Lesson Plan: From Box to Blues - Building Your Own Guitar

Student: Monica

Subject: STEM, Music, Engineering Design

Estimated Time: 60-90 minutes

Materials Needed

- **For the Guitar Body:** A sturdy cardboard box with a lid (like a shoebox) or a wooden cigar box.
- **For the Neck:** A piece of wood, like a 1x2 inch board, about 24-30 inches long. A yardstick can also work.
- **For the String:** A single guitar string (a 'high E' or 'B' string works well), or about 3 feet of fishing line (20-30 lb test).
- **For the Bridge and Nut:** 2 bolts or threaded screws (about 1/4 inch diameter).
- **For the Tuner:** 1 eye-screw with a washer and nut.
- **Tools:** A drill with a bit slightly larger than the eye-screw, a ruler or measuring tape, a pencil, strong glue or wood glue, and scissors or wire cutters.
- **Optional for Decoration:** Paint, markers, stickers.
- **Optional for Extension:** A smartphone with a guitar tuner app.

Learning Objectives

By the end of this lesson, Monica will be able to:

1. Identify the key parts of a guitar (body, neck, string, bridge) and explain their function.
2. Explain the basic physics of how a stringed instrument creates sound through vibration, resonance, and tension.
3. Follow a set of instructions to construct a simple, playable one-string guitar.
4. Demonstrate how to change the pitch of the string to play different notes.

Lesson Plan

Part 1: Introduction - The Secret Science of Sound (10 minutes)

Hook

Let's start with a question: What do your favorite rock song and a simple rubber band have in common? They both start with the exact same scientific principle: **vibration**! Every sound you've ever heard from a guitar is just a string shaking really, really fast. Today, we're not just going to learn about that science; we're going to become inventors and build an instrument that proves it.

Setting the Stage

We'll be building a simple instrument called a "Diddley Bow," which is a one-string guitar that was very important in the history of American Blues music. Many famous musicians got their start on homemade instruments just like the one we're about to make. By the time we're done, you'll have your very own, custom-built guitar that you can actually play!

Part 2: The Body - Learning and Building (40-60 minutes)

This part follows the 'I do, We do, You do' model. The educator will demonstrate each phase, then work with Monica, and finally let Monica take the lead.

Activity 1: What Makes a Guitar Work? (I do, We do - 10 mins)

- **I do (Educator Explains):** "A guitar makes sound using three key ideas:"
    1. **Vibration:** "When you pluck the string, it wiggles back and forth super fast. This is vibration." (Demonstrate by stretching a rubber band and plucking it).
    2. **Resonance:** "The vibration travels from the string into the hollow box. The box vibrates too, and because it's big and hollow, it makes the sound much louder. This is called resonance or amplification." (Pluck the rubber band again, but this time stretch it over an empty box. The sound will be much louder).
    3. **Pitch:** "This is how high or low a note is. We can change the pitch in two ways: by changing the string's **tension** (how tight it is) or its **length** (by pressing down on it)."
- **We do (Hands-On Experiment):** "Your turn, Monica! Take this rubber band and box. Pluck it. Now, stretch the band tighter. What happens to the sound? (It gets higher). Now, keep it stretched and press your finger down in the middle while you pluck it. What happens now? (It gets higher). You just discovered the secret to playing every stringed instrument!"

Activity 2: Let's Build! (I do, We do, You do - 30-50 mins)

Success Criteria: Our goal is to build a guitar where the string is held tightly over the box and can be plucked to make a clear sound.

Safety First: An adult should handle all drilling and cutting.

1. **Prepare the Neck (I do):** The educator shows Monica the piece of wood. "This is our neck. It holds the string tight."
2. **Attach the Neck (We do):** Let's position the neck on top of the box. It should run the length of the box, with about 6 inches hanging off one end (this will be the 'headstock') and the rest hanging off the other end. Trace where the neck sits on the box. Then, let's work together to apply strong glue to the bottom of the neck and securely press it onto the box. Let it sit for a few minutes to set.
3. **Create the Soundhole (You do):** "Monica, to let the sound escape the box, we need a soundhole, just like on an acoustic guitar. Using a pencil, you can draw one or two circles (about the size of a quarter) on the top of the box, near the neck. The adult will then carefully cut them out."
4. **Install the Hardware (We do):**
    - **Tuning Peg:** The educator will drill a hole in the 'headstock' end of the neck. Together, you and Monica will insert the eye-screw through the hole, securing it with the washer and nut. This is our tuner!
    - **Bridge and Nut:** "These two bolts will lift the string up off the neck. They are our 'bridge' and 'nut'." Place one bolt on the neck right where it leaves the box (near the headstock).

Place the other bolt on the far end of the neck. We can glue these in place later if they move around.

5. **String It Up! (You do):** "This is the final step! Monica, I'll help you tie one end of the string securely to the bottom end of the neck. Then, you can carefully thread the other end through our eye-screw 'tuner'. Wind it around a few times until the string is tight enough to 'float' on top of the two bolts. Make sure it's not loose."

Activity 3: Tuning and Playing (We do, You do - 5 mins)

- **We do:** "Let's tune it up! Pluck the string. Now, let's turn the eye-screw together. Listen to how the pitch changes. Can you make it go higher? Lower?"
- **You do:** "Awesome! Now it's your turn to be the musician. Pluck the open string. Now try pressing your finger down on the string somewhere on the neck and pluck it again. You're playing different notes! Can you play a simple song like 'Mary Had a Little Lamb'?"

Part 3: Conclusion - Recap and Showcase (5-10 minutes)

Learner Recap

Let's review what we learned. I'll point to a part of our new guitar, and you tell me what it is and what it does:

- "What does the box do?" (Makes the sound louder - resonance).
- "What happens when we tighten the eye-screw?" (The tension increases and the pitch gets higher).
- "How do you play a different note without turning the tuner?" (By pressing down on the string, which shortens it).

Summative Assessment

The final assessment is the performance! Monica will demonstrate her understanding by:

1. Successfully playing at least three different, distinct notes on her homemade guitar.
2. Explaining to the educator (or another family member) how she is making the notes different (by changing the string length with her finger).

Reinforce and Look Ahead

"Congratulations, Monica, you are officially an instrument builder—a luthier! You used science, engineering, and art to create something that makes music. Every time you see a guitar, a violin, or a piano, you'll know the secret science of vibration and resonance that makes them work."

Differentiation and Extension

- **Scaffolding for Younger Learners:** The educator can pre-assemble the main structure (neck glued to the box). Monica's role can focus on decorating the box, helping to string the instrument, and experimenting with the sounds.
- **Extension for Advanced Learners:**
  - **Add Frets:** Use a tuner app and a marker to measure and mark precise spots on the neck to create frets for a musical scale.

- **Add a Pickup:** Research how piezoelectric pickups work and try to attach one to the guitar, allowing it to be plugged into an amplifier.
- **Multi-String Instrument:** Challenge Monica to design and build a two or three-string version, exploring how different string thicknesses create different sounds.