⊛ Education
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ACTIVITY NAME:		DESIGN:
PLAY IT LOUD		Retro Boombox Phone Amp

ACTIVITY NAME:

Soundwaves are all around us! In this activity, students explore how different materials can be used to amplify everything from a voice to a cell phone speaker. Students can customize the Retro Boombox Phone Amp design to accommodate their cell phone and make an amplifier that looks and sounds great.

THEME:

Entrepreneurship - Practicing design thinking, collaboration, and prototyping
STEAM - Infusing creativity and art into engineering and science principles

GRADES:	PRINT TIME:	ASSEMBLY:	MATERIALS, TOOLS, AND SUPPLIES:	
6-12	**70** minutes	**10** minutes	1x Plywood Medium 1x Acrylic Thick Glue Rulers or other measuring tools	Materials for customizing the Retro Boombox Phone Amp (e.g., markers, stickers, pens, or paint)

THEMATIC QUESTIONS:

How does sound travel? How might different materials impact amplification?
How can you redesign and customize the Retro Boombox Phone Amp to amplify your phone's sound?
How can you customize a Retro Boombox Phone Amp to incorporate your customers' aesthetic preferences and demand for a high-quality speaker?

STANDARDS FOR STUDENTS:

ISTE Standards for Students
1.4 Innovative Designer– Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.
1.5 Computational Thinker– Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solution.

NGSS Science & Engineering Practices
- Asking questions (for science) and defining problems (for engineering)
- Constructing explanations (for science) and designing solutions (for engineering)

PREPARATION:

Have students read through the activity details to familiarize themselves with the steps to complete the activity.
Gather all of the materials needed to print, assemble, and customize their Retro Boombox Phone Amps.
Consider having a pre-printed Retro Boombox Phone Amp for individuals or groups to test their cell phones in prior to customizing their own designs.
Handouts : Play it Loud

SECTION:

1. PLAN

Have students...

1. Work in groups or independently to add their prior knowledge about sound and how it travels to the first column of the Play It Loud handout.

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SECTION:
1. PLAN (CONT.)

2. Use resources like the Khan Academy video "Sound Properties: Amplitude, period, frequency, wavelength" or the Science World unit "Sound" to learn more about sound and how it travels. Add any discoveries from this exploration to the second column of the Play It Loud handout

3. Listen to music through the printed Retro Boombox Phone Amp. Update the third column of the Play It Loud handout with observations about:
- Sound quality when music is played at different volumes;
- How well the design accommodates their phone's size; and,
- Amplification and aesthetic details.

4. Use a ruler to measure their phone's dimensions. Record this information on the Play It Loud handout.

SECTION:
2. CUSTOMIZE & CREATE

Have students…

1. Work independently or in groups to customize design plans for a Retro Boombox Phone Amp. Complete the All About My Phone section of the Play It Loud handout to help think through design elements like sound amplification, device fit, and aesthetics.

2. Consider how to customize the design by changing its dimensions, naming the mixtape, and engraving that name on the label.

3. Think about what items and features should be included in the design. Consider how the Trace tool in the Glowforge app can be used to add personalization to the design. Also, consider how extra layers in the design may impact how the Retro Boombox Phone Amp supports different phones.

4. Use the space in the Play It Loud handout or the back of the handout to plan out additional designs which can be scanned into the Glowforge app using the Trace tool.

SECTION:
3. USE

Ask students to…

- Create prototypes prior to doing final prints using cardboard for test prints. Just remember that if the design uses joinery such as slots or finger joints, these may need to be adjusted to suit the prototyping materials.

- Test the fit of their designs, and consider what changes need to be made to the Retro Boombox Phone Amp design. Add their ideas for changes in the final part of the All About My Phone section of the handout. Remember that the printing material could impact their design's amplification.

- Revise and iterate their designs in the Glowforge app based on their notes about necessary changes, and repeat steps as necessary.

- Showcase their Retro Boombox Phone Amps and play it loud!

SECTION:
3. REFLECTION

Help students consider…

- How might we improve the sound amplification of the Retro Boombox Phone Amp?

- How did the design and feedback process impact your original Retro Boombox Phone Amp design?

💡 Pro Tips:

Experiment with materials! Printing the wheel in acrylic allows you to write on it with dry or wet erase markers so you can use it more than once. Printing in cardboard helps you reuse materials around the classroom. When choosing materials, make sure to use materials that are laser compatible. Also, remember that if the design uses joinery such as slots or finger joints, these may need to be adjusted to suit other materials.

Consider other materials you can use to customize your Giving Wheel. Things like magnets, velcro, and tape can help you easily change the wheel sections to fit many uses.

Consider customizing your wheel with graphics and text in the Glowforge app or printing students' hand-drawn sketches using the Trace tool.

REIMAGINE:

- How might you use the decision-making wheel to create a game? Use the wheel as a fun addition to an open house or parent night. Raffle off chances to spin it to win fun prizes.

- Consider using this design to learn about parts of speech. By printing one wheel filled with verbs and another with nouns, students can spin the wheels to fill in their own MadLib activities. Consider using the acrylic white board material so that students can add their own words to the wheels.