

“Getting Forked Up: Taking a Bite Out of the Major Scale”



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Introduction

Eric Firestone currently serves as the Director of Choral Activities at South Miami Middle Community School. He has been teaching for twelve years and holds a Bachelors of Music from the University of Miami Frost School of Music, where he majored in music education and minored in music theory and composition. His students have won numerous awards and accolades, both as soloists and choral members, including All-State, State Federation Competitions, Superiors at MPA's and have been the middle school magnet first place winners at the annual Caroling Competition for over a decade. Eric Firestone has been using this project for one year.

Program Outline/ Overview

Getting Forked Up: Taking a Bite Out of the Major Scale is a cross-curriculum project between the music teacher and the science and math teachers. The intention is to create an interactive and engaging approach to cover a variety of cross-curricular concepts in the science and math areas, but to do so as an added bonus to the main focus and goal, which is developing a deeper understanding and execution of the major scale as a singer. By developing the students' inner ears, it also has helped improve their ability to discern and perform intervals. The supplemental math curriculum includes proportions, addition, subtraction and division; sound waves and their properties, including pitch (frequency), duration, timbre, and dynamics (amplitude) comprise the science curriculum. While this project is intended for the music teacher to be able to satisfy a STEAM component, it should be done around the same time as the science and math teachers do their own curriculum in order to have the greatest impact on student learning and success.

Based off of the Gordon thought process of sound before sight, the students must have been previously taught how to sing the major scale. While there is not sufficient evidence to suggest the success of one method over another, for the purposes of this project and his classroom, the teacher uses and references solfege syllables and the Kodaly/ Curwen hand symbols and uses a "Moveable Do" system for greatest efficacy. The class begins with the singing of the major scale, performed with the hand signs. This is then followed with singing each part of the scale intervallically with a return to "Do" in between (Do-Re-Do; Do-Mi-Do; Do-Fa-Do, etc).

Displayed on the board throughout the project, a drawn representation of a sound wave is on the board to assist visual learners understand the various aspects of sound. Each time a new concept is revisited (remember that it should be taught around the same time as the other teachers), the process is always the same - performance, discussion, visual representation, and student creation. Frequency,

and it's relationship to pitch is the final concept taught, and provides the segue to introduce hertz, and the actual tuning forks.

The project culminates in the students' abilities to successfully identify aural intervals, perform intervals when cued, and performing a major scale, with any starting pitch, based off of their understanding of intervallic relationships to the singular pitch given from their own tuning fork.

This project was written for students in the 6th through 8th grade levels, and has been successfully implemented in their choral classrooms. However, the teacher, having taught high school for many years as well, sees no reason as to why it could not be used in grades 9-12 as well.

Benefits

Many music teachers often balk at the idea that devoting the rehearsal time (classroom time) away from the repertoire, the students will not be ready for the next performance. However, it is evidenced that by keeping the tasks short and simple, but cumulative each day (you may combine days if your schedule does not allow you to meet everyday with your students), the teacher has found that not only were the students able to learn the given repertoire on time, but that this project has aided in their abilities to perform with greater tonality and memorization of the given repertoire. It shall remain to be seen, but it is also believed that this project will have immeasurable effects on the students' abilities in the future, for those that choose to continue the path of furthering their musicianship.

Students are often seeking for immediate answers and are not always challenged enough (enter Google). Research skills have therefore dwindled, and the attention span to focus on a non-cellular device has almost but all been lost. The short lessons are designed to keep interest in the topics and address a deeper understanding of the students' craft and academic interest.

Having briefly encountered tuning forks in their science class, learning about sound waves and mathematic basics, and then being able to combine these elements in a class where they can see the direct impact on their craft also affected the students' attitude and participation. They became more engaged and excited when they recognized elements from their other classes, and intrigued as they encountered the same information in a different and real-life applicable way.

Additionally, by reaching out to the other curricular areas, sharing ideas and realizing how symbiotic this project can be, an unintentional, but wonderful thing has occurred – appreciation. This appreciation was felt and expressed at all levels, including the students, who found that they had a deeper understanding of the subject matter, but also from the teachers involved. When the time came for either

teacher to request a student for a field trip, or provide the student with additional content assistance, a respect and cordiality was present, making the tasks more enjoyable for everyone.

Costs

Tuning Fork, Standard A-440 Hz with Soft Shell Case and Cleaning Cloth
\$7.99 per (CLASS SET MINIMUM REQUIRED)

Tuning Fork, Superior Quality, Musical Set of 8 (C Major Scale)
\$41.49 (teacher set needed only)

6-Quart Storage Boxes with Lids
\$22.88 (Pack of 12 for storage)

Ideas

Teachers that choose to adapt this project will find that the possibilities of what students can do are limitless. Tuning forks can be used to assist a capella music and tonality, can provide an affordable way for the student to practice a song, and even provide a gateway for the student to compose.

While I used this project to gear it towards developing their understanding of the major scale and intervals, one could easily change the direction of this project by focusing on different elements of sound waves – timbre comparisons, discussions on dynamics and amplitudes, OR can focus on different musical elements, such as chord creations, drones, chants, ensemble cooperation, etc!

Lastly, I highly advise that teachers familiarize themselves with the scientific concepts and their relationship to music before each lesson. Failure to do so will be disengaging for the students and defeat the purpose. Also, a key proponent to the success of this project is consistently involving it in the rehearsal process as much as possible. Without consistent implementation, the desired goal cannot be achieved.

Curriculum Areas

Music, Science and Math

Goals and Objectives

National Standards for Music Education

1. Evaluate and refine selected musical ideas to create musical work that meets appropriate criteria.

2. Evaluate and refine personal and ensemble performances, individually or in collaboration with others.
3. Synthesize and relate knowledge and personal experiences to make music.
4. Relate musical ideas and works with varied context to deepen understanding.

Sunshine State Standards for Music

MU.68.C.1.2, MU.68.C.2.1, MU.68.C.2.2, MU.68.S.1, and MU.68.H.3.1

Sunshine State Standards for Science

SC.912.S.1.2, and SC.912.P.12.2

Sunshine State Standards for Math

MAFS.678.RP.1, MAFS.678.NS.2,

School: FILL IN		Course: FILL IN			
Start Date: _____		Time: _____ Room: _____			
<u>Activities / Strategies:</u> Feel free to paste several days here, based off of the suggested curriculum. Then add your own daily lesson plan goals thereafter! THIS LESSON PLAN HAS BEEN ADAPTED FROM THE MDCPS Department of Life Skills Performing Arts Supervisor and is available for public use. PLEASE NOTE: IF PRINTING THIS LESSON PLAN, IT IS BEST IF THE PAPER SIZE IS LEGAL SIZE.					
<u>Assessment / Evaluation:</u> _x_ participation ___ quiz _X_ written assignment ___ group					
<u>Vocabulary:</u> 1. Varies per strand 2. 3. 4. 5. 6. 7. 8. 9.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;"> <u>Component:</u> _X_ rehearsal _X_ performance _X_ instrument ___ rhythm ___ game _X_ theory _X_ sing ___ other </td> <td style="padding: 5px;"> <u>ESOL Strategies:</u> G - Games R - Role Play S - Substitutions CT - Cloze Technique SR - Simple Repetition MR - Music & Rhythm VC - Vocabulary in context CC - Controlled Composition CoD - Completion Drills ChD - Chain Drills LEA - Language Experience Approach TPR - Total Physical Response WGIR - Whole Group to Individual Response DRFR - Direct to Free Response VAKT - Visual, Auditory, Kinesthetic, Tactual </td> </tr> <tr> <td colspan="2" style="padding: 5px;"> <u>Concepts / Skills:</u> ___ form ___ rhythm ___ style _X_ melody _X_ theory _X_ harmony _X_ singing _X_ listening _X_ technique ___ sight-singing ___ compose/create _X_ playing instruments expressive characteristics </td></tr></table>	<u>Component:</u> _X_ rehearsal _X_ performance _X_ instrument ___ rhythm ___ game _X_ theory _X_ sing ___ other	<u>ESOL Strategies:</u> G - Games R - Role Play S - Substitutions CT - Cloze Technique SR - Simple Repetition MR - Music & Rhythm VC - Vocabulary in context CC - Controlled Composition CoD - Completion Drills ChD - Chain Drills LEA - Language Experience Approach TPR - Total Physical Response WGIR - Whole Group to Individual Response DRFR - Direct to Free Response VAKT - Visual, Auditory, Kinesthetic, Tactual	<u>Concepts / Skills:</u> ___ form ___ rhythm ___ style _X_ melody _X_ theory _X_ harmony _X_ singing _X_ listening _X_ technique ___ sight-singing ___ compose/create _X_ playing instruments expressive characteristics	
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 Materials / Songs || **Home Learning / Events:** | | **Integrated Curriculum:** Fluency / vocabulary print orientation comprehension expression math-patterns social studies history science movement/PE movement/PE |

NGSSS/Common Core State Standards		NGSSS Science Integration Physical Science
Cognition and reflection are required to appreciate, interpret, and create with artistic intent. MU.68.C.1.1 Develop strategies for listening to unfamiliar musical works. MU.68.C.1.2 Compare, using correct music vocabulary, the aesthetic impact of a performance to one's own hypothesis of the composer's intent. MU.68.C.1.3 Identify, aurally, instrumental styles and a variety of instrumental ensembles. MU.68.C.1.4 Identify, aurally, a variety of vocal styles and ensembles. Assessing our own and others' artistic work, using critical-thinking, problem-solving, and decision-making skills, is central to artistic growth. MU.68.C.2.1 Critique personal performance, experiment with a variety of solutions, and make appropriate adjustments with guidance from teachers and peers. MU.68.C.2.2 Critique, using correct music vocabulary, changes in one's own or others' musical performance resulting from practice or rehearsal. MU.68.C.2.3 Critique personal composition and/or improvisation, using simple criteria, to generate improvements with guidance from teachers and/or peers. The processes of critiquing works of art lead to development of critical-thinking skills transferable to other contexts. MU.68.C.3.1 Apply specific criteria to evaluate why a musical work is an exemplar in a specific style or genre. Creating, interpreting, and responding in the arts stimulate the imagination and encourage innovation and creative risk-taking. MU.68.F.1.1 Create a composition and/or performance, using visual, kinesthetic, digital, and/or acoustic means to manipulate musical elements. MU.68.F.1.2 Create an original composition that reflects various performances that use "traditional" and contemporary technologies. Careers in and related to the arts significantly and positively impact local and global economies. MU.68.F.2.1 Describe several routes a composition or performance could travel from creator to consumer. MU.68.F.2.2 Describe how concert attendance can financially impact a community. The 21st-century skills necessary for success as citizens, workers, and leaders in a global economy are embedded in the study of the arts. DA.912.F.3.8 – Demonstrate effective teamwork and accountability, using compromise, collaboration, and conflict resolution, to set and achieve goals as required in the work environment. MU.68.F.3.1 Describe how studying music can enhance citizenship, leadership, and global thinking. MU.68.F.3.2 Investigate and discuss laws that protect intellectual property, and practice safe, legal, and responsible acquisition and use of musical media. MU.68.F.3.3 Identify the tasks involved in the compositional process and discuss how the process might be applied in the work place. Through study in the arts, we learn about and honor others and the worlds in which they live(d). MU.68.H.1.1 Describe the functions of music from various cultures and time periods MU.68.H.1.2 Identify the works of representative composers within a specific style or time period. MU.68.H.1.3 Describe how American music has been influenced by other cultures. MU.68.H.1.4 Classify authentic stylistic features in music originating from various cultures. MU.68.H.1.5 Using representative musical works by selected composers, classify compositional characteristics common to a specific time period and/or genre. The arts reflect and document cultural trends and historical events, and help explain how new directions in the arts have emerged. MU.68.H.2.1 Describe the influence of historical events and periods on music composition and performance. MU.68.H.2.2 Analyze how technology has changed the way music is created, performed, acquired, and experienced. MU.68.H.2.3 Classify the literature being studied by genre, style, and/or time period. Connections among the arts and other disciplines strengthen learning and the ability to transfer knowledge and skills to and from other fields. MU.68.H.3.1 Identify connections among music and other content areas and/or contexts through interdisciplinary collaboration. MU.68.H.3.2 Discuss how the absence of music would affect other content areas and contexts. Understanding the organizational structure of an art form provides a foundation for appreciation of artistic works and respect for the creative process. MU.68.O.1.1 Compare performances of a musical work to identify artistic choices made by performers. The structural rules and conventions of an art form serve as both a foundation and departure point for creativity. MU.68.O.2.1 Create a composition, manipulating musical elements and exploring the effects of those manipulations. MU.68.O.2.2 Demonstrate knowledge of major and minor tonalities through performance and composition. Every art form uses its own unique language, verbal and non-verbal, to document and communicate with the world. MU.68.O.3.1 Describe how the combination of instrumentation and expressive elements in a musical work can convey a specific thought, idea, mood, and/or image. MU.68.O.3.2 Perform the expressive elements of a musical work indicated by the musical score and/or conductor, and transfer new knowledge and experiences to other musical works. The arts are inherently experiential and actively engage learners in the processes of creating, interpreting, and responding to art. MU.68.S.1.1 Improvise rhythmic and melodic phrases to accompany familiar songs and/or standard harmonic progressions. MU.68.S.1.2 Compose a short musical piece. MU.68.S.1.3 Arrange a short musical piece by manipulating melody, form, rhythm, and/or voicing. MU.68.S.1.4 Sing or play melodies by ear with support from the teacher and/or peers. MU.68.S.1.5 Perform melodies with chord progressions. MU.68.S.1.6 Compose a melody, with or without lyrics, over a standard harmonic progression. MU.68.S.1.7 Explain and employ basic functions of MIDI for sequencing and/or editing, including interface options and types of controllers. MU.68.S.1.8 Demonstrate specified mixing and editing techniques using selected software and hardware. MU.68.S.1.9 Describe the function and purposes of various types of microphones and demonstrate correct set-up and use of two or more microphones for recording a music		Motion SC.912.P.12.1 Distinguish between scalar and vector quantities and assess which should be used to describe an event. SC.912.P.12.2 Analyze the motion of an object in terms of its position, velocity, and acceleration (with respect to a frame of reference) as functions of time. SC.912.P.12.3 Interpret and apply Newton's three laws of motion. SC.912.P.12.4 Describe how the gravitational force between two objects depends on their masses and the distance between them. SC.912.P.12.5 Apply the law of conservation of linear momentum to interactions, such as collisions between objects. SC.912.P.12.6 Qualitatively apply the concept of angular momentum. SC.912.P.12.7 Recognize that nothing travels faster than the speed of light in vacuum which is the same for all observers no matter how they or the light source are moving. SC.912.P.12.8 Recognize that Newton's Laws are a limiting case of Einstein's Special Theory of Relativity at speeds that are much smaller than the speed of light. SC.912.P.12.9 Recognize that time, length, and energy depend on the frame of reference. SC.912.P.12.10 Interpret the behavior of ideal gases in terms of kinetic molecular theory. SC.912.P.12.11 Describe phase transitions in terms of kinetic molecular theory. SC.912.P.12.12 Explain how various factors, such as concentration, temperature, and presence of a catalyst affect the rate of a chemical reaction. SC.912.P.12.13 Explain the concept of dynamic equilibrium in terms of reversible processes occurring at the same rates. NGSSS Language Arts Presentation of Knowledge and Ideas LACC.1112.SL.2.4 - Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks. Craft and Structure LACC.1112.RST.2.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. Production and Distribution of Writing LACC.1112.RST.2.4 - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. Research to Build and Present Knowledge LACC.1112.WHST.3.9 - Draw evidence from informational texts to support analysis, reflection, and research. Mathematical Practices Use appropriate tools strategically MACC.K12.MP.5.1 –Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. Proportional Relationships and The Number System MAFS.6.RP.1 : Understand ratio concepts and use ratio reasoning to solve problems.. MAFS.6.NS.1 : Apply and extend previous understandings of multiplication and division to divide fractions by fractions. Look for and make use of structure MACC.K12.MP.7.1 - Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y. Cognitive Complexity Through purposeful practice, artist learn to manage, master, and refine simple, then complex skills and techniques. MU.68.S.3.1 Sing and/or play age-appropriate repertoire expressively. MU.68.S.3.2 Demonstrate proper vocal or instrumental technique. MU.68.S.3.3 Sight-read standard exercises and simple repertoire. MU.68.S.3.4 Compare written notation to aural examples and analyze for accuracy of rhythm and pitch.

Suggested Curriculum

Day 1: Sound Wave drawn on board, in graph form, $X=Time$ $Y=Intensity$; Students perform major scale with hand signs in unison, then, in parts, with part 2 starting on “Mi” of part one, creating thirds between the two. (More parts may be done in the same fashion, depending on skill of choir). Discuss in socratic ways linear motion and harmonic motion, referencing the drawing. Relate linear motion to DO-HIGH DO and harmonic motion to the parts, where as each part sings linearly, but together, harmonically. Homework: Assign musictheory.net interval recognition, due Friday.

Day 2: Empty graph on board, students asked to replicate drawing of the sound wave discussed yesterday, properly identifying time, intensity, linear and harmonic motion. Students sing scale, this time, and subsequently in parts, with no stops in between. Students then repeat task, but on varying dynamic levels, as instructed (loud, medium loud, medium soft, soft). Introduce Italian equivalent music vocabulary.

Day 3: Using graphs created prior, see day 2, add new science vocabulary of amplitude. Guide students to realize the higher the amplitude, the louder the dynamic. Scale in unison in parts, then prompt musical vocabulary to adjust volume. Collect graphs and grade. (participation)

Day 4: Empty graph on board, students asked to replicate drawing of the sound wave discussed, properly identifying time, intensity, amplitude, linear and harmonic motion. Scale in unison and in parts, then prompt amplitude levels to adjust volume. Review graph and allow students to keep to study.

Day 5: FORMAL TEST – have students draw diagram of sound wave, as discussed, with elements discussed. Using student leader, have student leader choose dynamic levels, this time, only addressing sections and allow classmates to analyze and orally criticize the success of the performing section.

Day 6: New drawing of sound wave on board, showing different timbre to first week. Student lead scale singing, then in parts. Teacher instructs to perform each scale degree of varying lengths (4 beats, 2 beats, 1 beat, $\frac{1}{2}$ beat, $\frac{1}{4}$ beat, $1\frac{1}{2}$ beat). Discuss the X of graph – duration. Homework: Assign musictheory.net for Perfect Intervals only (P4, P5, Unison and P8) Due Friday.

Day 7: Student lead scale singing in unison and then in parts – students also choose various durations, as discussed in the previous day. Teacher questions whether the drawing on the board is still a sound wave – describes timbre. What type of timbre do you think the sound wave represents?

Day 8: Three empty graphs displayed, instruct class to determine how to draw a sound wave with the various instructions in mind, such as poignant sounding, smooth sounding and harmonic, for two beats, five beats and three beats,

respectively. Student run scale and parts. Instruct students to sing with different timbres.

Day 9: Empty graph on board, students asked to replicate drawing of a poignant sound wave for four beats, properly identifying time, intensity, amplitude, linear and harmonic motion. Scale in unison and in parts, then prompt amplitude levels to adjust volume. Review graph and allow students to keep to study.

Day 10: FORMAL TEST – have students draw diagram of sound wave given parameters. Following, have choir sing scale in unison, then begin interval singing by returning to “Do.” For example Do-Re-Do, Do-Mi-Do, Do-Fa-Do, etc all the way up the scale.

Day 11: Display wave formation for 4 seconds. In this example, it is imperative to ensure one cycle per second. Student run scale and intervals. Teacher, in socratic method, leads students to describe wave drawn in a fashion to segue into definition of period, which leads to frequency and hertz. Homework: Assign musictheory.net 2nds vs 3rds due Friday.

Day 12: Display new wave formation. Student run scale and intervals. Teacher seeks description of displayed sound wave, looking for descriptions of duration, timbre, amplitude, period and frequency. Teacher then shares inverse formula $T=1/f$ and $f=1/T$

Day 13: Display new wave and ask for frequency and period. Student leads scale and intervals. Homework: Frequency and Period conversions.

Day 14: Display 440Hz on board. Have class determine period. Sing the pitch A=440Hz. Share that the starting “Do” has been “A” this entire time. By singing A, our vocal folds are vibrating at 440 cycles per second. Student run scale and intervals.

Day 15: FORMAL TEST: Have students describe various waves with the proper Duration, Amplitude, Timbre, Period and Frequency. No more than 5 waves. Student run scale and intervals.

Day 16: Show an octave on board for display, in sound wave format. Student lead scale and intervals. Review frequency of “A.” So, if A=440, what do you think the higher A would be? A=880. Prompt singers to sing 440 vs 880. Assign musictheory.net all intervals, due Friday.

Day 17: Introduce tuning fork for class, A=440Hz. Allow student leader to use fork and provide starting pitch to choir for scale and intervals. Using the fork, have the student leader analyze their ending pitch.

Day 18: All students receive forks, and, without collective humming of the pitch, students will sing scale and intervals, determining their pitch off of their own tuning fork. Prompt 440 and 880. Question: If 440 and 880 are A, hypothesize the remainder of the scale, using division and proportions. Homework to ponder scale frequency.

Day 19: Discuss how for intonation in our scale, the higher a pitch goes, the more wide the gap between its predecessor. That is why each solfege syllable has a respective hand sign to visualize and remind the necessary thoughts to stay in tune.

Day 20: Review results of musictheory.net homework to assess growth. Having all students using their own tuning fork, sing scale and interval song. Then, have all students sing different intervals above the tonic pitch. Explore their intonation by having the students sing different intervals from the original tonic pitch, and then have them call that new pitch “Do” and see if they can create a scale from there!

These ideas should set you up to have a choir with much better intonation, as long as each of the ideas are reinforced. Students should also be able to give first-hand examples of properties of sound waves as well as do basic conversions. By allowing scientific approaches into singing, growth becomes much more achievable as students realize their abilities to control the outcomes. While the initial onset to singing is one’s talent, by continuing and developing their voice and technique, singing becomes a skill.

Resources

1. musictheory.net – free resource that allows an interactive interface with customizable practice tools for students. For assessment purposes, students can generate codes after they electronically sign their name to the given task, take pictures with their names signed, or even print the screen as evidence. Mobile device ready as well.
2. Foundations of Physical Science Tom Hsu, Ph.D. – online version available at: http://curiosityplace.schoolspecialty.com/delegate/ssi-wdf-ucm-webContent/Contribution%20Folders/CPO/fps_fl_ebooks/FPS3_FL_SE/mobile/files/assets/basic-html/page-1.html
3. Science World at Telus World of Science <https://www.scienceworld.ca/resources/activities/exploring-pitch-and-volume>