



Do Re Mi, 1-2-3

That's How Easy Math Can Be

Using Music to Support Emergent Mathematics

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Many of us have heard of the *Mozart effect*, a term coined in response to a 1998 study (Rauscher & Shaw) indicating that preschoolers' spatial-temporal reasoning, or their understanding of the space around them and the concepts of time, can be enhanced by listening to music composed by Wolfgang Amadeus Mozart. Don Campbell, in his book *The Mozart Effect* (2001), describes the phenomena that arose from this and similar studies suggesting that young children who listen to Mozart's music might be able to perform better on academic tasks such as mathematics.

In the late 1990s, due in part to belief in this music boost, a person might stroll down a school hallway and hear Mozart's concertos or symphonies playing, or visit a music store and find the Mozart collections sold out (Holden 1999; Levy & Rogers 1999; Shaw 2004). With society teased by the prospect of smarter babies, many music compilations for young children, including brain music, which is supposed to make infants, toddlers, and preschoolers more intelligent, are on the market (Church 2000).

However, little conclusive data supports the existence of the Mozart effect on children (Holden 2003). There also

may be no direct link between *passive* listening to music and improvement in spatial reasoning or mathematics tasks. Nevertheless, there is convincing evidence that *active* music experiences, such as singing or learning to play an instrument, can enhance brain development (Peterson & Thaut 2007). Research suggests that this active participation in music can support emergent mathematics, such as early patterning experiences and one-to-one correspondence, in young children, even from birth (Mendlesohn 1990; Frank 1996, 1997; Motluk 1997; Church 2000; Du Sautoy 2004; Perret & Fox 2006).

Emergent mathematics is a concept similar to emergent literacy. We will use it to describe how children begin to construct mathematics from birth and continue throughout their lives. They build this knowledge through a combination of cognitive development and interaction with their environment. Young children—whether 6 weeks, 6 months, or 6 years old—need to be immersed in mathematics and literacy through interactions with parents or caregivers.

Do children need to have musical instruction, such as piano lessons, to get the benefit of improved mathematical ability and understanding? Or can simply interacting with music stimulate development of mathematical understand-

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There is convincing evidence that active music experiences, such as singing or learning to play an instrument, can enhance brain development.



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Even very young children can inherently respond to music and the mathematical constructs it contains.

Hasan & Thaut 2004). For example, it is very difficult for children to not move to the beat when they hear a song or an instrument such as a drum being played. If they don't actually move their bodies, many times they will stop what they are doing and look toward the sound or move closer to try to play the instrument. This indicates that even very young children can inherently respond to music and the mathematical constructs it contains.

Musical elements

Early childhood educators, knowing that math and music share similar inherent characteristics, can use simple musical elements to introduce mathematical concepts, interactions, and ideas to infants, toddlers, and preschoolers. Yes, even babies are constructing the foundations of mathematics (Butterworth 2005) and can benefit from musical interactions. Some of the first patterning experiences that parents engage in with their babies are through rhythm and music. Rocking and patting usually takes on a rhythmical aspect, as does singing to the baby (Geist 2008).

As a teacher, you no doubt already integrate elements of music and mathematics daily. Think of the rhyme "Pattycake" or consider the rhythm that makes predictable books predictable. Young children anticipate a pattern in a story and song, first through the beat and then on into the words. They soon are repeating the language and, with our encouragement, improvising and making additions to the story or song.

If teachers can recognize a few musical elements, they can learn to use them to foster young children's early mathematical thinking. Let's identify the music elements and explore how they relate to mathematics.

Steady beat

Beat or pulse, called "steady beat" in this article, is what we feel or have a physical response to when we hear music. The steady beat is repetitive and evenly spaced. When we tap our toes to music, we are tapping along with the steady beat.

Keeping a steady beat can support the construction of the concept of "one." (See "A Steady Beat Experience.") Steady beat activities, such as clapping or marching, help children understand numerical relationships, such

ing? For infants, toddlers, and preschoolers, private music instruction on an instrument is rarely developmentally appropriate. However, young children can be exposed to and interact with music in many other ways.

Music and the brain

Math and music may be related in the brain from very early in life (Weinberger 1998; Begley 2000; Burack 2005). We know, for instance, that music contains numerous mathematical constructs within its basic structure. Musical elements such as steady beat, rhythm, tempo, volume, melody, and harmony possess inherent mathematical concepts such as spatial properties, sequencing, counting, patterning, and one-to-one correspondence.

Music seems to be associated with very primal parts of the brain (Holden 1999). Our bodies cannot help but react physiologically to musical input (Thaut & Kenyon 2003;

as *more* and *one-to-one* correspondence.

Toddlers may not know number, but they understand *more*. For example, if you clap once and then say, “Can you clap more than I clapped?” toddlers will most likely clap two or more times.

A steady beat is essential to any music experience. Also, keeping a steady beat while teaching adds a visual and auditory structure to the experience by promoting prolonged and higher quality attention to a task. (See “Tips for Incorporating a Steady Beat in Activities.”)

A Steady Beat Experience

Consider the tune of “Daisy Bell” (written by Harry Dacre in 1892): “Daisy Daisy, give me your answer, do. I’m half crazy all for the love of you. It won’t be a stylish marriage. I can’t afford a carriage. But you’ll look sweet, upon the seat, of a bicycle built for two.”

1. Hum, sing, or chant the song. (You can even sing it in your head.)
2. Tap your toes, slap your knees, or clap your hands to the heartbeat of the song (its steady beat).
3. Refer to the numbers in the following table that fall directly below the bolded syllable of the words. They represent the steady beat of the song.

	Dai-	sy	Dai-	sy	give me your	answer	do	
	1	2	1	2	1	2	1	2
	I’m	half	cra-	zy	all for the	love of	you	
	1	2	1	2	1	2	1	2
It	won’t be a	stylish	marriage		I can’t	af- ford a	carriage	
	1	2	1	2	1	2	1	2
But	you’ll look	sweet	up- on the	seat of a	bicycle	built for	two	
	1	2	1	2	1	2	1	2

Tips for Incorporating a Steady Beat in Activities

1. Announce the activity by tapping a steady beat (at least four times) on your knees or thighs or on a table.
2. Give verbal instructions as you continue tapping, emphasizing the steady beat. For example, say, “*Put the red blocks in the red bowl,*” keeping the beat on the italicized words.
3. Encourage the children to tap their knees to the steady beat along with you. For example, “*Wash your hands and get some snack. One, two, ready, go.*” The predictability of the beat helps focus the children’s attention on the two-step directions.
4. Overemphasize the syllables that are stronger steady beats. For example, in the song “Down by the Bay, stress the long sustained beat at the end of each line: “Down by the *baaaaaaaay*, where the watermelons *grooooooow*, back to my *hoooooome*, I dare not *goooooo . . .*” The mathematical pattern of the song’s beat is more complex and varied than the earlier examples, making the song more fun to sing along with and more likely to keep children’s interest.

Rhythm

Rhythm is not always the same as the steady beat. Using “Old MacDonald Had a Farm,” the difference is illustrated in “A Beat and Rhythm Experience.” The rhythm varies while the steady beat is constant, allowing children to notice more complex and distinct patterns. They can hear relationships between the song’s rhythm, beat, and words. The words represent the rhythm, and the clapping represents the beat. Keeping them synchronized, by clapping and singing together, creates a natural one-to-one correspondence experience.

Rhythm also helps children develop patterning skills as they repeat, predict, and extend rhythmic patterns. For example in “Old MacDonald,” when the teacher sings “with a moo moo here,” the children follow quickly with “and a moo moo there.”

Melody

Now let’s discuss the melody of “Old MacDonald,” this time focusing on the repetitive pattern E-I-E-I-O. Notice that the phrase goes from a higher note to a lower note. The first E-I is repeated on a higher note; the second E-I is repeated on a lower note, and O is sung on even a lower note. This moving from one note to another is the melody of the song—in other words, the tune.

With an elementary understanding of steady beat, rhythm, and melody, teachers can use music activities to promote emergent mathematics and encourage children to

explore pattern and one-to-one correspondence. They can use these three music components, alone or in combination, to create simple or complex patterns in developmentally appropriate ways.

Tempo, dynamics, timbre, and style

Other elements of music are tempo, dynamics, timbre, and style. Tempo refers to speed (beats per minute), dynamics relates to volume, and timbre involves the quality of the sound. Someone might describe the timbre of a tambourine as a high ringing sound or the sound of beating a drum as “dry.”

The style of a song usually involves the specific music genre (jazz, country, rock’n’roll, folk, hip-hop, and many more). Young children enjoy many kinds of music, and as they get older, they like to compare different styles of music. How are rock’n’roll and country music different? How are they the same? Do they have the same steady beat? rhythm? melody? Is there a specific rhythmic pattern that makes the style distinctive? What about the timbre? Think about these elements and their effects the next time you listen to your favorite music.

A Beat and Rhythm Experience

Let’s examine the familiar E-I-E-I-O of “Old MacDonald Had a Farm.”

1. Tap your feet (or heels) to the steady beat.
2. Now say E-I-E-I-O. Saying each letter to a beat is a good start.
3. Now try saying E-I-E-I-O, and tap only on the Es and the O.
4. You may notice that you are saying E-I on the first beat, E-I on the second beat, and O as the third. Your foot taps are the steady beat.
5. The E-I-E-I-O that you chant is the rhythm.

Rhythm	E-I	E-I	O	—
Beat	1	2	3	4

Note that Beat 4 is felt and tapped. It is a rest before continuing the song.

Music experiences to promote emergent mathematics

Including music as part of the early childhood curriculum can support young children’s learning (Frank 1996; Livingston & Fenton 1998; Perret & Fox 2006). Let’s see how to apply the different elements of music to create interactive experiences that promote young children’s mathematical thinking.

With five-month-old Julie in her lap, Maria sings “Twinkle, Twinkle, Little Star” to her daughter. Julie gazes intently at her mother’s face. She bursts into smile and excitedly kicks when Maria finishes the song.

Music is one of children’s first forms of communication and often is their first interaction with mathematics. Maria probably sang the song to Julie with distinctive steady beat and rhythm, emphasizing the strong beats of 1 and 2 in the song. She may have even tapped Julie’s hand or rocked her to the beat.

Julie, now 13 months old, hears a familiar song, “Twinkle, Twinkle, Little Star,” playing on the CD player at her toddler program. She takes the jingle bell bracelets from a nearby shelf and puts them on her wrists. Marching around a table, Julie shakes the bells with a beat and rhythm that roughly matches the song. Occasionally she sings along, using both recognizable and unrecognizable words.

As a toddler, Julie now links the song she heard as an infant to action. Her marching and singing indicate a beginning understanding of patterning and one-to-one



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correspondence. When babies and toddlers bang cabinet doors or clang pots and pans, they not only exercise some of their newfound abilities but also demonstrate their emerging mathematical understanding (Holden 1997).

Infants and toddlers enjoy exploring the sounds they can make with drums. The example in “A Drumming Experience with a 4-Year-Old” illustrates visual and auditory imitation and supports a one-to-one correspondence relationship in the child’s mind. Teachers can emphasize regular steady beats through movement activities such as tapping cymbals, shaking maracas, and marching.

Observe children imitating complex rhythms to determine their skill levels. When a child cannot follow your lead, consider whether the rhythm may be too complex or perhaps too easy, thus boring the child. You can adjust the complexity by changing the tempo or playing more steady beats in the activity.

Even amateur musicians can use elements of steady beat, rhythm, melody, tempo, dynamics, style, and timbre in interacting with children. These music/math techniques can make learning much more enjoyable and effective. Any activity can be made musical. For example, a teacher observes a child playing with colored blocks in a more or less random manner. To help the child recognize and sort by color, the teacher can chant the following phrases using a steady beat.

Rhythm	Here is a red bowl. There is a blue bowl.			
Beat	1	2	3	4
Rhythm	Put the red blocks in the red bowl and the blue blocks in the blue .			
Beat	1	2	3	4

Usually, phrases with four or eight steady beats are most effective. Remember, varying the steady beat can keep a child’s attention. For children who need extra help, the teacher can repeat the phrases in a simpler way, such as this:

Rhythm	Red in Red and Blue in Blue			
Beat	1	2	1	2

To fit a child’s individual learning needs, a teacher can change the tempo, making the beat faster or slower. Also try using dynamic changes to promote learning. For example, if a child has trouble matching the blue block with the blue bowl, the teacher can chant the word *blue* in a louder voice. This will give the child a clue to help her identify the bowl of the same color. The teacher could give the child another clue by pausing and slowing the tempo right before saying *blue*.

Teachers can use timbre, the quality of the sound, to get children’s attention. Try making a different quality of sound for a concept that a child finds challenging. Experiment

A Drumming Experience with a 4-Year-Old

1. Play one beat on your drum and wait for the child to play a beat on his or her drum.
2. Listen to what the child plays, then repeat it.
3. Follow the child’s lead. If the child goes beyond a single beat into a rhythm, repeat the full sequence back to the child.
4. Create a rhythm with two beats if the child persists in using just one beat. Wait to see if the child imitates. If the child does not imitate exactly, it’s OK. Just continue to create any rhythm. If the child does not play at all when asked to imitate, encourage the child to play along with you.

with different ways to sing the word *blue*, such as making the ghost-like sound *blooooo* to make the activity more enjoyable. The fun has real purpose, however; the change in timbre brings attention to the targeted concept.

Finally, you can change the style of the music to focus a child’s attention. Knowing how to sing or chant various styles might take some practice and a bit of courage. If you aren’t familiar with music’s various styles, spend some time listening and identifying different styles of music. Then, chant or sing for the children in a certain style. Can you sing the examples given in this article in a country style? At first, you may feel a bit silly, but such singing can be fun for adults and children alike.

Conclusion

Research on emergent mathematics is beginning to show that even infants can interact with and understand mathematics (Berger, Tzur, & Posner 2006; Brannon, Lutz, & Cordes 2006; Jordan & Brannon 2006; van Marle & Wynn 2008). Music can be an ideal and exciting tool for supporting early mathematical thinking (Geist 2001). Even the youngest children can engage in music experiences. Teachers can use the structure of musical elements such as steady beat, rhythm, and melody to support many different classroom activities. Mathematical activities such as patterning and one-to-one correspondence are especially easy to link to music.

All teachers are musicians. You don’t have to be a trained professional to use these techniques in your classroom. If you have trouble singing, then chant. Remember, as Harold Hill says in *The Music Man*, singing is just sustained talking.

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