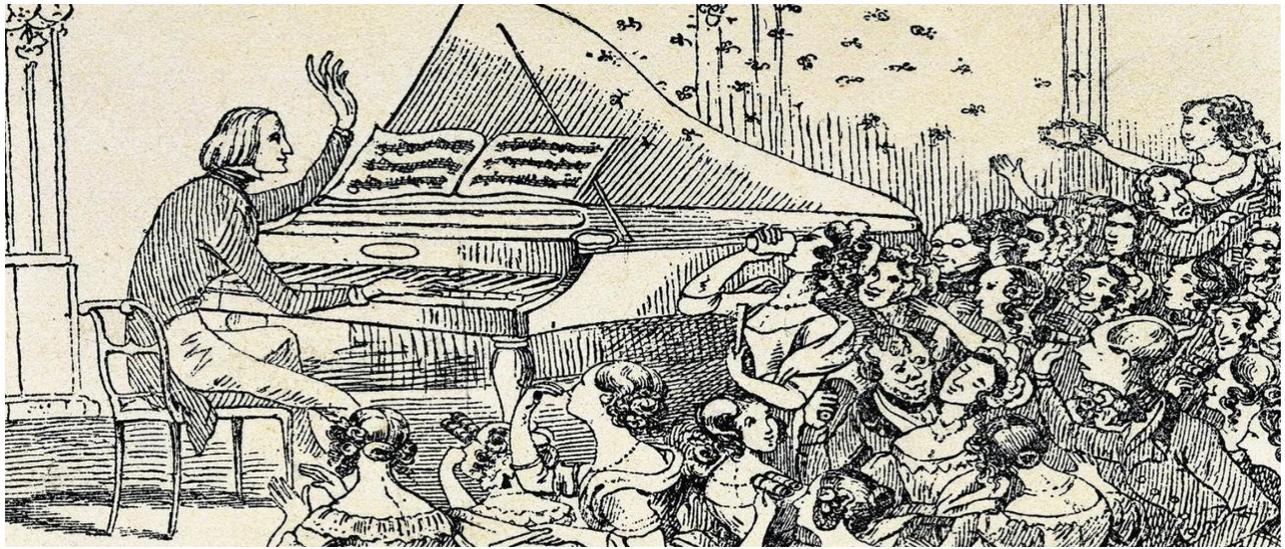


Physical Science Lesson Plan: Good Vibrations and the Music of Hungary



Franz Liszt performing in 1846 (Theodor Hosemann's Franz Liszt caricature, public domain)

Who was the first rock star? Some might answer Elvis Presley or Chuck Berry, but his name was actually Franz Liszt; a Hungarian pianist, composer, and author who lived during the 1800s. His performances were so riveting “women would literally attack him: tear bits of his clothing, fight over broken piano strings and locks of his shoulder-length hair” (see NPR below in “Materials” for more). The craze that he nurtured in his audiences was even dubbed “Lisztomania” by Liszt’s contemporary, the German poet Heinrich Heine. Although Liszt, whose native language was German, didn’t speak Hungarian; however, he always self-identified as Hungarian, and the people of Hungary still embrace his musical heritage as the vibrations of his piano strings pulled strings of another kind in hearts all over Europe.

What is it about the vibrations of strings in a box struck by a hammer that the human ear finds so appealing? How does the sound of one vibration change as it’s waves flow through different materials? Exploring the physicality of different instruments from around the world can broaden one’s understanding of vibration and its oscillations, while developing an appreciation of the different ways in which one instrument or one type of material *can* vibrate. Introducing popular, intriguing, and highly performative music from Hungary to young students can spark their interest in physical science and stimulate their curiosity about understanding the broader world we live in.

The following lesson plan is intended for third graders to fulfill physical science requirements.

Guiding Questions:

What is vibration?

How does the sound (or pitch) change when you press on the string? Does it matter where you press? Why?

If a string is vibrating, does it always make a sound?
Does anything vibrating make a sound?
Can humans always hear the vibration of objects?
How does a drum make sound?
Does the drum's sound change under water? Why?
Does a drum's sound change when it is decorated with a thick/thin material?
How does the proximity (nearness) of solid materials change the sound of a stringed instrument like a guitar?
What are sound waves?

Learning Objectives:

3.PS.3. Generate sound energy using a variety of materials and techniques, and recognize that it passes through solids, liquids, and gases (i.e. air).

3.PS.4. Investigate and recognize properties of sound that include pitch, loudness (amplitude), and vibration as determined by the physical properties of the object making the sound.

Lesson Preparation:

Review the lesson plan and materials below. Find a few music videos from the collection below that you are comfortable discussing and sharing with students. The night before the lesson as homework, give pupils the link to Tom & Jerry's "Cat Concerto" to watch at home. Briefly introduce them to the composer Franz Liszt and ask them to learn two facts about him (as his piece is the one played in the cartoon) and be ready to talk about him the next day in class. Make sure that you have watched/listened to one of his short biographies, below before discussion. In addition, ask students to write one or two observations about the piano in the cartoon. How does it work? How does it produce sound?

Lesson Presentation:

Have kids talk about Liszt and share some of the facts they learned. Introduce other Hungarian instruments and types of music while paying special attention to the strings on the violin, zither, and the structure and vibration of the drum, used in some Hungarian shamanistic ceremonies. If the resources are available at your school, take the students into the music room and collaborate with the music teacher. Allow the students to strike a drum and feel the vibration of the stick or pluck the strings on a violin or any available stringed instrument.

Lesson Practice:

Split students into small groups and have each individual student choose an instrument to construct. Provide them the materials and have students make either a drum or guitar. Make sure that both instruments are constructed in each group. Once students have made the instruments, allow them to experiment with pitch by changing the amount of tension on the strings and then

by changing out the materials on the outside of the drum. How might the material a piano is constructed from influence the sound of the strings inside? Also provide students with a bucket of water to dip the drum in and have them hit it while inside. How does the water change the sound and vibration? Can you ever see sound waves?

Lesson Production:

Have the students present what they learned about vibration, sound, and materials in their groups on. How can we *see* sound energy and why? Is all sound vibration of some sort?

Extend this lesson:

For more advanced students, turn this lesson into a mini-research project wherein pupils choose one Hungarian folk instrument to research at home. Have them write on famous performers or folk instruments and the construction and use of that instrument. Why are its vibrations pleasing to the ear (or why are they not)?

Materials and Media:

Stringed Instrument

cereal box or Kleenex box
rubber bands of different sizes
pencils
scissors
glue
masking tape
piece of rope or ribbon for a strap (optional)

Video: How to String a Homemade Guitar: Musical Instruments

<https://www.youtube.com/watch?v=uRbNpMAZr3A>

Drum

tin cans of all different sizes
balloons
pencils
colored duct tape

How to Make a Tin Can Drum: Sophie's World

<https://www.youtube.com/watch?v=Bm7TZMTo4kc>

large bucket (or two) filled with water

Tom & Jerry: The Cat Concerto

<https://www.dailymotion.com/video/x7tiofe>

Songs and Resources for Hungarian Music

1. Article: Musical Instruments and Music in Hungarian Folk Tales
<https://www.jstor.org/stable/902362?seq=1>
2. Video: Monti Csárdás (Czardas) Szalai Hungarian Gypsy Band
<https://www.youtube.com/watch?v=jJphp3nU1PA>
3. Video: Liszt – Hungarian Rhapsody No. 2

- <https://www.youtube.com/watch?v=ALqOKq0M6ho>
4. Video: Brahms Hungarian Dance No.5
<https://www.youtube.com/watch?v=p4GFQRyZpgg>
 5. Video: Lajkó Félix – A Madárnak (Official Music Video) *song starts at 0:45*
“Felix Lajkó –For the Birds”
<https://www.youtube.com/watch?v=x-SuyWy7LRw>
 6. Video: Magdolna Rúzsá – Felix Lajkó – Még azt mondják (folk song)
“They even say that ”
<https://www.youtube.com/watch?v=VAeYt-swWG0>
 7. Video: Hungarian Zither
<https://www.youtube.com/watch?v=uIrIWC0IDBU>
 8. Video: A Brief History of Franz Liszt
<https://www.youtube.com/watch?v=gRVvoFfif8E>
Video: A Brief History of Franz Liszt, Part 2
<https://www.youtube.com/watch?v=2B0fV6YabZU>
 9. Radio: How Franz Liszt Became the World’s First Rock Star (NPR All Things Considered)
<https://www.npr.org/2011/10/22/141617637/how-franz-liszt-became-the-worlds-first-rock-star>
 10. Video: Attila Heffner sacred shaman drum playing, spirit-singing, Attila Hungarian folk music
<https://www.youtube.com/watch?v=J53u2rogxe0>
(Note: Catholicism is the most dominant religious tradition in Hungary while shamanism is a fringe religious tradition, but well known. This video on shaman drums was chosen to engage students and to exemplify the difference between drum size, material, and sound. It is not meant to be representative of Hungarian culture, writ large.)

On the Science of Vibration:

1. Video: Good Vibrations: The Science of Sound (World Science Festival)
<https://www.youtube.com/watch?v=nsYt-FBhE2Q>