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Using Music to Teach Math in Middle School

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Abstract: Music is an effective tool to use in the middle school classroom. Music is engaging, makes learning memorable, and can help relieve anxiety. Music can be connected to math in many different ways. Lyrics, melodies, and movement can be used to enhance learning. Students can learn the quadratic formula song to help with procedural memory; they can identify fractions in musical composition and notation; and they can write class songs to help retain information.

Keywords: music, mathematics, middle school

Introduction

Music can be a great tool to enhance learning and help students remember math concepts. Research supports the effectiveness of using music when teaching math to young students (Lovemore, Robertson, & Graven, 2021; Bsharat, Barahmeh, & Turkman, 2021). The majority of the research available is based around the use of music in elementary school math and for supporting procedural learning. Songs can be effective for memorizing information, but what about the math hidden under the surface of all that music? The benefits of directly using music in the middle school mathematics classroom offer rich opportunities for deep learning. How far does the inter-relatedness go between math and music? The connections reach far deeper than the surface. Music is connected to math in so many different ways. Spotlighting some of those crossovers is the focus of this article. We will start with examples of using songs to aid in learning and then share ways to connect music in math with interactive math activities and literature. Examples are provided in the appendix.

Why Middle School?

At first glance, the use of music seems very limited for teaching and learning in middle school. It is more common to find students in elementary school singing songs to remember the water cycle, the days of the week, and a variety of other essential details. From author James Walsh's perspective, "The few instances where music was incorporated in my own middle school experience have stuck with me more than any other topic (the black plague song from sixth grade history, the quadratic formula song from Algebra, and the mercantilism song from seventh grade history)."

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Integrating music and mathematics is a great way to address young adolescents' physical, social, and emotional development. For example, moving to music is natural for most young adolescents. A middle school math teacher can use lyrics for the teaching and learning of geometric transformations and implement kinesthetic strategies to act out the changes associated with translations, reflections, and rotations. Think along the lines of songs like *The Electric Slide, The Cupid Shuffle, The Git Up, The Macarena,* and many more dance grooves. Middle school students love music and they love to move!

Increasing Engagement and Reducing Anxiety

There are many songs available from sources such as TeacherTube, BrainPop, and other online resources. We recommend starting by selecting a song appropriate for your content and your students. Play the song and let students enjoy the tune and lyrics. In addition to increasing student engagement, music can help reduce anxiety in the classroom. In 2019, a group of researchers helped to develop a collection of interactive songs to help reduce anxiety for a college Introductory Statistics course and found that it greatly helped students with preparing for tests (Lesser et al., 2019). The team implemented five different songs that aligned with the syllabus at a two-year college and a research college to see how students reacted. The students filled out a response sheet after utilizing the songs and both colleges found them to be "engaging, relevant, user friendly, and helpful for relieving their anxiety" (Lesser et al., 2019, p. 245-246).

Using Songs to Support Learning Math

Have you ever experienced hearing one of your favorite songs after not hearing it for years and still being able to sing along with the words? How often do you find yourself humming the jingle from a commercial advertisement? The musical tune helps us remember the words. In the same way, musical tunes can help us remember content we need to memorize. A study conducted on university students in an introduction to statistics course found that music strongly helped them understand topics. Furthermore, "comparing student responses to the pre-song prompts versus some post-song assessments on the same topics showed some short-term gain in understanding after engaging with each of those activities" (Lesser et al., 2019, p. 244).

At the middle school level, songs in math often help in remembering different formulas. For example, there are jingles to help remember the quadratic formula, sung to the tune of "Pop Goes the Weasel." Another example of incorporating songs is to utilize data circulating around music for mean, median, and mode. Appendix B includes an activity in which music is used to get students motivated to learn by utilizing the audio of songs. Play twelve different songs to the class, some recent and popular, some dated and not "hip"

anymore. Have students rate the songs on a scale from zero to five and then use the class data to find the mean, median, and mode ratings. The students will be actively engaged and really enjoy the rating part of the lesson.

Fractions in Musical Notes

Music can also be a great tool for teaching fractions. Fractions abound in musical composition and notation. A study done in South Africa had teachers use musical notes and notation as a way to teach fractions to fifth grade students. Lovemore (2021) studied utilizing musical notes to teach fractions. Students were taught different notes and how they fit together in musical measures. Fractions were taught using the ideas learned from the music notes. While they had concerns at first that students were learning more about music than math, they found it to be "mutually beneficial for the learning of both music and mathematics" (Lovemore et al., 2021, p. 9). The study found that students were more engaged, more confident with their work, and benefitted from the authentic problem solving (Lovemore et al., 2021, p. 10-11). Using musical notes provides an authentic connection to help students learn about dividing fractions. 'Keep-change-flip' is a beneficial phrase for memorizing steps, but it does not show students why we get those answers very well. Using notes and fraction blocks from the start can better show students what dividing fractions looks like and help them grasp the idea better than if you just give them the steps to solve.

Quadratics in Sound / Parabolas in Music

Parabolas can be a challenging concept to connect with real-life applications. The book *Music, Math, and Mind: The Physics and Neuroscience of Music* by David Sulzer has a great chapter on soundwaves, and soundwaves look quite similar to parabolas. A great way to start learning about parabolas is by learning a little bit about sound waves and how the waves change based on the kind of sound being produced. For some more advanced math classes (specifically high school), sine and cosine graphs look very much like sound waves.

There's Math in Those Lyrics

Another way to use music in the classroom is to create problem-solving activities based on lyrics. Lyrics are full of lines that can very easily transfer over to word problems. Distance concepts are common topics related in song lyrics, so these can be made into conversion problems based around different song lyrics. Songs are a great tool to help remember concepts, as well as analyze the lyrics' meanings.

Writing Class Songs

Writing class songs can enhance learning of content. While there are multitudes of songs on Teacher Tube, YouTube, or prepared by the teacher, what if we give our students opportunities to write their own? Instead of giving students a song, letting them write their own song could help with retention. One idea is to split students into separate groups and let them collaborate amongst themselves. After a few minutes, bring them back together and let each group share their ideas. Hold a class vote and decide on the "class song" that can be referred to when covering the topic. It may help to record each song since it will be different for each period, but then you can create classroom playlists of math songs that students can access.

Conclusion

Music is full of math that can really help students understand how some math topics work before getting to the actual material. Real world connections are one of the best ways to make math relevant to a student's life which does wonders to help with retention of material. The activities and ideas presented here may serve as a starting point for music-centered activities in the middle school classroom. It is really similar to how manipulatives were considered only for elementary students for the longest time before we realized they were great for middle school. The same can be applied for these math strategies integrating music. Together, mathematics and music can produce beautiful harmonies.

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Bsharat, T. R. K., Barahmeh, M. Y., & Turkman, J. M. H. (2021). The influence of music and educational songs on EFL students' achievement from their teachers' perspective in Jenin Region. *African Educational Research Journal, 9*(2), 728–738.

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Schwartz, D. M. (2017). *If you hopped like a frog.* Scholastic.

Schwartz, D. M. (2006). *Millions to measure.* HarperCollins.

Appendix A:
Making Math with Music Learning Center

Appendix B:
Annotated Text Set

Schwartz, D. M. (2017). *If You Hopped Like a Frog* (J. Warhola, Illus.). Scholastic.

If you could hop like a frog, just how far could you jump? This book is a really fun way to talk about fractions and ratios with some really wacky examples. It runs through a ton of really silly ratios that would be a great way to start up a conversation about fractions.

Schwartz, D. M. (2006). *Millions to Measure* (S. Kellogg, Illus.). HarperCollins.

From stones to distance to rulers, there are so many ways we can measure the world around us! This book gives some really fun and interesting ideas for what we can measure and how this applies outside of the classroom (to some ridiculous extremes). This is a great way to get students excited about topics that involve measuring or converting units.

Scieszka, J. (1995). *Math Curse* (L. Smith, Illus.). Penguin Young Readers Group.

After Mrs. Fibonacci's class on Monday, it becomes harder and harder for our main character to stop seeing math everywhere they go! This book is filled to the brim with great real-world questions and conversation starters for the math classroom. This is especially great for those students that always ask, "how will this ever affect me in the real world?"

Sulzer, D. (2021). *Music, Math, and Mind: The Physics and Neuroscience of Music*. Columbia University Press.

For a deeper dive into rich contextual examples, this book explores in-depth connections with the inter-relatedness of music and math on more advanced content. Specifically, the chapter on sound waves connects to the activity on parabolas in Activity 2. The entire book gives profound insights to how math and music are always together.

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About the Authors

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Activity 1: Fractions with Notes

Materials needed: Fraction blocks and a pencil

BEFORE STARTING

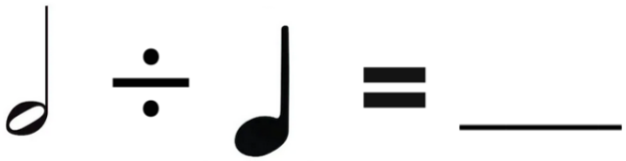
Watch this video explaining how we divide with fraction tiles:

In music, we break notes down into a few different types:

Whole Note	Half Note	Quarter Note	Eighth Note	Sixteenth Note
				
1	1/2	1/4	1/8	1/16

By using our fraction tiles, we ca see that there are two half notes in a whole note, two quarter notes in a half note, and two eighth notes in a quarter note (we do not have tiles for the sixteenth notes, but two of those go into an eighth note!).

Using the skills from this video and the knowledge of each of the notes, lets do some dividing!



Let's try some problems without the notes!

$\frac{3}{4} \div \frac{1}{8} = \_\_$

$\frac{1}{2} \div \frac{1}{5} = \_\_$

$\frac{3}{4} \div \frac{1}{12} = \_\_$

$\frac{1}{2} \div \frac{1}{6} = \_\_$

$\frac{2}{8} \div \frac{1}{12} = \_\_$

$\frac{1}{4} \div \frac{1}{3} = \_\_$

If you are having trouble using the fraction tiles,
watch this video and try this approach instead:

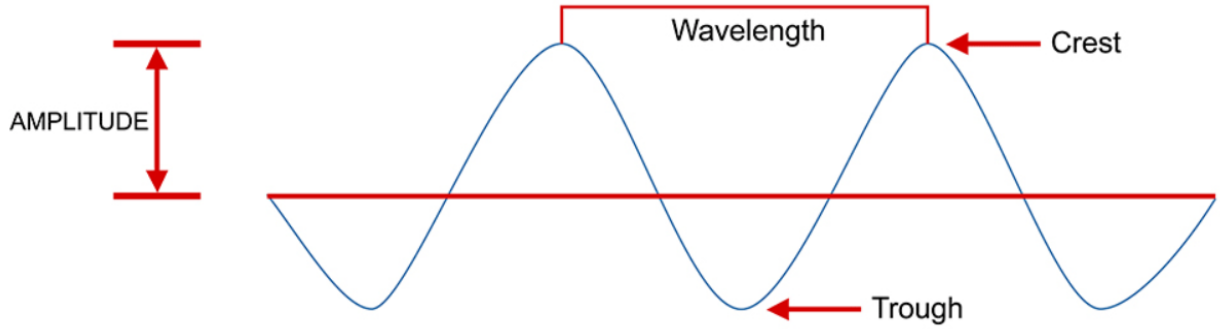
Activity 2: Quadratics in Sound

Materials needed: Pencil and calculator.

BEFORE STARTING

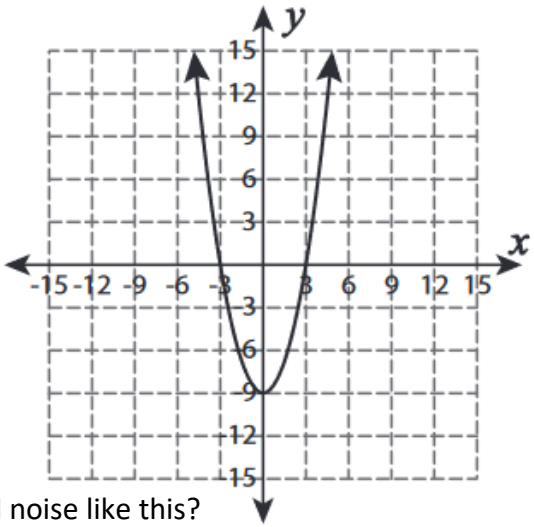
Check out this cool demonstration of sound wave:

Everything that we hear (music included!) comes to us in the form of soundwaves:



Don't they look extremely similar to the parabolas of a quadratic function? If we look hard enough, we can find all kinds of math around us! Go through and solve these quadratic problems to better understand how soundwaves work:

Determine the following from the given graph:



Zeros: _____

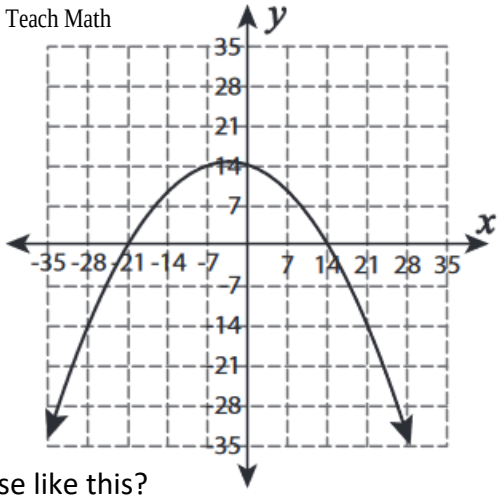
Vertex: _____

Positive or negative slope: _____

Domain: _____

Range: _____

What kind of sound would make a high-pitched, loud noise like this?



Zeros: _____

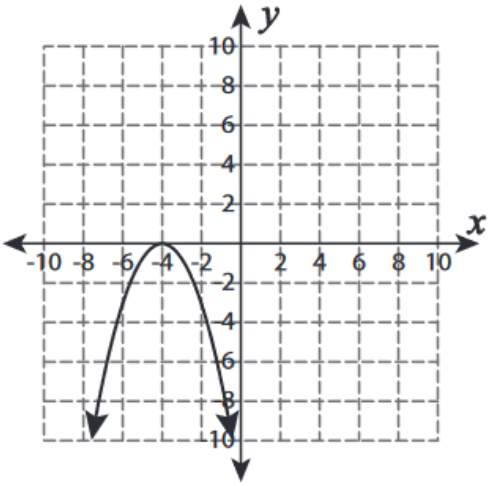
Vertex: _____

Positive or negative slope: _____

Domain: _____

Range: _____

What kind of sound would make a low-pitched, loud noise like this?



Zeros: _____

Vertex: _____

Positive or negative slope: _____

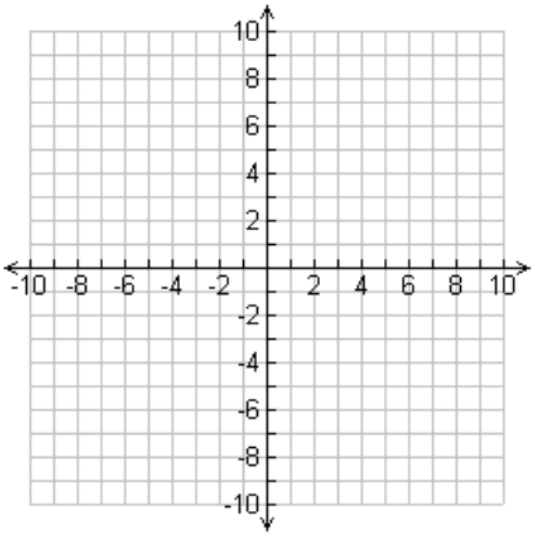
Domain: _____

Range: _____

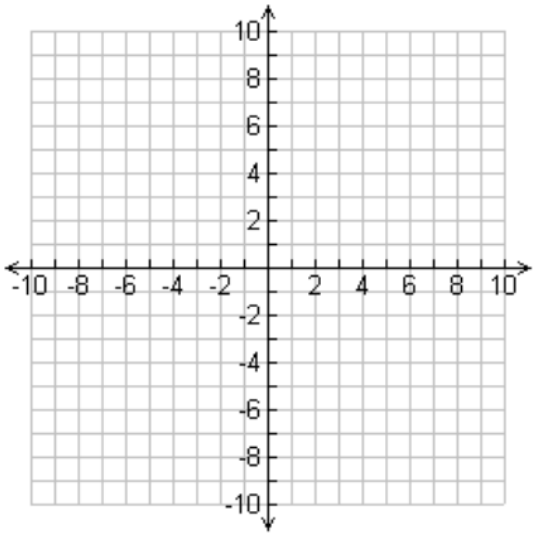
What kind of sound would make a quiet noise like this?

Can you make a parabola of a sound wave that is:

Quiet and deep



Loud and high pitched



Activity 3: There's Math in Those Lyrics!

Materials needed: A pencil and calculator (if needed)

We do not really realize it, but a lot of our music talks about math!

Using these song lyrics, answer each problem.

In their song "I'm Gonna Be," The Proclaimers sing "I would walk five hundred miles and I would walk five hundred more." If you walk at a pace of 3 miles per hour, how many days would it take you to walk that distance (round to the nearest tenth)?

Christina Perri sings "Darling don't be afraid I have loved you for a thousand years." How many minutes has Christina Perri loved her partner for?

Eddie Money sang about how he's got "two tickets to paradise." Eddie spent $400 on each ticket (paradise is an expensive place to go nowadays). If Eddie only makes $12.50 an hour at his job, how many hours did he have to work to get enough money for the tickets?

Justin Bieber talks about how he'd "spend ten thousand hours and ten thousand more oh, if that's what it takes to learn that sweet heart of yours." Is he really spending that much time to learn that heart? Use time conversions to prove your point.

Superfruit sings about someone that is "six feet tall and super strong." How tall would they be in centimeters? What about meters?

Harry Chapin sings about a driver "carrying thirty thousand pounds of bananas." How many grams of bananas is that? How many ounces?