by Dee Hansen and Sarah A. Milligan

Aural Skills

At the Juncture of Research in Early Reading and Music Literacy

Abstract: Pressure on music educators to accommodate reading initiatives in their schools continues to challenge genuine music-learning experiences. Children are taken out of music classrooms for additional reading time, although mounting research informs us of the value of music as a formidable avenue for developing crucial auditory skills needed for successful reading. For this article, we gather research from four areas—neuroimaging, auditory brainstem response technology, music classrooms, and general education—and cite findings that, through these disparate domains, all point to the significance of aural skills development in children. Because music learning is based in aural skill development, we offer several instructional examples that strengthen phonological and phonemic awareness while honoring musical development in young children.

Keywords: advocacy, early childhood, imaging, interdisciplinary instruction, literacy, prekindergarten, reading, research

The skills developed in the music classroom may take young children far down the road to becoming better readers.

Across the United States, reading literacy remains a priority in our schools. Despite waivers and flexibility granted to states for high-stakes testing, the attention and financial obligations assuring that future generations of children can successfully read have not changed. As state and federal monies for new school-improvement initiatives take shape, we are confronted with the age-old challenge of how to maintain high-quality music programs in a seemingly uninviting educational environment. While music teachers are not reading teachers, how and what do music educators do to support these important initiatives while still teaching music with integrity? What commonalities across research domains point to the benefits of music study? The purposes of this article are to explore research in four distinct areas, examining the significance of aural discrimination skills in language and music learning, their mutual influence on reading literacy, and current applications at the primary level for the music classroom.

Phonemic and Phonological Awareness

Reading specialists have long understood the significance of auditory and aural skill processing for successful reading. And so have music educators. Music is an aural/

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auditory art. We teach the youngest children to follow pitch contour in songs, move to the beat, and respond artfully to musical stimuli. As with reading, our earliest encounters with music are aural. Internalizing and discriminating sound is a process that is common and foundational to both domains. Reading specialists term this phenomenon "phonological awareness"—sensitivity to sound. Phonological awareness is the ability to understand the sounds of language, including the segmentation of words, the beginning and ending sounds of words, and the individual sounds of words, known as phonemic awareness.

Intersecting Lines of Research

Researchers from distinctly different areas find that music training or proficiency with musical skills helps reinforce reading ability. Music training influences auditory discrimination, the ability to discern nuance in sound. Aural language skills are strikingly similar to those needed for music learning. Figure 1 presents the four research areas explored in this article: neuroimaging, auditory brainstem response to complex sounds (cABR), music classrooms, and general classroom instruction. In the graphic, each line of research leads to an intersection of aural skills through phonological and phonemic awareness development.

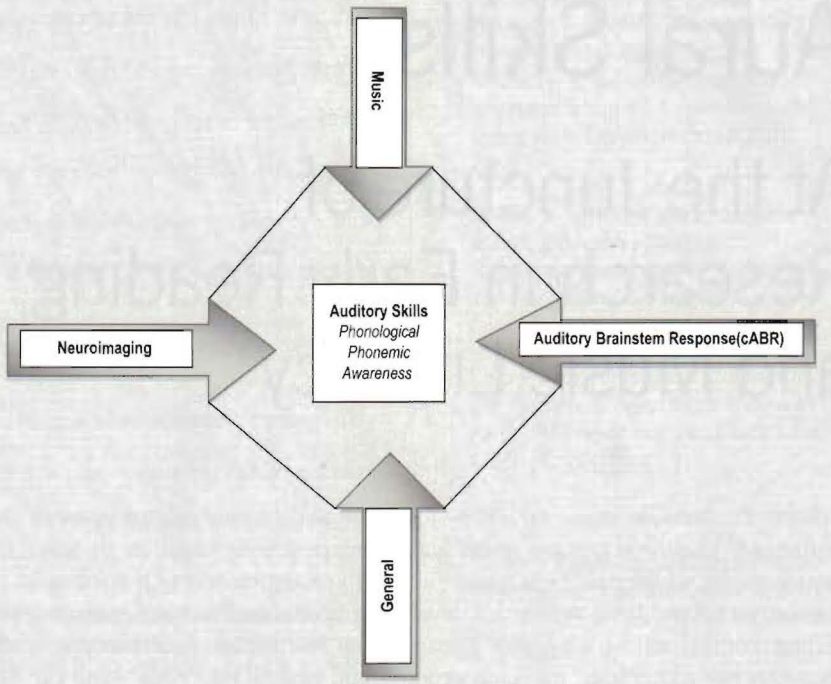
I. *Neuroimaging Studies*

Neuroscientists find the brains of musicians particularly enticing to study due to the profound effect musical training has on multiple neural functions. Rapidly developing technology makes this research accessible. Through neuroimaging and surface electrode techniques, scientists observe, record, and measure many aspects of brain activity. The most commonly used technologies include electroencephalography, event-related potential, magnetoencephalography, **positron emission tomography**, and functional magnetic resonance imaging (fMRI). In summarizing the research of cognitive neuroscientists reported by the Dana Foundation, Michael S. Gazzaniga, professor of psychology at University of California, Santa Barbara, and head of the SAGE Center for the Study of the Mind, states, "One of the central predictors of early literacy, phonological awareness, is correlated with both music training and the development of a specific brain pathway."[1]

Images rendered through brain scanning (fMRI) devices reveal that music training increases size and functionality in areas critical to sound sensitivity.[2] Researchers in the Department of Neurology at Beth Israel Deaconess Medical Center and Harvard Medical School in Boston are conducting numerous imaging studies involving musicians. They consider musicians an ideal subject pool because music training may begin early in life when the brain and its components are most adaptable. Music study naturally involves a great deal of cross-hemispheric skill building through instrument playing, movement, and music score reading. Music training can structurally and microstructurally change the brain.[3] Through their research, they find significant enlargement of the temporal lobe, the lobe responsible for auditory processing. Thick fibers of neurons that connect the right and left hemispheres also show significant growth.[4] Additionally, investigators found that instrumental musical training strongly correlates with auditory discrimination, fine motor skills, vocabulary, and nonverbal reasoning.[5]

FIGURE 1

The Juncture of Auditory Skills in Four Domains of Research.



II. *Auditory Brainstem Response to Complex Sounds*

Using surface electrodes placed on the skull, researchers at Northwestern University measured how accurately the brainstem processes auditory stimuli. Through cABR data, researchers established "a significant link between subcortical auditory function and reading."[6] They found that musical training heightens processing ability for pitch, timbre, and timing—processes critical to phonological processing. In their work led by neurobiologist Nina Kraus, specific links to the reading process have provided

strong evidence to the parallel functions of auditory learning in text reading and music learning. Both reading and music learning are acoustically and functionally complex, and both learning processes require high-order cognitive skills in order for the learner to be successful.[7] These researchers report on their website, http://www.soc.northwestern.edu/brainvolts/slideshows/music/index.php, that musicians are better than nonmusicians at

1. encoding music and speech,
2. showing greater neural enhancement of pitch,
3. encoding linguistic pitch information,
4. responding faster to speech,
5. responding to higher harmonics, and
6. responding to peaks of emotional stimulus.

On the basis of the results of their study, these investigators state that "The effects of musical experience on subcortical auditory processing are pervasive and extend beyond music to the domain of language."[8]

III. *Research in General Education*

Understanding the sounds of language is at the heart of the reading process. Auditory discrimination skills, specifically, phonological and phonemic awareness, provide the foundation for both reading and language. While Northwestern University researchers are tracking brainstem responses to pitch, timbre, and harmonics, Justin Miller of the Kennedy Krieger Institute in Baltimore, Maryland, and Paula J. Schwanenflugel, professor of educational psychology and instructional technology, University of Georgia, Athens, found that reading ability is linked to pitch, loudness, tempo, and rhythm patterns of spoken language, called *prosody*. Central to fluency is prosodic reading ability, an obvious parallel with musicianship, involving the ability to

- include pauses and changes in speed that reflect phrases, clauses, syntactic boundaries, comma, periods, question marks, and exclamation marks;
- raise and lower vocal pitch levels indicating the type of sentence, or expression of the text;
- accent or stress syllables or words indicating a part of speech and sometimes its meaning; and
- vary the rate of speed (tempo) as they read to indicate the mood or emphasize text.[9]

Miller and Schwanenflugel discovered that the ability to discriminate intonation contour (pitch discrimination) is a significant predictor of later fluency. In addition, fewer hesitations in reading (juncture) between the first and second grades and early acquisition of adultlike intonation contour predict better reading comprehension later.[10] Researchers at Northwestern University confirm this conclusion by submitting that long-term musical training strongly correlates with prosodic encoding. "Musicians have extensive experience using pitch information in the context of music, which requires both high cognitive demands and auditory acuity."[11] When considering the significance of pitch, accent, inflection, rhythm, and other factors pertinent to prosody, music study would appear to provide engaging and directly relational rehearsal of these phonological skills.[12]

Research in Music Education

Like emergent readers, musicians depend on rich auditory experiences. Developing musicians as well as professional musicians must acquire increasingly discriminatory sensitivity to sound. Young children learn to match pitch and move to a given beat pattern, while professional musicians develop the consummate ability to hear minute discrepancies in attacks, releases, pitch, and rhythmic nuances. Sound before symbol is a nearly universally accepted practice in music teaching and espoused by internationally recognized music educators Zoltán Kodály, John Feierabend, Edwin Gordon, and many others.

As further evidence of the benefits of music training, researchers Marie Forgeard, Gottfried Schlaug, Andrea Norton, Camilla Rosam, Udita Iyengar, and Ellen Winner found that in normal-reading children, melodic discrimination abilities predicted both phonological and reading skills.[13] In a landmark study, Joyce Gromko found that "kindergarten children who received four months of music instruction showed significantly greater gains in development of their phonemic-segmentation fluency when compared with children who did not receive music instruction."[14]

In a follow-up study, Lucas and Gromko found that phonemic segmentation fluency (the ease with which a child can discriminate small units of sounds within words) was significantly correlated with aural discrimination skills. They learned that children who could "perceive, remember, and judge for similarity the component parts of a musical pattern were also able to perceive, remember, and recite the component parts of a word."[15] Investigators Joyce Gromko, Dee Hansen, Anne Tortora, Eric Boccia, and Dan Higgins found that children rely on working memory skills to learn words and tones.[16] Additionally, researchers from the University of Hartford found that kindergarten children's tonal musical aptitude predicted preliteracy rhyming skills.[17]

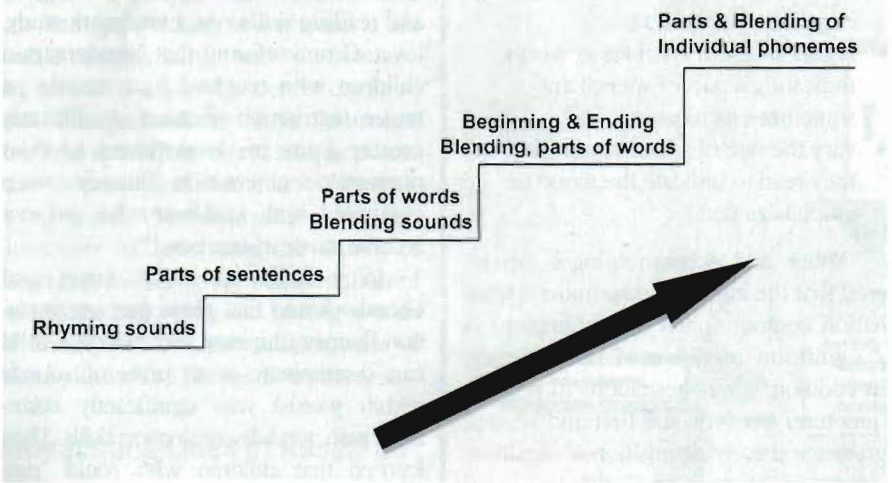
These findings reflect other research that seek explanations for observed relationships between music and phonological/phonemic awareness.[18]

Applications in Music Education

While researchers cannot determine exactly what aspects of musical training cause these advantages for musicians, they encourage musical training in schools with opportunities for auditory training for people with and without speech-encoding deficits. Investigators Susan B. Neuman, Carol Copple, and Sue Bredekamp also call for teachers to engage in rhyming chants and songs, clapping or tapping out syllables of words, and other activities that draw children's attention to language sounds.[19] Indeed, Canadian researchers found that music training appears to benefit certain skills necessary for reading.[20] Because readers learn sound sensitivity at

FIGURE 2

Phonological Awareness Continuum.



various levels of complexity, the following chart shows a learning sequence for phonological to phonemic awareness in language arts that may be applied to music learning (Figure 2).

Initially, children demonstrate their phonological skills in reading by expressing rhyme and alliteration. Songs, chants, and rhyming are important contributors to these language skills. As children grow older, they require more complex sound and language discrimination skills to navigate text. In the field of language literacy, it is assumed that children have a large aural vocabulary and have acquired a set of phonemes before formal instruction in reading begins. When children are learning a language, the optimal time for acquisition is between birth and five to ten years of life. For some children, however, hearing and aurally replicating the beginning and ending sounds of a word is difficult due to a multiplicity of factors, ranging from a lack of rich language environment to auditory/aural impairments.

While on the surface, music and language may not look and sound the same or express the same types of ideas, there are recognizable cognitive and developmental links between them. Language is the domain most comparable to music because both are organized temporally, and we perceive music and spoken language aurally.

Music educators teach children to listen and discriminate sound nuances. Because sound is at the heart of our discipline, we teach the conceptual ingredients of musical sound through such activities as singing, playing, moving, analyzing, and more. Jayne M. Standley found in a meta-analysis of thirty studies that used different music activities to enhance reading skills that "pairing alphabet recognition with phonetic patterns, practicing word segmentation and sound blending, and increasing decoding speed" were effective strategies to enhance reading.[22]

Using the structures from Figure 2, these lessons are examples to be taught after children have learned the songs, rhymes, or games that are already part of the primary music curriculum. While music teachers commonly integrate language activities in their lessons, the examples benefit music and phonemic awareness skills. These experiences are meant not to take away from valuable music-learning time, but rather to enhance students' awareness of language sounds in an already language-rich elementary music classroom.

Rhyming Sounds

The majority of simple songs and chants contain rhyme. Developing a sensitivity to rhyme is an important step toward understanding the complexities of phonemic awareness. Rhyme is natural and comes easily to most children; it is a fundamental step in the phonological awareness process.

Fingerplay: "Five Little Fishes" Poem

Invite children to

- Speak the poem in their normal speaking voices and whisper the rhyming words.
- Whisper the poem and speak the rhyming words.
- Emphasize rhyme through the movement. At the end of each "swimming" motion, the children should indicate the number of fish remaining by accenting the focus of their attention on the rhyme.

Song Tales: "There Was a Man"

Just as we read stories *to* children, song tales are sung *for* children to enrich their aural vocabulary and demonstrate the expressive nuances of language and song.

- After children are familiar with the song tale, invite them to sing the rhyming words.

Parts of Sentences: Words

The fluid nature of spoken language and singing often makes it difficult to distinguish individual words. Before understanding that words consist of phonemes, children must be aware that sentences separate our thoughts, sentences contain separate words, and these separate words in a certain order create the meaning of a sentence.[23]

Action Song: "My Hat, It Has Three Corners"

Lead children to

- Perform motions on the key words *my*, *hat*, *three*, and *corners*.
- Count the words in each sentence.
- Leave out another word on each repetition and substitute the motion.

- Sing each one-syllable word staccato and sing the only two-syllable word, *corners*, legato.

Parts of Words: Segmenting and Blending Syllables

Once students understand that sentences are made of words, help them to hear that words are also made of smaller parts—syllables. Singing is especially valuable in helping students experience syllable segmentation. In most children's songs, the rhythm of the words already segments the syllables. Another aspect of phonological awareness is how it feels and what it looks like (mouth, tongue, and throat) to speak the smaller sounds of a language. Singing exaggerates these feelings, particularly if a puppet is used to model how the sounds look.

Circle Game: "One Elephant"

Invite children to

- Count syllables, especially the three-syllable words—*el-e-phant*, *e-nor-mous*, and *an-oth-er*.
- Notice that words for different numbers also have different numbers of syllables, changing the rhythm of what they are singing.

Blending/Segmenting Parts of Words

At this point in the continuum, the students are ready to distinguish the particular characteristics of phonemes. A logical introduction to the concept of phonemes is to invite them to listen for the same initial phoneme in different words. Removing sounds from words (analysis) or adding sounds to words (synthesis) helps children notice that the meaning of a word changes.

"My Little Puppy"

In addition to finding rhyme and clapping or counting syllable, invite children to

- Listen for different words not next to each other that begin with the same phoneme, such as */t/ummy* and */t/ail*.
- After the students have had enough practice with initial phonemes, the same exercises can be done with final consonants. Final consonants are more difficult to isolate because often we do not articulate them.

Phonemes: Blending and Segmenting Individual Parts

Words are composed of strings of phonemes, which may be a combination of letters or single letters (eg., /cl/ /a/ /p/). We might equate a phoneme with a single pitch within a melodic phrase. Remember that phonemes are not syllables; they are the individual, small units of sounds in a word. Phonemes are more easily distinguished by how they are articulated. Students should be able to analyze and synthesize two-phoneme words before moving on to three- and four-phoneme words.

We recommend that students use separate blocks or similar manipulatives to represent each separate phoneme. Similarly, students can play instruments while simultaneously sounding out individual phonemes.

Simple Song/Beat Motion Song: "Frog in the Meadow"

Invite students to

- Find the two-phoneme words: *in* (i . . . n . . .), *the* (th . . . uh . . .), *out* (ow . . . t). Say the words slowly, adding a pause between each phoneme.
- Find the three-phoneme words: *get* (g . . . e . . . t . . .), *him* (h . . . i . . . m . . .), *take* (t . . . a . . . k . . .), *and* (a . . . n . . . d . . .).
- Find the four-phoneme words: *frog* (f . . . r . . . o . . . g . . .), *can't* (k . . . a . . . n . . . t), *stick* (s . . . t . . . i . . . k . . .), *stir* (s . . . t . . . i . . . r . . .), *about* (a . . . b . . . ow . . . t).
- Create an ostinato. While all students say /f/, one child or a small group strikes a wood block; then for /r/, another strikes a guiro; /o/, a triangle; and /g/, a hand drum. Keep this "phoneme" ostinato going (f . . . r . . . o . . . g . . . f . . . r . . . o . . . g . . .) while singing the song.

Music Teaching and Reading

Music educators must always continue to articulate the social, behavioral, and emotional benefits of music and teach music for its aesthetic and artistic merits. At this time, however, we are rapidly learning how music and language develop and work in the brain. The convergence of evidence indicating the significance of aural skills is indeed compelling. Side by side, comparisons of research in language arts, music, and neurophysiology reveal patterns demonstrating that music learning is beneficial to the reading process. Phonological awareness—developing sensitivity to sound—is as equally critical for music learning as it is for reading. Consistent and well-planned music experiences lead to physiological changes in the brain and behavioral changes in learning. Because current reading intervention programs, such as Response to Intervention, call for interdisciplinary collaborations between teachers in schools, we are now able to point to increasing volumes of research that justify music education as a means of building both music *and* reading literacy skills. As we continue to strive for literacy and high-quality educational opportunities, it is helpful to share these multiple lenses of research as important components of advocacy for music education in our schools.

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