

Lesson Title: Experimental Music

Grade level: 5-8

Topic/Subject Matter: Music, Science

Time Allotment Three 45-minute class periods, and additional in-class or out-of-class time to collect data for experiments in the Culminating Activity.

Overview: THE MUSIC INSTINCT showcases the research and discovery process of scientists whose work focuses on the interrelationship between music and science. Music is a topic that is very accessible and familiar to young people, and can be used as a medium for simple student-led experiments. In this lesson, students will learn about the elements of music and will design and conduct their own scientific experiments on how people respond to music, using examples from THE MUSIC INSTINCT as a guide. They will learn to determine a research question that can be tested in an experiment, will write a hypothesis, and will collect data using classmates, peers, or the community as their subjects.

In the Introductory Activity, students will begin by associating different chords with descriptive terms evoking the sounds' feeling or mood. Then, they will view segments from the MUSIC INSTINCT program to explore the elements of music, learning how differences in the basic building blocks of music (pitch, rhythm, tempo, timbre, melody, and harmony) can lead to the differences in expression and feeling that we come to associate with different musical styles through experience. These elements are also the simple variables that can form the basis of scientific experiments to test how people respond to music and sound. In the Learning Activity, the students will be led through a model experiment in the classroom, testing the class' response to different chords and learning about the process of the scientific method as they do.

As a Culminating Activity, groups of students will design and conduct their own experiments testing people's responses to music. After collecting their data, students will report their findings to the class.

While this lesson can be used to deepen student understanding of the scientific method on the one hand, and the elements of music on the other, students should have a basic understanding of these concepts prior to embarking on this lesson.

KEY MUSIC VOCABULARY:

Pitch = high/low

Tempo = fast/slow

Timbre = characteristic quality of an instrument or voice

Interval = distance between two notes

Chord = combination of three or more notes

Melody = tune

Harmony = chords, like major/minor

Rhythm = pattern of beats

Media Resources

Video:

The Music Instinct, selected segments

1. "Elements of Music." The musician Bobby McFerrin and the scientist Daniel Levitin explore how pitch, tempo, and harmony shape our feelings about music.
2. "Expression in Music." McFerrin and Levitin, with the help of other musicians, explore how the way people respond to music depends both on acoustics and on culture.

3. "Music in Cameroon." Scientist Thomas Fritz organizes a musical experiment in Cameroon, Africa.

To find the clip on the DVD use the following grid:

Clip #	Title for Clip	Timecode at START of clip	Timecode at STOP of clip	Visual and audio cue for START of clip	Visual and audio cue for STOP of clip	One-sentence summary of clip
1	Elements of music	20:48	24:45	Hand strumming guitar, "Sunday morning."	Bobby and Daniel conclude "walking slow" song and McFerrin says - "I like that."	Pitch, tempo, and harmony shape our feelings about music.
2	Expression in music	32:55	34:38	Daniel and Bobby on screen. Daniel starts to play a note on the sax and Bobby sings, before narrator says "the relationship between different tones"	Scene change away from red and blue squiggles on screen, after narrator says "and how much by our culture?"	The way people respond to music depends on acoustics and culture.
3	Music in Cameroon	48:09	51:25	Image of Africa onscreen. "We organized this expedition"	Graph on screen. Scientist has said "And sad", and a few bars of sad music play (end before his next sentence).	A scientist organized a musical experiment in Cameroon.

Websites:

Chord Structure Interactive

<http://www.pbs.org/wnet/musicinstinct/educators/lesson-plans-overview/15/>

This interactive feature of *The Music Instinct* website allows users to build and hear different chords.

Suggested sources for online audio clips that could be used in experiments:

Music Adventure Land

<http://www.netrover.com/~kingskid/cards/adventure.html>

This is a source for short, streaming audio clips from a variety of musical styles that students may use in experiments.

New York Philharmonic Kidzone: Instrument Storage Room

<http://www.nyphilkids.org/lockerroom/main.phtml?>

This is a good source for streaming sound files featuring each instrument of the classical orchestra.

Jazzy Jukebox

<http://www.geocities.com/BourbonStreet/2744/jazzyjuke.htm>

This is a library of well-known jazzy tunes in short, streaming audio files that students may use in experiments.

Standards:

National Standards for Arts Education: Music

<http://artsedge.kennedy-center.org/teach/standards.cfm?subjectId=MUS&gradeBandId=&sortColumn=&x=8&y=3>

Content Standard 6: Listening to, analyzing, and describing music

Grades 5-8 Achievement Standard

- Students analyze the uses of elements of music in aural examples representing diverse genres and cultures
- Students demonstrate knowledge of the basic principles of meter, rhythm, tonality, intervals, chords, and harmonic progressions in their analyses of music

Content Standard 9: Understanding music in relation to history and culture

Grades 5-8 Achievement Standard

- Students describe distinguishing characteristics of representative music genres and styles from a variety of cultures

National Science Standards:

www.nap.edu/html/nses/

Content Standard A: Science as Inquiry

As a result of activities in grades 5-8, all students should develop:

Abilities necessary to do scientific inquiry

- Identify questions that can be answered through scientific investigations
- Design and conduct a scientific investigation
- Use appropriate tools and techniques to gather, analyze, and interpret data
- Develop descriptions, explanations, predictions, and models using evidence
- Think critically and logically to make the relationships between evidence and explanations
- Recognize and analyze alternative explanations and predictions

Materials

For each student:

- 2 copies of the “Music Experiment Writeup” organizer
- 2 copies of the “Music Response Survey” organizer

For the class:

- Computer with internet access and audiovisual projection system, for playing video segments and chord structure interactive
- Simple drawings (smileys) of a happy face, sad face, and scared face, to be posted in the classroom (can be printed from images on the web or drawn yourself – see Prep for Teachers)

Objectives

Students will be able to:

- Name and give examples demonstrating comprehension of the basic elements of music: pitch, rhythm, tempo, timbre, melody, and harmony.
- Understand that intervals and chords refer to combinations of notes, and that different combinations can be associated with different feelings or responses.
- Understand that some of our responses to music are learned through experience and may not be shared in all populations or cultures.
- Determine a research question that can form the basis of an experiment on the topic of people's responses to music.
- Conduct an experiment according to the scientific method that tests a question pertaining to people's responses to music.

Prep for Teachers

Prior to teaching this lesson, you will need to:

Preview all of the video segments and Web sites used in the lesson.

Download the video clips used in the lesson to your classroom computer, or prepare to watch them using your classroom's Internet connection.

Bookmark the Web sites used in the lesson on each computer in your classroom. Using a social bookmarking tool such as del.icio.us or diigo (or an online bookmarking utility such as portaportal) will allow you to organize all the links in a central location.

Draw or print three smileys for posting around the classroom – happy, sad, and scared (to draw a simple scared smiley, draw raised eyebrows and an open mouth - either a round mouth or shaped like a downward-facing semicircle).

Practice using the Chord Structure Interactive and select some chords to use in the Introductory Activity (alternatively, if a piano is available, select a few chords to play on a piano for this exercise).

If you would like your students to conduct their experiments with subjects in another class (for example with peers or with younger students), arrange with other teachers in your school to do so.

Introductory Activity:

1. To get the students thinking about the emotions they might relate to everyday things, post the three smileys in different parts of the classroom. Ask the students to describe the emotion conveyed by each (happy, sad, and scared). Tell the students you will name some foods. For each food, the students should gather under the sign that best describes how they would feel *if that food item were all they had to eat for dinner one day*. (Sample food items might include – ice cream, Brussels sprouts, cheeseburger, zucchini, oatmeal, curried grasshoppers, vegetable broth, extra spicy chili stew, chicken feet, etc).
2. Tell the students that just as this simple exercise shows, we often have emotional associations with everyday things – and we also have these associations with different pieces of music. Tell the students that this lesson will focus on what impact different elements of music have on our emotions.

3. First the students will see if they can use emotion words to describe basic combinations of notes - chords. Load the "Chord Structure Interactive" (or prepare to play chords on a piano). Without telling the students what you are playing, play a chord and ask them to use an adjective to describe it (accept all answers, which could include "happy," "sad," and "scared," but also "rough," "smooth," "stable," "wistful," "aggressive," or any other descriptive adjectives). Do the same for several other chords (for example: C Major, C Minor, C Dominant 7, C Minor 7). See if the class can come to a consensus on a few descriptive words for each chord, and tell the students which chords are eliciting these reactions. Make a note of these adjective-chord associations for use later.
4. Explain that in this lesson, the students will be exploring how it is that different music can be associated with different feelings and reactions. Write the heading "ELEMENTS OF MUSIC" on the board. Underneath this, write the words "pitch," "tempo," and "timbre".
5. FRAME the beginning of the first Video Segment, "Elements of Music," for the class: they will see a few seconds of a video where a scientist demonstrates these terms. FOCUS the students: ask them to listen for how the scientist uses his voice to demonstrate the meaning of the words. PLAY just the first few seconds of "Elements of Music," and PAUSE it after Daniel Levitin says "variations in timbre." FOLLOW UP by asking the students to recreate the demonstration. Have the class provide a definition of each term Levitin mentioned (*pitch = high/low; tempo aka "timing" = fast/slow; timbre = the characteristic sound of an instrument or voice, e.g. the difference between how a note sounds on an oboe and a violin*).
6. Explain that changes in basic elements of music like these are what enable one piece of music to sound different from another. These elements are also what make us feel differently about the music – for example, we tend to think that music in major keys sounds "happy," and in minor keys more "sad." Add "harmony = chords, like major/minor" to the list of definitions on the board.
7. FRAME the rest of the first video clip: tell the students that they will see musician Bobby McFerrin and scientist Daniel Levitin discussing how people respond to the basic elements of music. Provide a FOCUS: ask students to determine if Levitin thinks that our responses to music are due to *instinct*, or are *learned*.
8. PLAY the rest of Video Segment 1. FOLLOW UP with a discussion about whether the responses we have to, for example, major and minor keys are due to instinct or learned, and why? (*There is evidence to support the role of both instinct and learning on our perception of music. While some basic aspects of musical perception may be common to all humans, this clip shows that our neurons are very flexible and are shaped by our experience. In other cultures, the associations between music and feeling may not be the same as in Western cultures. For example, much Middle Eastern music is in a "minor" key, but it is not always experienced as sad*).
9. Add the following terms to the list on the board: "interval," "chord," "melody." Ask the class for definitions of each (*interval = distance between two notes; chord = combination of three or more notes; melody = a sequence of notes, or tune*). FRAME Video Segment 2, "Expression in Music," for the class: in this segment, McFerrin and Levitin will describe how these elements influence how we feel about music. Provide the students with a FOCUS: ask them to use the segment to explain whether our feelings about combinations of notes have changed over time.
10. PLAY Video Segment 2. FOLLOW UP by returning to the focus question (*our assessments of certain combinations of notes have definitely changed over time. A major seventh chord would not have been considered "consonant" in Beethoven's time, but*

today it fits easily into jazz and other musical styles. This is another example of context and culture's influence on our musical tastes and feelings).

11. Review the elements of music that have been discussed, asking the students to provide an example of each one to enhance comprehension.

Learning Activity 1:

1. Ask the students to recall what the scientists had to say about what experience has to do with our responses to music (*experience shapes our reactions, for example what we think sounds "consonant" and "dissonant"*). Explain that some scientists have done experiments to try to determine whether people in other cultures, with different musical experiences than we have had, respond to music differently than we do. FRAME Video Segment 3, "Music in Cameroon" for the class: the students will see an example of one experiment conducted in a village in Cameroon. Provide students with a FOCUS, asking them to watch the video and then summarize the experiment.
2. PLAY the video segment and then FOLLOW UP by asking students to explain the experiment (*the scientist traveled to a remote village where inhabitants had no experience of Western music. They played piano pieces for the villagers, who ranked them as "happy," "sad," or "scary" by pointing to faces expressing these emotions*). You may want to note for the students the similarity between this experiment and the exercise the students did in the Introductory Activity – but while the class used smiley face representations of the emotions, the images used in the Cameroon experiment were photographs of a woman expressing sadness, happiness, and fear. These exact photographs are often used in experiments like these – they are called "Ekman faces" after the scientist who first used them, and have been tested to make sure they are accurately understood by people in all parts of the world.
3. Ask the students what the result of the experiment seemed to be? (*The villagers' opinions of the musical pieces were very much in line with the opinions of Westerners about which music was "happy," "sad," and "scary."*) You may note the additional information that while in this experiment the Cameroonian villagers' reactions to music were in line with Western responses, other studies have not had the same result, leaving the "universality" of emotions in music very much up for debate.
4. Ask the students if they can describe the differences between the "happy," "scary," and "sad" music used in the Cameroon experiment using the basic elements of music? You may want to REPLAY the last 30 seconds of the video segment (starting after the researcher is showing marking X's on a chart) so the students can listen for the differences. (*The happy music is in a major key, takes a quick tempo and is in a steady, simple rhythm. The scary music has a lot of repeated chords and a more unpredictable rhythm. The sad music is in a slow tempo and a minor key*).

Learning Activity 2

1. Explain that shortly, the students will be designing their own experiments to test people's associations with different musical examples. These experiments will be following the scientific method, so the students will have to come up with a research question, form a hypothesis, and then follow a procedure for collecting and analyzing the data. Explain that before the students design their own experiments, you will go through a sample experiment with the class, using associations with the chords you played in the Introductory Activity.

2. Distribute a “Music Experiment Writeup” organizer and a “Music Response Survey” organizer to each student.
3. Pick one of the adjectives the class came up with to describe a chord you played earlier. Have the class write down a research question using this information (something like “which chord does our class think is the most wistful?”). Lead them through the steps of filling out the organizer through the “procedure” section (*the subjects will be the individuals in the class, the sound samples will be three chords of your choosing, including the one described earlier by the adjective, and the procedure will be that students will listen to three chords and rank them from 1 to 5 on how “adjective” they sound*). The students should also fill out the pertinent information on the Survey Template Organizer.
4. Play the chords for the students (being careful not to let the students know which one you’re playing when) and have them mark their responses on the Survey Template Organizer.
5. Collectively, analyze the results, finding a numerical class average for each of the three chords.

Culminating Activity

1. Divide the students into cooperative groups. Distribute a new “Music Experiment Writeup” organizer and a new “Music Response Survey” organizer to each group (note – if distributed to the students electronically, the RTF files can be modified by the students using word processing software, if desired).
2. Tell the students that they will be conducting their own experiments on a research question of their choosing. They will also choose the music samples (these may be from their own collection of music, for example on an mp3 player, or from online sources – see the “websites” section of this lesson plan for examples of free streaming music samples. They can make their own recordings by playing selections themselves). The subjects may be other students in the class, or alternatively might be students in a peer class, or younger students (if this has been arranged).
3. Remind the students that their research question should in some way relate to the feelings evoked by changes in different elements of music. For example, their question might be:
 - a. Do first-graders think minor chords sound more “sad” than major chords?
 - b. Do students in our class associate music that has a faster tempo with happier mood?
 - c. Do eighth-grade students think “Amazing Grace” sounds more solemn when played on an oboe or on a violin?
4. Allow the students some in-class and homework time to devise their research question and select their sample sounds. Make sure to help them come up with a question and procedure that is testable (while this experiment may not control all variables, the sound samples should still be somewhat similar, in order to reduce confounding variables).
5. Prior to collecting data, have students submit their Research Question, Hypothesis, Materials and Procedure for teacher approval. Once approved, the students should schedule time to conduct their experiments and collect data.
6. Have each student group analyze the data and write up the Results of the experiment (remind them that the Results can include things the students would do differently if they

were to run the experiment again). Each group should orally report their Results to the class.

Key Words experiment, music, elements of music, chords, harmony, scientific method, lesson, video, inquiry, science of music

Annotation A video-enhanced lesson plan in which students learn about musical experiments that can be conducted, and design simple experiments to test people's responses to music.

Music Response Survey

My name is _____ and I would like to ask you to participate in an experiment I am conducting on the reactions people have to musical sounds. For each music sample you will hear, please rank the sample from 1 (low) to 5 (high) on the following question:

Circle your responses below:

Music Sample 1

1 2 3 4 5

Music Sample 2

1 2 3 4 5

Music Sample 3

1 2 3 4 5

Thank you for participating!

Music Experiment Writeup

Research Question:

Hypothesis:

Materials and Procedure:

Subjects:

Sound samples:

- 1)
- 2)
- 3)

Describe the procedure:

(Use reverse side for Results)