Sound Charades: Visualizing and Generalizing Movement-Music Connections

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Computational Thinking Focus: Abstraction

Additional Computational Thinking Concepts Supported: Pattern Recognition

Neurodiverse Workplace Skills: Collaborating, Communication, Persevering, Problem Solving

Elements of Telematics: Embodied learning through movement, Ensemble/collective activities, Embodied learning through space

Arizona Computer Science Standards

*Computing Systems (CS), Networks and the Internet (NI), Data and Analysis (DA), Algorithms and Programming (AP), Impacts of Computing (IC)

- 6.DA.S.1/7.DA.S.1/8.DA.S.1 Identify multiple encoding schemes used to represent data, including binary and ASCII.
- 6.DA.IM.1 Discuss the validity of a computational model based on the reliability of the data.
- 7.DA.IM.1 Use computational models and determine the reliability and validity of data they generate.
- 8.DA.IM.1 Design computational models and evaluate them based on the reliability and validity of the data they generate.
- 6.CS.HS.1 Explain how hardware and software can be used to collect and exchange data.
- 6.AP.V.1 Identify variables that represent different data types and perform operations on their values.

Arizona Academic Standards in the Arts: Dance

*Creating (CR), Performing (PR), Responding (RE), Connecting (CN)

- DA.CR.1a Generate and conceptualize artistic ideas. Explore relationships of movement components and concepts through creative processes by investigating various improvisational approaches.

- DA.CR.1c Generate and conceptualize artistic ideas. Create movement from a variety of stimuli (e.g., music/sound) that expands movement vocabulary and develops artistic expression.

Arizona Science Standards

- 8.P4U1.4 Develop and use mathematical models to explain wave characteristics and interactions.

Objectives

- Students will form abstractions by:
    - extracting common features from specific examples to create generalizations
    - incorporating body movement using Wearable Music Sensors (e.g. M5 Sticks).
- Students will model data using gestures, drawings, and graphical representations.
- Students will identify variables using the Wearable Music Sensors (e.g. M5 Sticks)and music apps.
- Students will identify inputs and outputs using the Wearable Music Sensors (e.g. M5 Sticks)and music apps.

Timeline

Day 1: Activation and Foundations (60 minutes)

Day 2: Application and Culmination (60 minutes)

Day 3-4: (Optional) Extensions

Vocabulary

- Abstraction
- Sound
- Vibration
- Wavelength
- Amplitude
- Frequency
- Medium
- Pitch
- Echo

- Tilt
- Modulation
- Grains
- X-axis
- Y-axis
- Z-axis

Materials

- Link to Instruments https://playnewmt.github.io/app/index.html
- Laptop (Activation)
- Rain stick app and sound bank (Activation)
- Wearable Music Sensors or Sensor (e.g. M5 Sticks)
    - Make sure sensors are in “Accelerometer Mode”. Gyroscope mode doesn’t pair too well with Rainstick; however, it might make for interesting sound mapping for exploration activities. (Activation)
- Wearable Jazz Instrument (Applications)
- Sound Vocabulary Pages printed and cut into cards (Foundations)
- Sound Worksheets- Describing Sound Effects (Foundations)
    - Sound Worksheets- Graph (digital or printable) (Activation)
    - Sound Worksheets- Axis Graphs (Foundations)
- One or more rainstick (Activation)

Day 1:

Activation (Engage & Explore)

Exploring Rainsticks (20 minutes)

Today we are going to explore the Rainstick application. This activity can be done in small groups or individually. Designate which students will be working on the X-axis, Y-axis, and Z-axis.

Directions:

1. Choose a sound from Rainstick's sound dropdown menu.
2. Click on the axis (X, Y, or Z) that I have assigned to you. Use the Sensor Sidebar Menu to change the axis.
3. Click the "Test Sound" button to play your sound back or move your sensor to hear your sound become part of the Rainstick.
4. Visualize the movement that the sound is making.
5. Notice the way you move the sensor to create the sound. Do you move the device side to side, up and down, or forward and backward?
6. Perform the motion along with the sound.

Now the students can try using an actual rain stick or the teacher can demonstrate with one. Do you move the rain stick side to side, up and down, or forward and backward to make the sound? Does the motion of the rain stick match the motion of the sensor that is connected to the Rainstick app?

Have the students draw their motions on the graphs (Worksheet Slide 3 or 4). If using the digital copy, have students make a copy on their laptop before filling out the worksheet.

Foundations (Explain)

Introducing vocabulary (40 minutes)

Print out multiple copies of the vocabulary pages and cut them into vocabulary cards.

Now it is time to connect the students' experiences with the Rainstick app and the Sensor to the sound vocabulary. Use the sound vocabulary page to dive into the foundations part

Note:

 **Collaborating.** Students are learning social skills when they interact to determine which movements make which sounds. They work together in small groups and share individual or small group findings with the whole group, building on each other's ideas.

 **Communicating.** Students can describe sounds with body movement instead of speaking or writing it down on paper.

? **Problem Solving.** Students make input/output connections by visualizing how a sound is moving and how moving creates sound.

 **Persevering.** Students build general background knowledge about inputs (movements) and outputs (sounds) which supports their future work. Students store the movements and related sounds in their memory using embodied strategies rather than rote memorization.

*This is a total embodied activity, so it is important to use the negative space around the students to help develop the concept of abstraction.

*The drawing on the graph will be a general representation of the movement and is not expected to be mathematically precise.

of the lesson. Introduce the vocabulary using the written word and the visual as well as by relating it to what the students just did in the Activation part of the lesson. Let the students know where the cards will be kept or posted so that they can be referred to later.

Ask the students to visualize the pictures to develop the use of **abstraction**. Tell the students that we use abstraction when we focus on what is necessary and ignore what is not important. There might be a lot of information, like when we explored with the Rainstick and Wearable Music Sensors, but when we focused on the movements and sounds, we were able to find patterns and determine that certain movements (inputs) made certain sounds (outputs). Then we were able to represent those abstractions as drawings on a graph.

Continue building vocabulary and background knowledge with sounds. It's important that the students know how to describe what they are listening to. Oftentimes students will give vague descriptions of what they hear (i.e., it was weird, sounds cool). We want to build that vocabulary up!

Use the Describing Sound Effects worksheet that is attached to the lesson. You can type directly onto the worksheet, or you can print it out. You will use worksheet 1 or 2 depending on your method of implementation. If using the digital copy, have students save a copy to use on their laptop.

Note:

Communicating. Introducing vocabulary after students have built some background knowledge is important. This allows students to connect abstract ideas to new words. In the Foundations section, students are introduced to new vocabulary by sharing connections to the Activation part of the lesson and by using vocabulary cards.

Communicating. Students further develop communication skills by practicing descriptive words. To support students, it would be helpful to post a list of adjectives and a list of words that match the sounds in the sound bank. This will help students who have challenges with expressive language and with spelling.

We are going to work in groups of 6 today. Go to the Rainstick application. At the top of the application is a dropdown list of sounds. Each of you will pick a sound to use.

Directions:

1. Click on a sound and use your Sensor to play it.
2. List what the sound is.
3. Describe it.
4. Using your body, add a motion/movement to it.

5. Have the students draw their motions on the Axis Graphs (Worksheet Slide 3 or 4). If using the digital copy, have students make a copy before filling out the worksheet.

Wrap-up by having students volunteer to share their sound, movement, and graph/visual. Notice if the students are focusing more on input/output connections and if they are using the axes on the graphs in alignment with their movements.

Day 2:

Application (Elaboration)

Sound Charades (40 minutes)

Students have built up vocabulary to be able to describe sounds on paper and with movement. They dove further into the aspects of movement and motion by exploring axes and planes. Students were spatially aware of their movements as they were developing the visual for the sound they chose.

Now the students are ready to play Sound Charades. They will return to their groups of 6 from the Foundations part of the lesson. Each group can choose a volunteer to perform one of their chosen sounds, or they can choose to perform together. The other groups will guess what was chosen by watching their peer(s) perform the associated movement. Have a list of sounds from the sound bank listed for the class to see. Begin with level 1 and add level 2 when the class is ready for the challenge.

Level 1: The students in the first group will choose one sound from the worksheet they created in the Foundations part of the lesson and their representative(s) will perform the movement of the sound for the class WITHOUT using the Rainstick application. The class will guess the sound and tell why they think it is that sound. If the class cannot guess, the group will change the axis of their Sensor in the Sensor Sidebar Menu (the button looks like a Sensor and opens whenever a new Sensor is connected) and play the sound with the Sensor and Rainstick application for the group while making the associated movement. Then the other groups will take their turn.

Level 2: The students in the first group will choose one graph from another group's worksheet and their representative(s) will perform the movement of the sound for the class WITHOUT using the Rainstick application. The class will guess the sound and tell why they think it is that sound. If the class cannot guess, the group will then change the axis of their Sensor in the Sensor Sidebar Menu (the button looks like a Sensor and opens whenever a new Sensor is connected), and play the sound with the Sensor and Rainstick

application for the group while making the associated movement. Then the other groups will take their turn.

Review how the movements on the graphs are connected to the movements in space (x, y, z axes of the Sensor) and how the students can visualize the movements to make a drawing on the graph. What you do with the Sensor (input) determines what sound you get (output). You can represent what you think might happen when you move certain ways with the Sensor using a drawing or model. Using **abstraction**, you make sure to focus only on the important patterns to solve the problem.

Culmination (Evaluate)

(20 minutes)

Assign each student a sound on the Rainstick application. The student should use a clean copy of the following worksheets: Describing Sound Effects and Axis Graph. Optional: Use FlipGrid or a selfie camera to record movements.

Directions:

1. Click on the sound and play it.
2. Name the sound is. What is it?
3. Describe it. What does it sound like?
4. Using your body, add a motion/movement to it. Which movements create which sounds?
5. Have the students draw the motions on an Axis Graph.

Rubric:

Beginning	Progressing	Ready for the Extension: Sound Charades with Wearable Jazz
Student is: Beginning to generalize pertinent information from the M5Stick interactions.	Student: Generalizes pertinent information from the M5Stick interactions at times.	Student: Often generalizes pertinent information while using the M5Sticks in the Sound Charades activities.
Beginning to model data using gestures, drawings, or graphical representations.	Models data using gestures, drawings, or graphical representations.	Models data using gestures, drawings, AND graphical representations.
Beginning to connect inputs (movements) to outputs (sounds).	Connects inputs (movements) to outputs (sounds) at times.	Consistently connects inputs (movements) to outputs (sounds) at times.
Beginning to understand variables as movement through space.	Understands variables as movement through space at times.	Describes variables as types of body movement through space and as movement across planes using x, y, and z axes.

The rubric can be used throughout day 1 and day 2 activities to assess student progress on objectives.

Adaptations:

1. The Activation can be done in small groups, pairs, or individually. When creating groups, consider student strengths (i.e., speaker with non-speaker, strong writer with someone for whom writing is a challenge).
2. Sound Charades is created in levels to build the concept of visualizing and practice abstraction. Move across levels as needed for your specific group of students.
3. The worksheets are designed to be used on the computer or hard copies can be used.
4. Students with visual impairments can hold the arm (or gesturing body part) of the person that is moving (with permission) instead of watching the performance. Instead of drawing, the student with visual impairments can use playdough to model sound movement.

Note:

Communicating. Throughout this kit, communication was developed by incorporating many ways for students to engage with the concepts, represent ideas, and express themselves, including drawing, writing, typing, moving, and through music/sound and geometrical/spatial modes.

Extensions:

1. Sound Charades with Wearable Jazz (40-60 minutes)

Today we are going to continue exploring sounds using a new app. The Rainstick app is one player at a time. Today we will use Wearable Jazz, which is more complex because it makes three kinds of sounds (the drums, the melody, and the effects) with three kinds of movements. Have the students open Wearable Jazz, connect three Sensors (the Sensor controlling the drums should be switched to gyroscope mode, the other two controlling the melody and effects should be switched to Accelerometer mode)and play with the app for 5-10 minutes. You will not need to choose a sound file in Wearable Jazz. The student controlling the effects should choose which effect they want to use. Ask the students to

share about what they are noticing. Do they focus on the input and output patterns? Can they generalize to describe what is happening?

Next, ask the students to make the movements for the music they have created. Give them 5-10 minutes more to explore. Discuss the following questions: Which movements trigger the drums, the melody, and the effects? What happens if they use movements with the Wearable Music Sensor in a different order? Students will be able to imagine the potential sound based on the movement they performed. Students are developing memory storage, muscle memory, and the beginning understanding of decomposition.

For the next 20 minutes play Sound Charades Level 3 and 4.

Level 3: The students will choose one movement (i.e., side to side, forwards and backwards, up, and down) to perform for the class WITHOUT sound. The class will guess whether the movement would trigger the drums, the melody, or the effects. Encourage the whole class to copy the movement to help remember which input connects with which output. Then perform the movement WITH sound to check if the guesses were correct. Take turns sharing movements WITHOUT, then with sound.

Level 4: The students will choose three movements in a specific order (i.e., side to side, forwards and backwards, up and down) to perform for the class WITHOUT sound. The class will guess whether the movements would trigger the drums, the melody, or the effects, and in which order they would sound. Encourage the whole class to copy the movement to help remember which input connects with which output. Then perform the movement WITH sound to check if the guesses were correct. Take turns sharing movements WITHOUT, then with sound.

Questions to ask: Do the same kinds of movements work the same way for both Rainstick and Wearable Jazz? What sounds do you remember from Rainstick and which movements triggered them? Can you visualize the original sound from your Rainstick movements? What might a drawing or graph look like using the movements needed to play Wearable Jazz? What kinds of movements do not trigger any sound, and how did you figure that out?

Add a twist to Sound Charades by playing Assigned Group or Descriptive Sound Charades. To play Assigned Group Sound Charades, group students, and assign a number to each group. A representative from each group picks a sound name paper from a hat/bowl. Play the sound using “Test Sound” button in Rainstick. The students then draw the movement, choose the axis, and create a motion for their group sound together. Last, they map this motion. Encourage the students to play around with Rainsticks parameters to change the tambre and quality of the sound. In Descriptive Sound Charades, students can work alone or in small groups. Have students pick an adjective from a teacher-prepared list. Students then choose a sound and an axis. They then change the Sensor to match the chosen axis using the Sensor Sidebar Menu. The students are encouraged to play with the parameters of Rainstick to make their sound embody the adjective they chose or were given. Students

can then perform their motion with the Sensor while other students/groups try to guess which adjective they have. This activity works on abstraction by abstracting the adjective to sound and motion. One example of an adjective could be 'spiky.' The zip sound with short percussive movements could be used to enact 'spiky'.

2. Have the students match the vocabulary terms to the definitions and/or visuals using the vocabulary cards. (15 minutes)

3. To dive even further into abstraction of sound (triggered by movement) students can make observations of what they hear while drawing. Play this clip and have the students make observations of what it sounds like to them. Please view the Abstract Sound Video on the Kit 1 curriculum page (open in Google Chrome). Students can draw or use modeling clay to represent the sound. Discuss what aspects of the sound they were focusing on most and why. Which parts of the audio did they 'tune out' and why? (30 minutes)

4. Play Pass the Sound/Sound Lines with Wearable Jazz (30 minutes)

Students are split into 2 groups.

Group 1: Students create a circle and think of a creative way to pass the sound using the Wearable Music Sensor. For example, wearing the Sensor on a wrist or ankle, they will connect to Wearable Jazz and make a series of movements. Once the students have their movement (pattern). They will perform the movements and pass the sound to their neighbor. Passing could be by tossing, bouncing, handing the sound (think of tossing an imaginary ball) to the next person. The next student then takes the sound (think of catching the imaginary ball) and performs their own set of movements before passing it to the next person. The students should pass the sound around the circle three times.

Group 2: Students will have paper and something to write with (colored markers, colored pencils, etc). They will draw the sound as they hear it passed in Group 1. The drawings can be whatever the students are visualizing.

Then the groups will switch so everyone has a turn. This activity allows students to dive deeper into sound abstraction without knowing actual the source of the audio. Discuss what aspects of the sound they were focusing on most and why. Which parts of the audio did they 'tune out' and why?

Expansions:

In this series of lessons and activities, we used a variety of cross disciplinary skills to understand abstraction in the context of (input) movement and (output) sound. We also incorporated many styles of learning to reach the whole child during the lessons. Below are some ideas for continuing to study some of the concepts beyond abstraction that were engaged with during this kit.

1. Delve deeper into the characteristics of sound waves by studying sound waves and by exploring graphs of waves. https://www.physicsclassroom.com/Teacher-Toolkits/Describing-Waves/Describing-Waves-Complete-ToolKit
   https://byjus.com/physics/characteristics-of-sound-wavesamplitude/
   https://www.ams.jhu.edu/dan-mathofmusic/sound-waves/

2. Have students work in groups, pairs, or solo to choreograph a dance (movement) using Wearable Jazz. Students can use drawing, modeling, and other forms of visualizing to help with the choreography. Perform it for an audience. The Transport Tempo control in Wearable Jazz can be used to change the speed that Wearable Jazz generates at, so students can perform fast or slow choreographed dances.

3. Engage students in a discussion about spatial awareness in groups and sensory preferences. Where are there preferred boundaries when working in groups? Which sounds were calming? Which sounds were exciting? Which parts of the activities did they enjoy the most and why? Which parts of the activities did not feel good to them and why? How can the class work together to respect each other's spatial boundaries and sensory needs?

4. Expand on the musical ideas engaged with in this kit by further exploring musical patterns and loops.

Below are some ideas for further exploring **abstraction** in other content areas:

1. While solving math word problems, encourage the students to notice which information is necessary to solve the problem and which information is not necessary.

2. Give the students interdisciplinary tasks that require problem solving. Have them brainstorm all the things related to the task. Then have them circle or highlight only

those items on the list that are most important to completing the task or solving the problem. For example, if the task was to design a raised vegetable garden that held 48 ft^3 of soil, the students would list everything they knew about raised gardens, vegetable gardens, soil, and volume. They would need to determine just what information was needed to design the garden to the given specifications.

3. Write Mad Libs and discuss the difference between specific and general language. https://code.org/curriculum/course4/5/Teacher Or use language to describe an everyday object. https://docs.google.com/document/d/1FvRf4TOJ9jWPnekBDHPQe1OiZ32jmWLc2CR9A7sctHE/edit

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Lead author: Kristin Kennedy

Please send feedback to Ananí Vasquez at avasquez@neurodiversitycenter.org

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