

MODIFIED UBD LESSON PLAN

COURSE: Introduction to Engineering

UNIT: The Electric Guitar

EXERCISE: Guitar Design Portfolio

TIME FRAME: 5 - 10 Hours



PREPARATION: *Summary of "to do's" that the teacher should understand and prepare before bringing this lesson to the classroom.*

Teachers will need to ensure that the proper supplies are available for students to build their solutions.

Materials:

- ELECTRIC GUITAR IN A BAG
- GUITAR NECK, POPLAR 34"
- INSTRUMENT CABLE 15FT
- AMPLIFIER 10W CUBE ROGUE
- GLUE STIC MULTI TEMP PK30
- CHIPBOARD 9X12 PK 40

Tools:

- SCREWDRIVER #2, 10" LONG
- SCREWDRIVER 5/16, 10" LONG
- DRILL FISKARS HAND
- PLIERS LONG NOSE 6 1/2"
- GLUE GUN LOW TEMP/MINI

Information:

Before beginning this exercise, students should have an understanding of material covered in:

- ✓ Presentation: Anatomy of an Electric Guitar
- ✓ Video: Moving a Magnetic Field



SAFETY: *Summary of safety strategies in the lesson.*

There is the possibility for safety strategies depending on what guitar kit you are using. Glue guns are hot, use care.

S1

DESIRED RESULTS:

ESTABLISHED GOALS:

Problem Solving Techniques and Applications Standards:

TRANSFER:

Students will be able to independently use their learning to...

- Understand and appreciate how the electric guitar works.

MEANING:

UNDERSTANDINGS

Students will understand that...

- The pickup transforms mechanical energy into electrical energy through the process of induction

ESSENTIAL QUESTIONS

Students will keep considering...

- How they could change their guitar design to obtain a different sound

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ACQUISITION OF KNOWLEDGE AND SKILL:	
<i>Students will know...</i>	<i>Students will be skilled at...</i>
<ul style="list-style-type: none"> The basic parts of a guitar and its purposes The safety operations of tools 	<ul style="list-style-type: none"> Designing and fabricating an electric guitar

S2 EVIDENCE:	
EVALUATIVE CRITERIA:	ASSESSMENT EVIDENCE:
<ul style="list-style-type: none"> Constructed well Performs as expected 	<i>Performance Task(s):</i> Guitar Design Portfolio In this exercise, students will design and construct an electric guitar.
<ul style="list-style-type: none"> Complete Correct answers 	<i>Other Evidence:</i> <ul style="list-style-type: none"> Assessment rubric included at the end of the Guitar Design Portfolio Sounds like STEM unit test found in the Test Topic

S3 LEARNING PLAN: *Summary of Key Learning Events and Instruction*

Outline:

- 1) **Kit**
The learning plan will change greatly depending on the kit that is being used. The lesson plan should be based mainly on the instructions included in the kit.
- 2) **Tools**
If tools are needed to complete the kit, the instructor should provide proper training for the tools and establish proper safety procedures for using the tools needed.
- 3) **Assembly Instructions**
Basic Instructions:
 1. Use the neck template and a sharp pencil or knife to carefully mark out the locations of the nut, saddle, tuner hole, bridge hole, and fret positions on the wood you have selected for your guitar's neck. Take your time! The more precise you are the better your guitar will sound.
 2. Use a 3/16" bit to drill a hole through the neck for your tuner.
 3. Place the eye bolt through a washer, then the hole, then another washer and keep everything together by loosely threading on the wing-nut.
 4. Use a small bit ($\leq 1/8"$) to drill a hole through the neck for your bridge.
 5. As precisely as possible, glue the 3/8" square dowel piece in the saddle position and the 1/4" square dowel in the nut position.
 6. Glue the magnet inside the middle of the bobbin of wire. This assembly, the spool of wire with the magnet in the middle, is called a pickup.
 7. Use a wire stripper or a sharp knife to carefully remove 1/2" of the plastic insulation from each of the wires extending from the pickup.
 8. You have two options for placing the pickup on the neck:

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- a. If you just want to finish quickly, simply glue the pickup assembly to the face of the neck just in front of the saddle. Orient it so that the wires extend toward the tail end of the guitar. This way will make it more difficult to play like a normal guitar later but it is much better for playing with a slide.
 - b. Use a large forstner or spade drill bit to drill a pocket into the neck about 3/16" deep. Glue the pickup into the hole.. This will produce a guitar that has a better string "action" which will make it play easier and more in tune. You could also chisel this pocket into the neck if you don't have an adequate drill bit.
9. Attach the jack plate to the end of the wood piece on the tail end of the guitar with the screws provided. The location isn't critical as long as the wires from the pickup reach the plate.
10. There are two terminals on the back of the output jack. Each terminal has a small hole in it. Attach the wires from the pickup to the output jack by passing the bare wire through the hole and then twisting it back upon itself. One wire goes to each terminal and it doesn't matter which goes where but the stripped ends must not touch each other. If you have the tools, soldering these joints will make your guitar much sturdier.
11. There is a nut threaded onto the front of the jack. Take it off then place the jack through the large hole in the jack plate and thread the nut back on to hold the jack in place.
12. Before we put the string on we want to carve a groove in both the nut and saddle for it to sit in. How deep? Make the groove in saddle such that the string will be held close to, but not touching, the pickup even when you're playing high notes. Start small you can always make it deeper. The groove in the nut is less critical. Don't make it too deep or the string may touch the pickup and "buzz" on high notes.
13. Thread your guitar string through the back of the bridge hole and onto the front of the neck. Take it over the saddle, over the nut and through the eye bolt.
14. Pull the string snug and hold it that way pinching it to the neck with your finger just past the eye bolt. Take the loose end of the string and wrap back underneath the string between the eyebolt and the nut. Then make a sharp bend back over the string and try to crimp it before turning the eyebolt to tighten the string.
15. Twist the eye bolt to tighten the string while you pluck it to listen to your note. If you want it tuned to a particular note increase or decrease the tension until you're in tune. Otherwise, stop whenever you like because one of the best parts about a one-string guitar is that it always plays in tune with itself. You can't be out of tune as long and you're a solo act!
16. Plug in and shred!

(These instructions as well as a video walk through of the guitar assembly are in the supplemental resources section of the unit)

How it Works:

An electric guitar is a generator and like any other generator it works by the movement of a coil of wires near a magnet. But wait, your coil and magnet don't move? The key is in the steel guitar string. Steel is attracted to magnets. The invisible magnetic field surrounding the magnet is disturbed or wiggled by the steel string vibrating so close to it. The magnetic field wiggles at the same frequency as the note playing on the string and this moving magnetic field accomplishes the same thing that moving the magnet would. The electrical current generated is tiny and leaves via the jack through the cable and to the amplifier where it is amplified by a transistor circuit before being sent to a speaker. Come to think of it, a speaker is a coil of wires and a magnet as well! Take one apart and check it out!

4) Test

At the end of the exercise, administer the unit test.

Progress Monitoring:

- The instructor will need to monitor the classroom, check students' work, and ensure students are on task and following directions.
- Ensure students store their projects at the end of class and leave all materials in the room.
- At the end of the activity, post student projects in the room and provide appropriate feedback.



DIFFERENTIATION: *Summary of Key Differentiation Techniques*

Please use this space to insert your differentiation techniques. Depending on the needs of students, various techniques might be needed in a classroom,

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therefore use the information below and experts in the area needed to design your plan for differentiation.

The ASCD Study Guide for Integrating Differentiated Instruction and Understanding by Design: Connecting Content and Kids.
by Carol Ann Tomlinson, Jay McTighe

Integrating Differentiated Instruction and Understanding by Design: Connecting Content and Kids.
by Carol Ann Tomlinson, Jay McTighe
ISBN-13: 978-1416602842
ISBN-10: 1416602844

Differentiating Reading Instruction
by Laura Robb.
ISBN13: 9780545022989

A Teacher's Guide to Differentiating Instruction
The Center for Comprehensive School Reform and Improvement



CAREER CONNECTIONS: *Summary of Career Opportunities Associated with this Lesson*

Musician

Some musicians play the guitar and should know how it works.

Music Instructor

Music instructors should know how sound is produced from instruments.

Physicist

Physicists can envision magnetic fields and determine their properties.



KEYWORDS: *Please Insert Keywords from this Lesson with their Definitions*

PICKUP – a device that produces an electrical signal in response to some other kind of signal or change

GUITAR – a stringed musical instrument with a fretted fingerboard

RESONANCE – the reinforcement or prolongation of sound by reflection from a surface or by the synchronous vibration of a neighboring object