

# Facilitation Guide



## Design Challenge Extension: “Musical Echolocation”

SABES Lessons 22–26

## EXPERIENCE OVERVIEW

In this extension to the Engineering Design Challenge (EDC), students will learn about and draw inspiration from musical instruments for the design of their echolocation devices. Additionally, they will incorporate the skill learned earlier in the unit of writing musical “phrases” to write and perform another musical phrase to be used in the testing of their device.

The musical phrase that students create must align with the criteria of the SABES Engineering Design Challenge (that it can produce noises at differing pitches or volumes). This arts-integrated extension also includes a challenge rubric, which teachers may utilize to assess students on the design challenge’s learning objective.

## Standards

### SCIENCE

- SEP 2: Developing & Using Models. PS4: Develop a simple model based on evidence to represent a proposed object or tool.
- ETS1.B: Developing Possible Solutions. PS1: Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem’s solutions to other people.
- ETS1.C: Optimizing the Design Solution. PS1: Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- CCC6: Structure and Function. PS1: The shape and stability of structures of natural and designed objects are related to their functions.

### MARYLAND STATE ARTS STANDARDS

- E:P-2:1: With teacher guidance, create musical ideas for classroom composition activities, using appropriate technology as available.

## Getting Ready

### SABES LEARNING OBJECTIVES:

- Unit Goal 5 – Students will act as rehabilitation engineers to create a device (echolocator) that produces sound to help a person with vision challenges “see” the world around them.

### MATERIALS:

- Rubber bands
- Toy kazoos
- Toy flutes/recorders etc.

### STUDENT PREREQUISITES

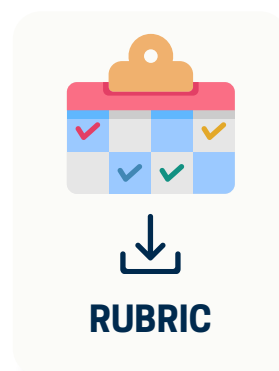
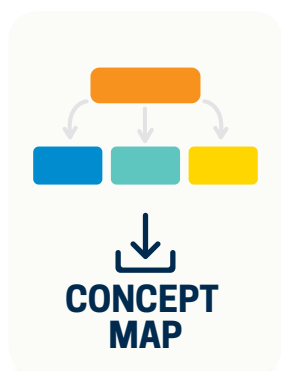
Students should have some general knowledge of how sound moves and more importantly, how it bounces back to our ears in an echo.

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## ARTS INTEGRATION MATERIALS



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## TEACH

### Engage

- To get students excited about the project, it may be helpful to facilitate a fun, game-like warmup to introduce the EDC extension.
  - An idea for this could be a “Mystery Musical Instrument Guessing Game.” This could be as simple as playing short audio clips of musical instruments and having students guess what instrument is being played.
  - Whichever engagement/warmup you decide should lead into you explaining that students will be **designing their echolocation devices using inspiration from a specific family of musical instruments.**



VIDEO TUTORIAL

### Experience

- Use the slides (included here) to review the engineering design challenge and to introduce students to the added element for the arts-integrated extension of the project: **Use a family of musical instruments as inspiration to design a device that produces a sound to help a person with vision challenges “see” the world around them.**
- Next, use the slides to introduce students to the 4 instrument families from which they will draw inspiration for their device: String, Brass, Woodwind, Percussion.
- Use the slides to show visual examples of the instrument family and to listen to the video clips of these instruments being played.
  - *Note: If you have access to real instruments from these families, or perhaps a student, colleague, friend, etc. who plays any of these instruments, this could be a fantastic way to deepen the engagement and integration of the music into the project.*



SLIDES

### Apply

- Students will perform the Engineering Design Challenge, as outlined in the SABES curriculum unit, but with the added challenge of choosing an instrument family as the inspiration for their device.
  - By no means should students be expected to exactly recreate an existing instrument, but rather should use components of an instrument family and its production of sound to inspire the overall design and function of their device.

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## TEACH

### Apply

- Once their device is built, students will apply their learning from the “My Sound Song” music writing activity to write another short musical “phrase”.
  - The musical phrase they write should include a change in pitch or volume to align with the SABES design challenge criteria.
  - Students will play the musical phrase they write with their echolocation device during the assessment phase of the project.

### Assess

- Use the rubric for the Engineering Design Challenge extension (included here) to assess the final project.
  - Note: This rubric is aligned to the existing SABES rubric with the inclusion of the extension project’s criteria.
  - This document also provides space for students to:
    - Draw their prototype
    - Write their musical phrase

↓  
**RUBRIC**