering)
- Technology
- Reading and Literacy
- History

Time Allotment:

2-3 class periods (45-60 minutes each)

Next Generation Science Standards:

- **3-PS2-4:** Define a simple design problem that can be solved by applying scientific ideas about magnets.
- **4-PS4-3:** Generate and compare multiple solutions that use patterns to transfer information.
- **MS-PS4-3:** Integrate qualitative scientific and technical information to support the claim that digitized signals are a reliable way to encode and transmit information.
- **MS-ETS1-1:** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution.

Background Information:

- Occam's Razor is a problem-solving principle stating that the simplest explanation is usually the best. It is used in science, engineering, and logic to eliminate unnecessary assumptions when analyzing a problem.
- Suggested resources:
    - Occam's Razor Explanation

Vocabulary:

- **Occam's Razor** – The principle that the simplest explanation is usually the correct one.
- **Morse Code** – A method of encoding messages using dots and dashes.
- **CQ Call** – A general call sent via radio to invite any station to respond.
- **Circuit Components** – Parts of an electrical circuit such as resistors, switches, and batteries.

Materials:

- Copies of Ada Lace, Take Me to Your Leader (1 per pupil or projection device)
- Ada Lace, Take Me to Your Leader Part 1 of 3 (8:08-13:10)
- Ham radio (if available)
- Morse code key handouts
- Circuit symbol matching activity sheets (Google Form)
- Simple circuit-building kits - for example, Snap Circuits (optional)

Lesson Procedures:

Before Reading Discussion:

1. **Review Chapter 1**
    - to recall key plot points and introduce Occam's Razor.
2. **Ask students**:
    - What does it mean to solve a mystery? Outline the steps taken by a detective.
    - What strategies do you use when something seems confusing or unexplained?
        i. Brainstorm some real-world examples / unsolved mysteries

Reading Chapter 2:

1. Discuss key comprehension questions:
    - Why did Nina wake Ada in the night? *(Heard noises on the radio)*
    - How does George try to help? *(Lullaby)*
    - How do the girls respond to the strange sounds? (They attempt to communicate via radio.)
    - According to Ada, Nina has some "kooky ideas". She says that the book probably "got into her head." Explain this idea. (spooky, aliens, foil hats...)
    - How do the girls respond to the strange sounds? (spoke into the radio, CQ - anyone there?)
    - When Ada wakes up, what does Nina have to say? (voice came back, "release the swarm," they said)
    - How does Ada respond? What does she think? (I know you're not crazy. Worries about Nina)
    - Where does Ada go for support? (neighbor, Mr. Peebles)
    - Which other neighbor kid has a ham radio? (Milton)
    - Why doesn't Ada want to chat with him? (She thinks he is a sneaky cheater. He imitates her actions.)
    - Predict: What might Mr. Peebles suggest? (Answers will vary.)

Hands-on Activities:

1. **Matching Circuit Components**: Students match symbols to their corresponding electrical components and discuss how circuits function. (Reference)
2. **Morse Code Exploration**: (Morse Code Video)
    - Provide students with a teacher-generated Morse code key of your choice.
    - Have students encode a short message, exchange it with a partner, and decode it.
    - Conduct a class challenge where one student taps out a message and others decode it.
3. **Applying Occam's Razor**:
    - Present various mystery scenarios related to communication (e.g., strange sounds on a radio, a misheard message).
    - Students apply Occam's Razor to determine the most likely explanation.

Differentiated Instruction:

a. **Visual Learners:** Circuit diagrams, videos, and ham radio demonstrations.
b. **Auditory Learners:** Listening to ham radio transmissions and practicing Morse code.
c. **Kinesthetic Learners:** Hands-on circuit building and Morse code tapping challenge.
d. **ESL Students:** Provide translated vocabulary lists and use visual aids.
e. **At-risk Students:** Assign peer partners for structured guidance.
f. **Advanced Learners:** Research how Occam's Razor applies to space exploration and engineering.

Extensions:

- **Morse Code Relay Challenge:** Students use flashlights or hand signals to communicate a simple phrase in Morse code. This introduces the concept of signal encoding beyond radio waves.
- **Historical Exploration:** Research how Morse code was used in real-world scenarios, such as in the Titanic distress signal or wartime communication.
- **Occam's Razor in Space Exploration:** Discuss how scientists use Occam's Razor when analyzing signals from space (e.g., SETI, pulsar discoveries).