Music, the Brain and Being Human

Document Overview:

Lesson plan
Music survey handout
The Brain and Music handout

Minnesota State Science Standards:

9.1.1.1.2 Understand that scientists conduct investigations for a variety of reasons, including: to discover new aspects of the natural world, to explain observed phenomena, to test the conclusions of prior investigations, or to test the predictions of current theories.
9.1.1.1.3 Explain how societal and scientific ethics impact research practices.

Objectives:

- Introduce students to how the brain is part of everyday life processes
- Show relationship between music and brain functions
- Describe relevance of neuroscience to the study of human behavior
- Spark student interest in the study and general field of neuroscience in preparation for future lessons

Type of Activity: Multimedia, interactive discussion, writing, observation and interpretation of phenomena, inquiry

Duration: 90 minutes, but can be easily modified for any time frame

Connection to Nobel speaker:

Speaker: Vilayanur Ramachandran, Director of the Center for Brain and Cognition and Professor, Psychology Department and Neuroscience Program at the University of California, San Diego.

- V.S. "Rama" Ramachandran is most recognized for his research in the area of visual perception and behavioral neurology. He is credited with exploiting so-called mirror neurons in the development of therapies for phantom limb pain.

Speaker: Aniruddh D. Patel, Esther J. Burnham Senior Fellow in Theoretical Neurobiology, The Neurosciences Institute, San Diego, Calif.

- Ani Patel has been a leader in the use of new concepts and technology to investigate the neural correlates of music. His research explores how the brain processes music and language, and in what the similarities and differences between the two reveal about each other and about the brain itself. He has approached his research with a variety of techniques, including neuroimaging, theoretical analyses, acoustic research, and comparative studies of non-human animals.

Materials:

'Music Survey' student copies (see attached)
'Music on the Mind' diagram copies (see attached)
Computer
Projector
Speakers (or headphones on individual computers)

Recommended Prior Knowledge: none

Concepts, Connections, and Terms addressed in the activity: Study of neuroscience – general, music; Terms: Amusia, fMRI

Description of Activity: This activity is designed as the "anticipatory set" for the study of neuroscience and being human as related to the Nobel Conference and/or a unit on the nervous system.

Procedure:

1. Survey: Distribute 'Music Survey' (see attached) to each student and allow them to complete the survey. (5-7 min) (You may want to keep survey results from class to class or year to year for statistical lessons/purposes)
2. Class discussion: Ask students to think about why they love music. Use survey topics to guide discussion. Write student responses on board. Next, ask students how music and the brain are related. Take all responses as this is an introductory activity. Finally, ask students to comment on how important they think music is to cultures and societies. Is there good reason to study music and how it affects the brain? (10-15 min)
3. Watch Video: http://www.ted.com/talks/lang/eng/

bobby_mcferrin_hacks_your_brain_with_music.html (3:04) This video shows Bobby McFerrin enlisting the audience in an impromptu musical lesson. How many students were humming along? At the end of his audience exercise, Mr. McFerrin states that no matter where in the world he does this exercise, the audience response is the same. Ask students to interpret this statement on a personal, societal and global level (Evolutionary? Genetic?).

4. Explain to students that neuroscientists know that many parts of the brain are active when listening to music (motor, perception, emotion, learning, memory, reward, stimulus

etc. Neuroscientists use fMRI (functional magnetic resonance imaging[1]) to map the activity of the brain in real time. Ask students to describe and give examples of each active site(s). Handout 'Music on the Mind' diagram (see attached). Identify and address misconceptions with students. (10-15 min)

[1]See related article on fMRI in the 2011 Teacher Materials for the Nobel Conference at www.gac.edu/nobel

5. Music Activity: How does music enhance our perception of phenomena? Without any preface or description, show series of video movie clips (pre-load prior to lesson and make them full screen so students cannot infer information about the clip). *Show these first without sound*, then show the same clips again *with sound*. (If you choose to use alternate clips, try to find clips of movies that students would not be familiar with, and that have minimal dialogue). For the 'no sound' clip, ask students to write their descriptions of what they think is happening in the clip (what the characters are trying to portray). Ask students to describe how they feel when they watch the clip. Then ask them to do the same after you show the 'sound' clip. Discuss how students' perceptions, emotions, reactions change with the addition of the musical score.

   2001: A Space Odyssey http://www.youtube.com/watch?v=cWnmCu3U09w&feature=feedwll (1:17)
   Chariots of Fire
   http://www.youtube.com/watch?v=L-7Vu7cqB20 (2:34)
   JAWS
   http://www.youtube.com/watch?v=8gciFoEbOA8 (:21)
   UP!
   http://www.youtube.com/watch?v=F2bk_9T482g (students may be familiar with this one) (4:21)

   After students have viewed the four clips, discuss as a class how students responded to the before and after clips, how music made a difference in the clip, and what parts of the brain were likely engaged while watching each clip, (foot taping, singing/humming along, facial expressions, feelings (surprised, foreboding, happy, sad). (30 min)
6. Tell students that neuroscientists can actually measure the affects of music on the brain. Neuroscientists use fMRI (functional magnetic resonance imaging) to show heightened brain activity in real time. The next video shows Dr. Oliver Sacks listening to Bach and Beethoven and his brain's reactions in relation to his feelings about the music. (5 min)

Video: http://www.pbs.org/wgbh/nova/body/mind-for-music.html Oliver Sacks being tested on musical preference (4:05)

7. Ask students how they might feel if music sounded like nails on a chalk board or just like noise. There is a condition called Amusia that some people have. It is a brain disorder that some people refer to as "tone-deaf", but it's actually the inability to recognize music from noise and/or remember or memorize music. (2-3 min)

Video: http://www.youtube.com/watch?v=tPRW0wZ9NOM&feature=player_embedded Oliver Sacks on Amusia (3:59)

Assessment:
Formative: Ask students to review their Music Survey answers. Ask each student to do a "3-2-1" on a half sheet of paper or note card that you can use for future lesson considerations. (20 min or homework)

"3-2-1"

- List and briefly describe THREE new questions you have about the study of neuroscience based on today's lesson.
- Explain TWO concepts from today's lesson that really impacted you and why.
- After this lesson, write ONE six-ten sentence paragraph that discusses how the study and understanding of neurological disorders, such as Amusia, makes it better or worse for the people suffering in terms of society and how people treat them and their disorder.

Extension(s):

View and discuss other neurological disorders

Synesthesia

http://www.youtube.com/watch?v=jqbyJ3pjLlE Ramachandran interviewing a woman with Synesthesia

http://www.mc.edu/campus/academics/BIO/Ramachandran%20SciAm_2003.pdf Ramachandran Synesthesia article in Scientific American 2003

Phantom Limb Pain

http://www.youtube.com/watch?v=Tl70d9MR_so&feature=related clip from TV show HOUSE, MD – House uses a mirror box to help a man with Phantom Limb pain (based on Ramachandran's work)

http://www.youtube.com/watch?v=YL_6OMPywnQ Mirror Therapy for Phantom Limb suffers

Savants

http://www.youtube.com/watch?v=Ak2jxmhCH1M 60 Minutes interview with Derek Paravincini, a musical savant

Tourette's

http://www.youtube.com/watch?v=yQ-fdQ7zM-M from 'Musical Minds' documentary, Matt Giordano has severe Tourette's and uses drum therapy

Ask students to design and implement an experiment to test how music affects a population. (i.e. Different types of music affect on heart rate, design short animations* with and without musical score)

*www.animoto.com is a free site that allows students to create short cartoon animations

Resources:

http://science.howstuffworks.com/fmri.htm How Stuff Works explanation of fMRI

http://www.sciencedaily.com/releases/2009/02/090223221230.htm Science Daily article Brain Hub That Links Music, Memory and Emotion Discovered.

http://web.mit.edu/synesthesia/www/ Synesthesia Information

http://www.pbs.org/wgbh/nova/body/musical-minds.html NOVA Musical Minds

Student Name_____

Music Survey

Rate each statement using the scale of 1-5 to the right for each response. A '1' means that you strongly disagree with the statement. A '3' means you feel neutral about the statement. A '5'

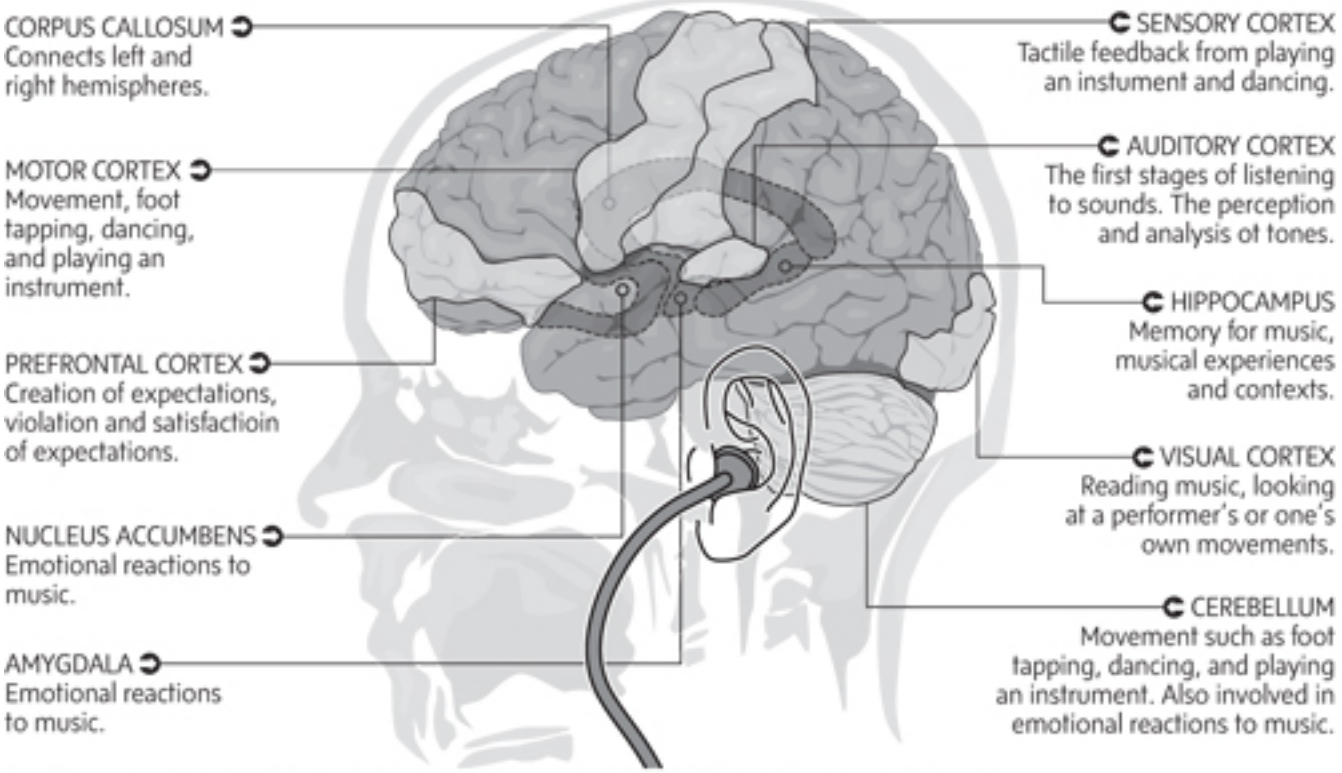
means you strongly agree with the statement.

	SD	***D***	***N***	***A***	***SA***
Music is a big part of my everyday life.	1	2	3	4	5
I listen to music at least one hour per day.	1	2	3	4	5
It's easy to memorize the words to music.	1	2	3	4	5
I can recognize songs quickly if I've heard them before.	1	2	3	4	5
I feel like music helps me focus when I study.	1	2	3	4	5
Music helps me sleep.	1	2	3	4	5
Depending on the music, I feel emotion when I listen to music.	1	2	3	4	5
I like to sing along with music or sing in general.	1	2	3	4	5
There is some music I like better than other music.	1	2	3	4	5
I associate memories with music (music triggers memories).	1	2	3	4	5
Music can help me feel calm or relaxed.	1	2	3	4	5
When I listen to music, I keep with the beat (i.e. tap hands, foot)	1	2	3	4	5
I could live my life without music and not really notice.	1	2	3	4	5

Comments/Thoughts:

Music on the mind

When we listen to music, it's processed in many different areas of our brain. The extent of the brain's involvement was scarcely imagined until the early nineties, when functional brain imaging became possible. The major computational centres include:



MIKE FAILLE/THE GLOBE AND MAIL » SOURCE: THIS IS YOUR BRAIN ON MUSIC: THE SCIENCE OF A HUMAN OBSESSION

Image from http://www.yourbrainonmusic.com/