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Music and early reading skills: Implications for programming for deaf or hard of hearing students

Elizabeth Sawyer
Washington University School of Medicine in St. Louis

MUSIC AND EARLY READING SKILLS: IMPLICATIONS FOR PROGRAMMING FOR DEAF OR HARD OF HEARING STUDENTS

by

Elizabeth Sawyer

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Karen Stein, M.A.Ed., Independent Study Advisor

Abstract: This paper explores the potential for music perception in children who are deaf or hard of hearing and the benefits of using a music program to facilitate the development of reading skills in preschool children.

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Introduction

Throughout history music has played an important role in shaping cultures around the world, and enriching the lives of those who experience it. Music has been used as a way for people to express themselves, and their feelings about personal experiences, cultural, community, or political issues. Music can also represent an entire generation through its style and the messages it communicates. In general, "*music*" can be defined in a number of different ways, such as: singing, dancing, and the production of rhythms and melodies through the use of musical instruments. Because music plays such an integral role in our culture, it is largely defined by the individual and what they think and feel. Music inspires us; it can have a positive impact on many aspects of our lives.

There is a plethora of research available to support the benefit exposure to music can have on the population in general, and on school-age children in particular. Some research has demonstrated that children with a hearing loss can also benefit from music in various ways. Participating in a music program, or a therapy session that incorporates music can help deaf or hard of hearing students with cognitive development, speech, language, and auditory skills as well as social development. Though it may seem counterintuitive to discuss the importance of music in deaf education, over 200 years of music education can be documented within the field of deaf education. The oldest record of music education for children with hearing loss dates back to 1802, and was conducted by Jean-Marc-Gaspard Itard, a French otologist, and a deaf educator. He used a series of different musical instruments in order to help his students develop their auditory discrimination skills (Solomon, 1980).

With the advancement of new technology in the past decade, research scientists, doctors and audiologists have worked together to develop and improve different types of hearing devices,

hearing rehabilitation, and interventions needed to provide maximum benefit, with a specific focus on access to speech sounds. They have studied the varying degrees of hearing losses and their etiology in order to continue to improve the ways in which patients with hearing loss can access sound. Cochlear implants were designed for children and adults with a sensorineural hearing loss that receive little to no benefit from hearing aids. Hearing aids are designed to amplify sound and transmit it through the ear canal, while cochlear implants are designed to bypass the damaged inner ear, transmitting sound as electrical stimulation to the auditory nerve. The microphone and speech processor are designed to pick up sound signals that are important for the perception of speech. Music perception will differ for children using hearing aids versus those with cochlear implants because of the technical characteristics of each device. Though the input of sound is different for cochlear implant recipients than that of their typically hearing peers, research indicates that children with cochlear implants benefit from them, specifically in the area of speech and language development. As research continues to show the improvement of speech for children using cochlear implants, there has been an increasing interest in the potential for additional benefits, including the ability to perceive music. Significant improvements have been made to the design of cochlear implants over the last twenty years, to improve the perception of spoken language. Now that children and adults have better access to sound through the use of cochlear implants, new technology is being explored that implements changes to the design to help recipients have better access to the components of music (McDermott 2004).

I began to connect what I knew about reading with my passion for music and consider the potential benefits music could have for children with hearing loss. In my research I discovered that recent studies have identified some benefits of using music to assist children during early reading development for children with typical hearing. With the advances in technology, children

with hearing loss can now be provided with better access to music, and this access will only improve with further advances in technology. This led me to ask: *Can teachers of the deaf use music to assist them in early reading instruction for children with hearing loss?*

Evolution of Music Education

Music Education has been part of the United States school system for hundreds of years. In 1848, the country experienced major changes in history, changes that effected geography, politics, demography, and education. This set the tone for the future of music education in schools today. Around the eleventh year of the establishment of music education in schools, education of children with hearing loss was gaining attention. William Wolcott Turner and David Ely Bartlett advocated for music in deaf education, through an article published in the *American Annals of the Deaf and Dumb*, now called *America Annals of the Deaf (Darrow & Heller, 1985)*. In their article, Turner and Bartlett argued that children who are deaf or hard of hearing can perceive instrumental music by using their senses of sight, and touch, and their knowledge of musical rhythms. According to Darrow and Heller, (1985) the Turner and Bartlett article "is likely the first statement in print of a rationale and a methodology for teaching music to the hearing impaired." Bartlett became the teacher of a young girl who lost her hearing at the age of eighteen months. The young girl was given a piano, by her father with the expectation that it would be used for her amusement rather than real music education. However, the child began to show an interest in playing it, and a family friend taught her some music and rhythm techniques. Eventually she attended New York School for the Deaf, where she continued her music instruction under Bartlett (Darrow & Heller, 1985).

This was just the beginning of music education for children who are deaf or hard of hearing. In 1883, Alexander Graham Bell, founded the Kindergarten and Primary School for

Hearing and Deaf Children in Washington D.C., where the teachers used a piano as a way to teach vocalization, singing, and interactive music games. In 1890, teachers at The Warren Articulation School of New York, used whistles, clapping, and other environmental sounds in their aural instruction (Solomon, 1980). Historically music education for children with hearing loss continued to develop as a viable avenue for learning. There are many reports documenting deaf educator's use of organs, pianos, and singing as techniques for improving auditory, speech and language skills. In more recent research, music programs include using a piano to teach pitch, rhythm, and accents, through visual and tactile cues.

The above historical account demonstrates music programs in schools for the deaf have gained importance over the past 150 years. Before looking into the potential benefits of music programs, one needs to see how children with hearing loss, specifically cochlear implant recipients are able to access music.

Music Perception in Children with Cochlear Implants

Music Educators have found it challenging to work with hearing impaired children not only because it is difficult for children to perceive music, but because it is also difficult to integrate them into the classroom setting. According to deaf culture music can be an important tool for individual expression and cultural awareness. While hearing is a physical process, the art of listening is a mental process, involving intent on the part of the listener. The auditory stimulus is delivered to the brain via the auditory nerve. Once the message reaches the brain, the individual has to interpret what was heard, attaching meaning to the stimulus. Music class is good place to facilitate listening skills for cochlear implant recipients (Darrow, 2007). Students with cochlear implants need to be given the opportunity to develop and exercise their listening and auditory skills and a music program can help them achieve that goal.

While there are a number of studies that look at music perception in adult cochlear implant users, there has been less focus of what is possible for pre-school cochlear implant users. Some studies have focused on specific areas of music. By breaking music down into small components; pitch, melody, timbre, and rhythm, researchers can better understand what aspects of music children with cochlear implants can perceive. For children with congenital or early onset of deafness, the lack of musical experience impacts their ability to perceive music. Though understanding the concept of high versus low pitch in musical notes is abstract for the typically hearing preschool student, it is more difficult for preschoolers with hearing loss. In a 2008 study conducted by Hsiao, preschool children were asked to listen to an ascending musical scale comprised of eight notes. Typically hearing preschooler were able to recognize eight different sounds; however some preschoolers with hearing loss were unable to perceive subtle differences of pitch or perceived the sounds as compressed or distorted (McDermott, 2004). These perceptual difficulties will impact a preschooler's participation in musical tasks such as, recognizing familiar simple tunes like "Happy Birthday", and "Twinkle Twinkle" (Hsiao, 2008).

In another study, congenitally deaf Japanese children with cochlear implants, ranging in age from four to nine years, were evaluated on their performance on an identification task. These thirteen children were asked to identify a song that accompanies a familiar television program. Each song was presented in three forms: the original version, karaoke version, and a flute version which is comprised of the melody without rhythmic cues. The children recognized the original version because of the vocal and instrument cues, but were not able to recognize the other versions (Nakata, Trehub, Mitani, Kanda, Shibasaki, & Schellenberg.,., 2005). A similar study was conducted in Canada with 10 typically hearing peers and 10 cochlear implants users, all between the ages of eight to eighteen. As in Nakata's study, participants were asked to identify

the songs they heard. However in this study the children with cochlear implants were able to name some of the songs during the instrumental version, though their results for all three versions was lower than those of their typically hearing peers (Vongpaisal, Trehub, & Schellenberg, 2006).

From the studies mentioned above, it is clear that continued research and technology updates will improve students' abilities to perceive music using cochlear implants technology. Though technology has limitations transmitting certain components of music this limitation does not prevent children with cochlear implants from having musical experiences. An enhanced musical therapy or education program may give them the training they need to be able to enjoy music and the benefits it can provide in other areas. In general music education historically shows a positive impact for children who are deaf or hard of hearing in areas of articulation, speech, language, auditory skills, and cognitive development (Solomon, 1980). For the purpose of this review, however, the focus will be on the potential benefits of music education as it impacts the development of early literacy skills.

Music and Language

Music and language are specific to human beings and share the same avenue for input-the auditory system. Historically music and language were thought to be localized in different areas of the brain: speech functions in the left-hemisphere and music functions in the right-hemisphere. With advances in medical technology, neurophysisists are now able to study brain functions using brain imaging and scans. These technologies allow doctors to have a new perspective on music and speech functions, and the role of specific areas of the brain. Tallal and Gaab, (2006) discovered that music and speech have some neural modules or networks in common. This could prove fundamental in developing strategies for utilizing music education.

In further studies researchers have explored the commonalties of music and language, both of which define a human being (McDermott, 2008). Both music and language involve complex meaningful sound sequences. Melodic and linguistic phrases are found to produce activity in the same areas of the brain (Patel, 2008). With this connection of music and language in the brain, could have significant implications for ways to improve early reading skills in preschool children with cochlear implants.

Music is also like language in that it has a base of auditory modality and the use of the voice for output. Music and speech are built with different elements; the elements of music are notes and the elements of speech are phonemes. Both elements, notes and phonemes, follow specific rules and can be arranged in unlimited combinations, forming utterances that convey meaning.

Music ability can be connected to early reading skills in preschool children, particularly for the development of phonological awareness skills. In research conducted by Anvari (2002), he and his colleagues discuss that in order to perceive elements of music such as rhythm, melody, and harmony discriminations some auditory skills are needed. These same skills can also be relevant for processing language. The ability to discriminate pitch, a way to strengthen musical perception, can also be correlated with phonological awareness, an essential skill for development.

Music and Reading

There are numerous studies written about the experiences and interventions that support the best possible early literacy development for at-risk learners within the hearing population. Because of their hearing loss, children with cochlear implants also fall into the category of at-risk readers. Children who are deaf or hard of hearing have many struggles to overcome during their

school years, as they learn to listen and talk. They often have a language, and consequently a reading delay.

In order to understand the struggles children with a hearing loss have when learning to read, it is helpful to identify what the reading process is. According to Thomas Gunning (2012), reading is "a process in which we construct meaning from print." Reading requires phonological awareness. It also requires strong vocabulary and knowledge about life. Having a strong vocabulary enables the reader to process complex syntax found within the text, therefore allowing them to become successful readers. By the time typical hearing peers have reached preschool, they are competent language users and have built and acquired an extensive lexicon. Early readers have learned new vocabulary from daily exposure, overhearing, and print everyday life. No matter the socioeconomic status of the family, most children have some exposure to books or print, and have had the opportunity to use crayons, pencils, and other literacy tools to express their new skills (Gunning, 2012).

The components of reading instruction include: language development, phonological awareness, decoding, comprehension, vocabulary, and fluency. These make up the framework for literacy and are important to address when teaching children with hearing loss to read. As current research documents, children with a hearing loss often struggle with these components of reading (Gunning, 2012).

Early readers are competent language users, have a strong vocabulary, and significant world knowledge. However, children who are deaf or hard of hearing have very different language experiences due to their hearing loss, thus making the reading task more difficult. Historically, children who are deaf or hard of hearing have not had access to the phonological

sounds necessary for reading. Therefore teachers taught their students using word recognition rather than phonological awareness strategies (Ganek & Robbins, 2012). With new discoveries and advancements of technologies, children with hearing loss now have more access to sounds, and can benefit from instruction that focuses on developing all reading components.

Research shows that children with hearing loss continue to fall behind their hearing peers in the development of reading and perceiving music. The prospect of creating a music program that has a positive impact on early reading skills seems improbable. However, research documents the use of music therapy in reading programs for children. The first question that needs to be answered is; can music be used to improve reading outcomes? There are several studies that address this topic, identifying common aspects of both processes. Music and writing both have a formal written notation that is displayed and read from left to right in order to make sense. Both music and writing use written codes to communicate. Music uses musical notes, while writing uses letters. One might speculate, that practicing reading musical notations could help with reading, or at least make the task more familiar and consequently easier (Butzlaff, 2000).

The second similarity is the ability to discriminate among sounds, phonological sounds for reading, and different tones, or pitches for music. Research shows that children, who participate in a music program, have the opportunity to practice auditory skills as they listen to music. This can carry over into reading instruction to facilitate participation in phonological awareness activities (Butzlaff, 2000).

The third are of overlap involves the lyrics to songs. When children learn the lyrics, they are engaged in reciting or reading text. For a majority of songs, lyrics have a pattern and can be somewhat predictable. Language in early readers often uses repetition and patterns too, creating

predictability. Practicing these skills in music may help train students to better recognize and use them in reading (Butzlaff, 2000).

Another possible benefit of music instruction would be to give students the opportunity to work together as a team. When hearing students join choir, band, or orchestra they learn to work together in a team. Along with working together, students learn the importance of responsibility and doing their part and practicing. Learning these skills in a music program can be carried over into the classroom, hopefully increasing academic performance in all areas (Butzlaff, 2000).

Anvari (2002) and her colleagues conducted a study to examine the relationship between phonological awareness, music perception skills, and early reading in children ages 4 and 5. In her study, she discovered that music perception appears to use an auditory mechanism that is related to reading, specifically the area of phonological awareness. This suggests that there might be linguistic and nonlinguistic auditory mechanisms involved in the reading process that are also activated through music experiences. Anvari also suggests that learning a language requires the learner to build a basic foundation with words, syllables, and phonemes. In the same way the basic learning process of music can be similarly built using elements of music (Anvari, Trainor, Woodsidem & Levy, 2002).

For their study, Anvari (2002), and her colleagues looked at the abilities hearing children ages four and five. The children were recruited from schools or daycare programs in Canada. There were a total of 50 four year olds (29 female, and 21 male), and 50 five year olds (30 female, and 20 male) who participated in the study. The children were given a set of tests over five sessions, lasting 20 to 30 minutes each. For all of the tasks, the children were given three practice tests to be sure if they understood the task. These tests were presented to the children individually, in quiet rooms. The children participated in tests in the following areas: phonemic

awareness, reading, vocabulary, music, digit span, and mathematics. For the purpose of this review, I will focus on results on phonemic awareness, reading, vocabulary, and music tests.

In the phonemic awareness test, there were four parts: rhyme generation, oddity, blending, and the Rosner Test of Auditory Analytic Skills (standardized). The rhyme generation test used twelve target words, and required the child to generate as many words that rhymed with the targeted word as they could. For the oddity test, the child was given a set of four words that either began or ended with a different sound. The child was required to give the word that sounded different in the exact order it appeared in the set. The blending test used a combination of sounds and syllables presented in segmented form and the blend was used to create a word. For example, a word in this set might be, c-at. The last test, Rosner Test of Auditory Analytic Skills, measured the child's skill in identifying, segmenting, deleting, and recombining the syllables and sounds of a word.

The reading subtest was a standardized test called the Wide Range Achievement Test-3. It progresses from letter recognition to reading a series of words. The Vocabulary test used in this study was the Peabody Picture Vocabulary Test used to measure the child's receptive vocabulary skills. The child is asked to point to a picture out of a set of four that best represents the word the teacher says (Anvari et al, 2002)

The music tasks were created to parallel the phonemic awareness tests. There were five tasks making up the music test: same/different rhythm discrimination, same/different melody discrimination, same/different chord discrimination, rhythm production, and chord analysis. The same/different rhythm discrimination requires the child to determine whether two computer generated rhythmic patterns are the same or different. The same/different melody discrimination requires the child to determine whether two computer generated melodic patterns are the same or

different. For the same/different chord discrimination task the child is asked to listen to a pair of chords and identify if they are the same or different. The rhythm production section requires the child to listen to a rhythm produced vocally and repeat it back to the examiner. The chord analysis task requires the child to determine if the sound they heard was two musical notes or one. Comparing the scores of these tests, Anvari and her colleagues indicated that music perception skills are related to phonological awareness and early reading development. It is suggested that even when phonological awareness is removed, music perception is still predictive of reading skills (Anvari et al, 2002).

Anvari's research established a link between music education and written language learning. According to Anvari, music can awaken a preschooler's mind to the written word. In one of her studies, children between the ages of four and eight, who scored high on various musical aptitude tests and melodic tests, have better success in phonological awareness and word recognition. Children who are poor readers usually have difficulty with rhyme and alliteration, thus indicating a link between auditory skills and reading (Anvari et al, 2002).

Another study by Gromko (2005) was conducted to determine whether music instruction is related to young children's phonemic awareness success. The participants for this study were four intact kindergarten classrooms at one elementary school, where music instruction was provided by four music students from the local university. As a control group, a second elementary school with kindergarten children was chosen. A total of 103 kindergarten students from both schools participated in the study, 43 at the first school and 60 in the control group (Gromko, 2005). All 103 kindergarten children received the same amount of reading instruction during school hours. In this specific school district, all kindergarten students are given phonemic awareness tests, each quarter. These tests included: letter-naming fluency, phoneme-

segmentation fluency, and nonsense-word fluency. Letter-naming fluency requires the children to look at a grapheme and say its name. Phoneme-segmentation fluency is an aural test, and requires children to listen to a word and respond with its component sounds. Nonsense-word fluency requires the children to look at a word and sound it out. Reading instruction in the classrooms was based on these tests. Both schools emphasized letter-naming fluency and initial-sound fluency, which were accessed on their quarterly tests. During reading class, the teachers read aloud to their students. They also provided the students with access to picture books and early reading books (Gromko, 2005). Neither school did provided kindergarten students with a music program.

The four music students from the local university were supervised by the kindergarten teachers as they taught their music programs. Each of the four music students were randomly assigned a kindergarten class where they taught a morning or afternoon class 30 minutes per week from the beginning of January 2004 to the end of April 2004. The control group of kindergarten children received no music instruction (Gromko, 2005).

During these music classes, students first learned to sing a new folk song that was derived from a variety of different cultures. Then they added simple body percussion to reinforce a steady beat and word rhythms, as well as high and low pitches and kinesthetic movement to help students "organize their perception of musical sound in time and space". Students also had the opportunity to add an instrument. Some of these instruments included, egg shakers, wood blocks, rhythm sticks, triangle, finger cymbals, bells, and hand chimes. All instruments are used to reinforce a steady beat, word rhythms, pitch, and melody. Lastly students were given a chart that they touched while singing. On this chart there were dots that represented a steady beat, a square or triangle that represented a word rhythm, and a line that represented pitch or melody. In doing

this, the music students from the university were teaching these kindergarten children to read and derive meaning from written symbols. Early readers learn to connect sounds or phonemes to letters or symbols, in the same way these students were learning shapes based on the sound, pitch, or rhythm of a note.

At the end of the music instruction the students were retested with the same tests given quarterly. The results revealed that kindergarten children who received music instruction had significantly higher scores than the control group, on the phoneme-segmentation fluency test. Their scores on the other two tests were also higher, though not significantly so. Gromko's believed the reason these tests were not significantly higher was related to the fact that they depended solely on grapheme recognition, a skill that was still developing. However, Gromko does conclude that because of the nature of the music instruction, there was improvement in auditory skills (Gromko, 2005).

There is anecdotal evidence of the use of music as a tool in oral deaf education classrooms. It can facilitate language fluency, aid in brain development, and be an enjoyable activity for students of all ages, creating a positive culture for learning.

One example can be seen in a school in the Midwest, where music is used as a way to benefit their student's oral communication. The teacher created and implemented a music program to help her students learn to be attentive listeners and develop phonological awareness and fluency. The teacher also used music to expand her student's vocabulary, promote sight words, and increase their ability to identify rhymes and retell stories (Hachmeister, 2010).

Teachers at this school seek to use music in as natural a way as possible, attaching songs to routines and transitions. When students wash their hands they sing the song *Wash your hands* to the tune of *Frere Jacques*. When children clean up after an activity, they sing a song called

Clean up to the tune of *Heigh Ho*. The purpose of these songs is to give students the language for the activity they are performing in a format that is fun, repetitive, and easy to remember (Hachmeister, 2010).

The teacher also uses music to teach comprehension, retelling stories through song, and fluency. Songs can be a way to help children with a hearing loss. While benefits cited here are anecdotal, it does demonstrate the positive impact a music program can have on children with a hearing loss in overall development of skills related to reading (Hachmeister, 2010).

Implications and Further Research

During my research I learned that children with cochlear implants do have better access to music and that there are potential benefits in using music instruction as a means to teach reading skills to children with hearing loss. However, there are areas that need future exploration. Current research suggests that music training helps to develop auditory skills and abilities has potential to be used to improve the phonological awareness of preschool children. In order to make music more accessible for children with cochlear implants, further research and investigation needs to be conducted on music perception. As technology improves, more children with hearing loss can enjoy the benefits of listening to music, both for recreational purposes and academic achievement. This opens the door for future research in music programs for children with a hearing loss. With better access to music through features developed in cochlear implants, new studies can be conducted to improve music programs and create new strategies to provide the best opportunities deaf educators to teach children. Another area of focus for future research is the connection of music and reading. New discoveries on the benefits of using music to improve early reading skills can also lead to more opportunities for success within the classroom. The following questions need to be further explored: What areas of reading are more likely to

benefit from music instruction? What kind of music instruction will have the biggest influence on early literacy skills? How should music instruction be implemented to best facilitate reading? What is the best age to implement music instruction that will produce the best reading improvements?

Conclusion

Years of participation in music education has shown the impact it can have on children who are deaf or hard of hearing. Exposure and training in music can improve cognitive, language, and auditory skills. In addition to strengthening these skills, participation in a music program has the potential of also strengthen children's early reading skills.

Though there is need for future research, teachers of the deaf or hard of hearing can use music as a way to enhance the learning experience of students. Music can be an engaging and educational activity that can provide an opportunity for children with a hearing loss to practice the skills taught during early reading, while also strengthening their cognitive, language, and auditory skills.

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