## Task A-2
### Lesson Plan

<table>
<thead>
<tr>
<th>Intern Name: Scott Townsend</th>
<th>Date: 1-18-2010 (3-4 day lesson)</th>
<th>Cycle: N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Students: 18</td>
<td># of IEP Students: 0</td>
<td># of GSSP Students: 0</td>
</tr>
<tr>
<td>Age/Grade Level: 4th (PST)</td>
<td>Subject: Science</td>
<td>Major Content: Force/Motion</td>
</tr>
<tr>
<td>Unit Title: Force and Motion</td>
<td>Lesson Title: Sounds All Around</td>
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</tbody>
</table>

### Context

- **Identify the unit topic and the unit objective(s) addressed by this lesson:**
  
  This lesson is not part of a unit plans. It is taught as a stand-alone lesson to show the use of the learning cycle on the first day of class of an elementary science methods class to show an example of a KTIP-style lesson plan using the 5E Learning Cycle for the procedures. Although the lesson is designed for 3rd/4th graders, I will be using it in the context of a methods classroom designed for preservice teachers who will possibly be teaching 3rd and 4th graders.

- **Describe the students’ prior knowledge or the focus of the previous lesson:**
  
  I have no knowledge of the students' background regarding the concept of sound. However, some of them may have taken PHY 102 and have participated in similar activities. As a result, I will be implementing procedures to formatively assess students background knowledge about the subject during the “engage” stage of the lesson.

- **Describe generally any critical student characteristics or attributes that will affect student learning:**
  
  Although this is a stand-alone lesson and I have no previous background information about the learners’ content knowledge or pedagogical knowledge, I noticed an overall trend of a lack of confidence in the preservice teachers' attitudes towards teaching science (based on a survey given prior to this lesson).

### Lesson Objective(s)

State what students will demonstrate as a result of this lesson. Objective(s) must be student-centered, observable and measurable.

As a result of this lesson, students will be able to:

1. Students will investigate how the rate of vibration of an object changes the pitch (high-low) of the sound it produces.
   
   *Students successfully meeting this objective will explore different objects such as rulers, tuning forks, string-cup phones, xylophones, etc to correctly identify patterns regarding factors that change pitch. This will be assessed by observing their actions and verifying the outcomes in their science journals and recording with a checklist.*

2. Explain and illustrate that change in the rate of vibration cause object to make sound and produce different levels of pitch.
   
   *Students successfully meeting this objective will explain and illustrate why two different stemmed glasses make two different pitches when the rims of the glasses are rubbed. They will correctly use the phrases/terms “rate of vibration” and “pitch” to describe the differences (using an open response question).*
Connections
Connect your goals and lesson objective(s) to appropriate Kentucky Core Content and/or Program of Studies. Use no more than two or three connections, and if not obvious, explain how each objective is related to the Program of Studies and/or Core Content.

Program of Studies: Understandings
SC-4-MF-U-3
Students will understand that sound is produced by the vibration of matter, and the rate of vibration affects the pitch of the sound.

Program of Studies: Skills and Concepts
SC-4-MF-S-3
Students will investigate how the rate of vibration of an object changes the pitch (high-low) of the sound it produces

Related Core Content for Assessment
SC-04-1.2.3
Students will:
• explain that sound is a result of vibrations, a type of motion;
• describe pitch (high, low) as a difference in sounds that are produced and relate that to the rate of vibration.

Vibration is a type of motion that can be observed, described, measured and compared. Sound is produced by vibrating objects. The pitch of the sound can be varied by changing the rate of vibration. The relationship between rates of vibration and produced sounds can be described and graphed.

Assessment Plan
Using the tabular format below, describe how each lesson objective will be assessed formatively to determine student progress and modify instruction if needed. Describe any summative assessment to be used if it is a part of this lesson. Include copies of any assessment instruments and scoring criteria or rubrics if applicable to the lesson.

**Objective/Assessment Plan Organizer**

<table>
<thead>
<tr>
<th>Objective Number</th>
<th>Type of Assessment</th>
<th>Description of Assessment</th>
<th>Depth of Knowledge Level</th>
<th>Adaptations and/or Accommodations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Formative</td>
<td>Students will be recording their guided inquiry investigations in their science journals. I will ask class questions and look at individual journals to formatively assess understanding and guide practice.</td>
<td>3</td>
<td>Help in recording for those who need it. Provide guiding questions for those who need it. (I don’t know learners’ prior abilities)</td>
</tr>
<tr>
<td>2</td>
<td>Summative</td>
<td>Students will be completing an open response question regarding the inter-related concepts of vibration, sound, and pitch. They will be doing this last and submitting for a final assessment</td>
<td>2</td>
<td>Help with terms will be provided if necessary</td>
</tr>
</tbody>
</table>
Resources, media and technology
List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.
If appropriate, list technology resources for the lesson including hardware, software and Internet URLs, and be sure to cite the sources used to develop this lesson. (If your committee thinks the technology observed in the lessons does not fairly represent your use of technology, provide additional documentation in your Component 1 exhibits. See Standard 6.)

Engage: music box cranks
Explore A: plastic knife or 12-inch plastic ruler, rubber band, whiteboard/marker
Explore B: tuning forks of various sizes and pitches (vibrations per second), wooden block, foam packing peanut, transparent tape, string, bowls, water, paper towels
Explain: Sounds All Around by Wendy Pfeffer, ScienceSaurus: A Science Toolkit, empty Styrofoam/coffee cups and/or empty ziplock bags with short, clean straws
Extend:
   Station 1: Cup-phones (premade: plastic cups, string, paper clips)
   Station 2: Clucking chicken materials (premade: cups, string, paper clips, 1” x 1” sponges, string, water)
   Station 3: Ear guitar (cotton string)
   Station 4: Pop bottle music (six small soda bottles filled with various amounts of water, cut straws)
   Station 5: Xylophone (Glockenspiel) and sticks

Cheapie Oscilloscope Demo: (premade—directions posted on Bb)

Evaluate: Summative: Two stemmed drinking glasses, water, open response question

Procedures
Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

This lesson will utilize methods of the 5E Learning Cycle, guided inquiry, cooperative learning, science process skills, discrepant events.

See below for procedures:
Engage:
This lesson will begin with a discrepant event for the learners. The students will be told not to speak to anyone (because we will be doing a think-pair-share) and to “sit on their hands.” Each table will then be given an object (jack-in-the-box/music box cranks—one per table) and will be asked if anyone knows what the object is. I will ask, “has anyone ever gotten to use one of these before?” Without speaking, they will write in your journal where you have seen one of these before and what you think will happen when the handle is cranked. Allow time for students to think back to prior experiences with similar objects and to write/make predictions in their journal. They will then be given the opportunity to write in their journal what they think may happen when the handle is cranked. They will be encouraged to draw a picture of the object in their journals for later reference. Walk around the room and observe what they are writing and drawing. Be sure all are engaged.

Now I will ask the Group Leaders from each group to hold up their hand crank devices (off the table so all group members can see) and turn the handle until I tell them to stop.” Did anything happen that was different/same than they predicted? Allow time for writing or sharing. Now allow some time for each member of the group to have a turn using the music box—holding it up in the air.

For the discrepant event part of the engage, have the last person holding the box in each group sit the device down flat on the table and discuss what they observed. I will then have the student crank the music device while it is flat on the table. We will do this at the same time with a “1, 2, 3, GO!” “Was there anything different?” Let others try it. “Is this trial the same?” Ask the students to write an “I believe” statement in their journals. “Maybe the music box was louder when sitting on the table because…” I’ll give time for several students to share their ideas AFTER all have recorded their ideas in their journals. It’s very important that everyone records their own ideas in their journals first.

Explore: (use explore discussions to build an ongoing poster about sound)

Part A: Vibrations and Pitch
Give the students a plastic ruler and ask them if they can make the object make sound “make music” like the music box device. Allow a minute or two for exploration. Ask for a show of hands for anyone that wants to share. Look for a student that partially extends the ruler over the edge of the desk and plucks it so it makes a twang noise. Have everyone stop and observe the student to model the way to successfully made the sound.

Now give the students the following guided inquiry prompt by writing it on the white board: “How does the length of the ruler/knife hanging over the edge of the table affect the sound it makes when you pluck it?” Encourage the students to first make predictions in their science journals followed by a short investigation. Walk around and make sure the students are recording the evidence of their investigations. After a few minutes, bring the class back together and ask for a show of hands of anyone that found a relationship between the length of the ruler over the edge of the table and the type of sound it made. As they explain, either draw on the board or have the students draw on the board. Evidence and conclusions will be recorded on a t-chart (see attached notes page).

“Optional” Give the students a rubber band and ask them if the same principles apply to the rubber band as they do to the ruler/knife. Follow the same prediction-explore-share procedure as before (time permitting). If time doesn’t permit, consider assigning this as a homework assignment.

Part B: Vibrations and Sound/Matter Interactions
Hold up a tuning fork and ask for a raised hand if anyone knows what the object is I’m holding. Ask if anyone has ever used on before. After allowing necessary wait time, call on students to share their ideas. Demonstrate how to properly/safely use a tuning fork. Be sure to stress the importance of using the tuning fork properly. Explicitly state that any unsafe use of a tuning fork will result in the tuning fork being taken away.

Pass out tuning forks to every member of the class, making sure that each group receives different sizes and pitches. Tell the students to hit their tuning forks against the sole of their shoe or their rubber block (if provided). What do they notice/experience? Have the students draw and write this in their journals. Give the students time to demonstrate/share their tuning forks with their groups and ultimately with the class (class discussion).

Finish the explore by asking the students to strike the tuning fork and then grabbing the end with their other hand. What happens? Now ask them to strike the tuning fork and touch the end to the following things (written on board): 1. desk (2) packing peanut or ping pong ball hanging from kite string (3) dip into a bowl of water (4) nose/cheek/ear.

First, have the students quickly record in their journals, then have a class discussion about what they experienced.
**Explain:**
The explain is integrated with the explore. Be sure the students are given the chance to explain the relationships and experiences they found while exploring with the various objects. Record any important and relevant information on the board.

Read the first 8-10 pages of *Sounds All Around* by Wendy Pfeffer—preferably as a scanned document shown via the LCD projector. Be sure to use expressive reading when reading the book. When the book mentions situations that were similar to our explorations, stop and ask for raised hands to explain how the situation was similar to what we did. Ask for participation when appropriate (have students place their hands on their vocal chords and hum when the book says to or encourage students to snap their fingers when the book suggests they do so). Ask, “did we hear/see anything in the book that reminds us about what we did earlier?” Give students a chance to make connections and explain. Be sure to encourage and repeat ideas that pertain to the stated core content.

Using their ScienceSaurus books and the materials remaining on their tables, have the students draw and write about the relationships between the following words and the experiences they’ve had: Allow five minutes for work time (much longer in a real classroom, possibly an extra half day or full day in an ELE science class).

**Key Terms:**
Vibration
Rate of vibration
Pitch
Transmit
Frequency
Volume (optional)
Amplify (optional)

*Optional* Give the students a styrofoam cup or an empty ziplock bag to blow up and have them sing/talk into it to feel the vibrations. How can we relate the demo we are doing to the key words on the board?

Sing the "Vibration Song" together while everyone holds the cup/ziplock bags in front of their mouths:

*Vi-bration, Vi-bration
Vibration is the word…
Vi-bration, Vi-bration
Vibration is what you heard!*

**Extend:**
It is very important to encourage the students to use the Key Terms from the explain stage throughout the extend stage. It is important for them to apply the terms to these extended activities. In methods, we may only have one group do each lesson and share. If this lesson was taught with 3rd/4th graders, I would dedicate an entire class period to the extend so all groups could rotate through.

Each table/extend activity will come with a Prompt Card (see attached).

**Station 1: How Sound Travels (Cup Phones)**
Provide this table with a “toy phone.” Provide the prompts:
“Have you ever played with or observed one of these before? What can it be used for?”
“Experiment with it and see what it takes for one person to speak into one side and another person hear from the other side.”
“What were some problems you had? What did you have to do to get it to work? What key terms could this relate to?”

**Station 2: Clucking Chicken**
Provide the table with different sizes of "clucking chicken" instruments.
The directions will prompt them to wet the sponge and squeeze excess water out, firmly wrap the sponge around the string near the top, and while squeezing tightly, pull the sponge down the string. Try the different clucking chickens.

**Record in your notebook (drawings/writing) what you did and what you observed. Did you notice any patterns that support things we’ve done earlier? Do any of our Key Terms relate to what you did?”**
Stations 3: Ear Guitar
Provide half the students with a 2-3 foot piece of cotton string. Have the students partner up. While one student holds the string tightly between his/her middle and ring finger, have the other student pull the string slightly tightly and pluck the string. *Does anyone hear anything? Who hears what? Can you change anything to produce different sounds? Be sure to record (draw/write). Does this relate to any of our Key Terms?*

Station 4: Pop Bottle Music
Fill six small soda bottles with increasing amounts of water. Provide a drum stick or a plastic knife. Give the students the following prompt:

1. Using your “drum stick,” tap on the different bottles. Do you notice any differences in sound? Describe this in your science journal.
2. Have a group member open a straw and blow across the top of the bottle openings. What do you observe? Any patterns? How does it compare to tapping bottles? Do you observe any relationship?

Do any of your observations relate to any of our Key Words?

Station 5: Xylophone
Before touching the xylophone, answer the following question: *What do you think the different sounds will be when you tap the different bars on the xylophone?” Please draw a simple diagram and explain your predictions.*

Conclusions
Review information discovered from the extend rotations:
Do “Cheapie Oscilloscope” demo for the class. Ask them how it works. Draw final conclusions as a class and revisit Key Terms.

Evaluate:
Formative:
Engage: Use questioning techniques and journal entries to see if the students are making the connection between the ideas of vibration and sound. If students have more background knowledge about sound/vibrations than expected, then I can move on quickly.

Explore: Walk around and ask questions and observe students. Check to see if they are making the connection between the ruler length and changes in sound. Read short journal entries/drawings to check for understanding. Use class discussion and responses to questions to assess comprehension to inform subsequent instruction and investigations.

Explain: Look for student connections between the exploration experiences and the new terminology (discussion/journal entries/demonstrations).

Extend: Discussions/journal entries/questions and answers regarding the station rotations.

Summative evaluation:
See open response prompt
Prompt:
If Rosa dips her finger in water and rubs the top rim of a stemmed glass, it will produce a sound she can easily hear.

If she does this to two different glasses (see picture), then they make two different sounds.

Instructions:

A. Explain why each glass makes a different sound.
B. Identify which of the two glasses will make the lowest sound and explain why.

Rubric:

Examples to Look for in a Student Response

The student should know that sound is produced by vibration and relate that to rubbing the rim of the glass.

The bigger glass will have a higher pitch.

The smaller glass will have a lower pitch.

<table>
<thead>
<tr>
<th>The student accurately describes why the glasses make different sounds using the concept of vibration. -and- The student will identify that the larger glass will have the lower pitch based on rate of vibration. Student correctly integrates terms such as rate of vibration and pitch.</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student accurately describes the cause of the sound -but- only generally explains why the two glasses makes two different pitches. The response may contain minor errors or reflect minor misconceptions.</td>
<td>3</td>
</tr>
<tr>
<td>The student partially connects the concept of vibration, but shows minimal understanding of difference in vibration rates and doesn’t connect to the concept of pitch.</td>
<td>2</td>
</tr>
<tr>
<td>Student demonstrates minimal understanding. May partially describe vibrations, but other parts are missing or major misconceptions are present.</td>
<td>1</td>
</tr>
<tr>
<td>No effort or response by the student.</td>
<td>0</td>
</tr>
</tbody>
</table>
Possible notes page on board for explore stage:

Sample Board Notes:

What is the relationship between ruler length and the type of sound?
- Short over table
  - faster vibrations
  - pitch higher
  - sounds like a "soprano"
    - Mariah Carey
  - shorter "arc"
- Long over table
  - slower vibrations
  - pitch lower
  - sounds like alto/bass
    - Barry White
  - Longer "arc"

How do the tuning forks compare?
- higher pitch (like the short ruler)
- the "vibrations" are not visual
- lighter?
- sound lasts longer
- lower pitch
- Sue said, "I can see the end vibrating."
- heavier?
- sound doesn't last long

- Tom discovered that the short tuning fork says "1024 u.p.s.", and the long one says 572 u.p.s.
- Casey said, "the tuning fork that says 180 u.p.s. makes the BIGGEST splash in the water"

Big Question: How are the tuning forks and rulers similar?