Music Education and Blind Students:

Perception and Implications of Braille Music Notation

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Introduction

As a music educator who has focused on music in special education, I thought it would be beneficial for my career to research an area of music education that I have not become well versed in. Therefore, I decided to focus my research on visual impairment and blindness in music. The first topic I researched was the history of music notation for the blind. The issue with this topic is that not much has changed since braille music was invented in 1829 by Louis Braille. The only real improvement has come with technological advances, like the invention of braille readers. But braille notation is just as cumbersome as it was in the early 1800's since it relies on tactile sensation, meaning that blind musicians cannot sightread on their instrument. Instead, they are required to take the information from braille notation and memorize it. While that is the standard for blind musicians, it makes notated music rather inaccessible, particularly in the group setting.

Thus, I land on the current focus of this report. A goal of the following paper is to discuss how blind musicians perceive music as it relates to notation, taking into consideration the accessibility of music and music notation, and report on available assistive technology. Another goal is to use this information to provide suggestions to music educators so they may create inclusive and accessible classrooms for their students with visual impairments. More specifically, the point of this research is to discover correlations, if any exist, between the way visually impaired musicians are taught and the way they perceive and understand music concepts as they relate to notation. By looking at research regarding music perception of blind individuals, speaking with an educator who works directly with a blind music student, and by

speaking with the same blind music student, the information will help inform how to adequately support blind musicians in the music classroom.

History of Blind Education

Because we are concerned with education of visually impaired students, it makes sense to start with a history of pedagogical practices for teaching individuals with visual impairments. The first record of education for the blind was in France. Prior to this establishment, there was no public provision made for the education of the blind. In the year 1780, "Hany, a French Philanthropist, established at Paris an institution for their [blind individuals] instruction" (Fuller, p. 63, 1873). In the year 1771, Valentine Hauy [Hany] was moved to create the school when he attended a blind concert where the performers were dressed up and make a spectacle of. The blind individuals were dressed in, "grotesque robes" (Alexandre, 2012) and paraded on the stage playing instruments. He was so upset with the treatment of the disabled people that he made it his mission to make their lives easier through providing education to the blind. By 1786, the school expanded from just one student to twenty-four. After the French revolution, the institution prospered.

When Hany retired, he was invited to Russia by the Czar to start another school for the blind in St. Petersburg. This institution did not last, as it was more of an attempt to glorify the government, rather than bettering the lives of blind people of Russia. Conversely, a similar institution in Berlin flourished because the founders embodied Hany's spirit for teaching the blind (Fuller, p. 65, 1873). As time went on, other institutions were established throughout Europe. Several in England taught multiple subjects but focused on music. Many churches of the time hired blind organists from the school. Unfortunately, after Hany retired his school fell

into disarray, except for the subject of music. After a few years with a less than ideal superintendent, a new one was hired who brought the school back to it enviable status (Fuller, p. 66, 1873).

Raised lettering was first used to educate blind students at Hany's school in Paris. The system was based on Écriture Nocturne [night writing], which was created for French soldiers to communicate at night without needing light to read. This was the true precursor that inspired Louis Braille to create the six-cell dot system that is popular today. Louis Braille first published an explanation of his embossed dot code in 1829. The first raised print book published in the United States, the Gospel of St. Mark, was published in 1833. The braille code was perfected in 1834. It wasn't until 1855 that braille was popular enough for France to adopt it as the official reading mode for people who are blind. Throughout the 1840's and 50's several printing houses for the blind were opened across the United States, making literature more available to blind Americans. The American raised-point system was created at the Perkins School for the Blind in 1878; it is closely related to braille but is not identical.

The movement for blind education in America started in 1832 by Dr. S. G. Howe in Boston, Massachusetts. Several schools were opened around the same time. Dr. Howe taught a young woman named Laura Bridgman who was blind, deaf, and mute. She, through instruction at the New England Institution for the Blind, learned a great deal. At home she learned through imitation, but her communication was very limited. She learned to identify items through tactile feel of a label with raised letters which spelled the name of the items, like spoon, fork, knife, and keys. After a while, they moved to using just the letters and required her to organize them in the correct order for the correct items. Soon, she learned that the letters could be used

to communicate anything; her communication barriers had been overcome. Within weeks her vocabulary was extensive. The teachers were able to take her knowledge of the letters and teach her how to position her hands to communicate with sign language instead of having to spell with the letters. She had many ideas and, "intellectual faculties" (Fuller, p. 74, 1873). Her communication style, particularly the raised letters, were like braille, which was not as widespread or readily available.

After many years of residential and day schools being established for the blind, along with the creation of many inventions including braille print, typewriters, and textbooks, the University of California offered the first teacher preparation course for teaching the blind in 1918. Although music was a popular subject across the world for the blind population, the first pamphlet on braille music notation was not published until 1871. The music notation was standardized by the International Congress for the Standardization of Braille Music Notation during their 1871 conference in Cologne, Germany.

Disability in Music

Disability in music is a developing field. It is only withing the last hundred years or so that disability has become a mainstream concept. The movement for deinstitutionalization started in the mid to late 20th century when numbers of patients in residential institutions was at an all-time high. Children with any kind of disability, physical or mental, were often abandoned at these facilities. Many of these hospitals were understaffed and over capacity. The patients were abused, neglected, and subject to medical, physical, and psychological torture. With society realizing what horrors lay within these facilities, new therapeutic and

medical interventions becoming available, and the civil rights movement becoming active, people were more inclined to be aware and accepting of disability (Stiker, 2018). Therefore, concept of disability has changed. The way society interprets and responds to disability has also changed accordingly. The current trend is to perceive disability as a personal, cultural, and social identity (Straus, p. 18, 2011). This is especially true for disabilities that affect the senses or communication because these disabilities mean that individuals innately interact with the world differently. Therefore, a culture and specific set of skills become linked to people who have the same disability. However, this is not to assume that every person with a given disability has the same symptoms or experiences. This is just to establish that there is shared culture and experience in being blind, as there is with being Deaf or autistic.

The social model of disability has made blindness become perceived not as a deficit, but as, “a different form of ability” (Straus, p. 18, 2011). This ideology reflects positively on the concept of disability but doesn’t do much in terms of enabling the disabled community to have an equitable and accessible life. In fact, it could be argued that this turn of phrase is limiting since it minimizes the effects of disability. Rather than providing a realistic view into the world of disability, it makes it sound like a superpower. It could result in able-bodied neurotypical people overlooking accommodation needs, making it harder for disabled people to access the world.

Also, we must address the myth regarding blindness and inherent music ability. Blind people are not necessarily compensated for their disability with, “preternaturally acute hearing as well as prodigious musical gifts” (Straus, p. 17, 2011). However, it is common, cross-

culturally, that blind people are attracted to musical activities. As a result, there is still a close association between music and blindness.

Blindness and Perceiving Music

Author Joseph N. Straus theorizes that disabled musicians interpret sound differently. He coined the term, "disablist hearing" (Straus, p. 150, 2011) to describe the phenomena. The type of hearing is informed by information theory, expectancy theory, and gestalt theory, just like typical listening. However, the way disabled individuals understand music is inherently different because their way of interacting with it defers from the typical population. As a result, they have a different way of hearing, interpreting, and conceptualizing sound. Straus goes on to distinguish between the types of hearing because each disability has its own implications in terms of hearing.

Blind hearing in general leads to "extremely sensitive, acute listeners" (Straus, 170, 2011) because auditory stimulus is the primary way that blind people interact with their environment. For example, early blind musicians can detect beat asynchrony earlier and with better accuracy than sighted musicians (Lerens et. al, p. 1090, 2014). Early blind musicians also perform better than sighted musicians at detecting pitch direction changes (Gougoux et. al, p. 309, 2004). The neurology of blind musicians compensates for their lack of visual input by developing a more refined listening skillset that is informed only by sound. Sighted musicians inform their concept of pitch from sound and from the visual of the music staff. In fact, there is a "diatonic bias of the staff" (Straus, p. 172, 2011; Westergard p. 18, 1996) that perhaps makes

blind hearing the more impartial way of hearing. Music notation does not mediate or interfere with the listening, performing, or comprehension skills of blind musicians.

Blind musicians become more sensitive to music, including structures that western music notation does not convey. This is especially true of aspects regarding, "articulation, dynamics, tuning, or timbre" (Straus, p. 172, 2011). Ashlee, who's interview will be discussed later, reports that she experiences this refined level of hearing. She can hear intonation issues at a more subtle level then her peers generally can. She usually can predict cut offs, particularly when singing with a choir. She typically still has someone guide her for entrances and releases just to be sure. Ashlee can also listen to and comprehend speech as a much faster rate than many of her peers. This comes from years of practice since she has used text-to-voice reading applications to gain access to most technology, including her cell phone, computers, and ATMs.

Interestingly, Ashlee's tactile perception is still influenced, in part, by the concept of sight. For example, a common technique piano teachers use for to help their students gain an understanding of the keyboard is closing the key cover so the musician cannot see as they play. Even though Ashlee *cannot see* she struggled with the exercise just like her sighted peers did. She couldn't play her piece successfully with the key cover blocking her from "seeing" the keys, even though she already couldn't see them. This suggests that despite being blind, Ashlee's brain is still looking for visual cues. This provides some insight as to the way her brain is processing music and perhaps is part of the reason why many blind individuals develop synesthesia – to make up for the sensory information that sight would provide.

Braille Music and Technology

Though music is an aural tradition, notation informs perception for some musicians. Most, at the very least, learn to expect intervallic relationships that are obvious on a music staff. But those concepts do not translate in Braille music notation. In fact, the concept of the staff that sighted musicians know does not exist in the Braille counterpart. In fact, Braille music notation has very little to do with music perception in blind musicians. Reasons for this include the lack of availability of braille music, the lack of resources to learn how to read it, and the overall cumbersome experience which makes learning music via braille not ideal, especially considering that blind musicians typically learn from recordings.

Before discussing the details of braille notation, it is important to establish an understanding of the notation system. Braille music has *nothing* to do with the traditional staff and clefs that sighted musicians typically interact with. Instead, it is a code, much like the braille system for letters and numbers. Blind musicians can only read one line, one note at a time. There is no difference in how braille music and braille lettering is written to the point that there is a specific braille code that signifies the start of a musical composition. Without this special signifier, braille music would read as a jumbled mess of numbers and letters. The code is specific for each letter and rhythm. For example, when sighted musicians see the note “a” on the staff in the same place and read it the same way regardless of the rhythmic value. In braille music that “a” is different depending on if it is an eighth note, quarter note, half note, whole note, etc. Each note and rhythm combination has its own special character in the braille music notation system. The blind musician must use their best judgement and make an educated

guess regarding what octave to play in. (D. MacDonald, personal communication, March 28, 2023)

Since every note in braille takes up its own individual braille cell, one piece of music ends up taking much more space on paper. Every layer of the music means another separate part on the braille notation. Additionally, if the musician plays a chordal instrument, like the piano, the many lines of music are difficult to put together. Each voice, from highest note to lowest note, must be individually written out. A piano score is more like reading the entire soprano voice part, then alto, then tenor, then bass, rather than reading a score of the music. A blind pianist must learn how the lines fit together which is easier done with a recording anyway. The implication of this bulky and difficult way of interacting with braille music results in a rather inaccessible medium, especially considering we are referring to music, which is still an aural tradition.

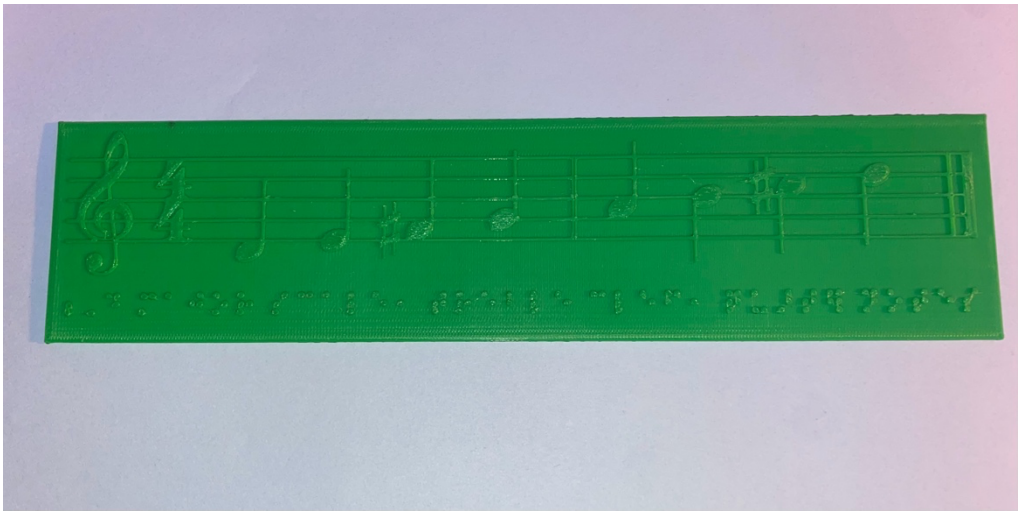
If braille is the primary way that a blind musician interacts with music notation, this has vast implications for their perception and comprehension of content. Blind musicians have much more work to do in terms of memorizing the code for reading. It takes much longer to master reading music braille in context. Though it can be done, and it is typically expected of blind musicians, especially at the collegiate level in aural and theory music courses. Once they memorize how to read and interpret the code, the musicians still must memorize every piece they learn and perform, especially if hands are required to play their instrument. Only blind singers *might* be able to sight read, but it still would be a challenge.

To learn more regarding assistive technology, I met with Dr. David Macdonald, the Assistant Professor of Music Theory and Composition and Graduate Coordinator at Wichita

State University. His expertise comes from several sources, but his newest information comes from personal investment in this field because he works directly with a completely blind undergraduate music student. I also interviewed the student, my friend Ashlee Thao, to gain an understanding of how she reads and perceives music. Though Ashlee had some knowledge of braille music prior to college, she really honed her braille music reading skills during her undergraduate career.

Dr. MacDonald and Ashlee both told me a story from her first music theory course. Within the first week of school, they ran into a dilemma because Ashlee had never interacted with a music staff. When Dr. MacDonald discussed the rules of beamed eighth notes, Ashlee raised her hand and asked, “What are beams?”. Ashlee had never considered what written music could ‘look’ like prior to the course. The concept of a written eighth note baffled her; nor could she understand the concept of a ‘beam’. Although Ashlee had a great understanding of the aural concepts, she still needed to understand what the written concepts look like. Ashlee had to learn what the music staff looks like to communicate effectively with other musicians. If she was going to teach, compose, and perform like she planned to, she would need an understanding of the way a music staff looks and functions. The two had to work together to make the material understandable and accessible for Ashlee. Dr. MacDonald was able to introduce the concept of a staff to her by 3-D printing a model of a staff (image 1.A is a copy of the print), along with examples of notes, including the braille music ‘translation’ so that she could at the very least *perceive* what her peers were working on.

1.A – 3D printed Braille and music notation of D Major Scale



Modern technology has provided visually impaired musicians with many ways to interact with braille music. However, the notation system and accessibility has not changed much. While braille music was invented closely after the braille coding system, the notation system did not gain popularity until the early twenty-first century. Ultimately, it is still difficult to find braille music. This type of music is so difficult to find that visually impaired musicians started to order scores from the library of congress and would pay any associated fees for not returning it, rather than paying for an original braille print or paying a scribe to create the score for them. Even if braille music is available, the cost is a secondary barrier. To pay for brailling of music, the minimum is about $9 per page; and not very much information can fit on a page. The result of the difficulty of reading and the expenses of braille music is that musicians with visual impairments often never interact with braille music; they learn everything by ear, either in the rehearsal room or from recordings.

Additionally, braille music is not as practical as printed music or braille literature. The notation is on large paper, meaning that it is difficult to carry around and interact with. In the

classroom, this required Dr. Macdonald to have two braille copies of music examples; one to keep in the classroom and the other for the student to review at home before class. Without reviewing prior, this student would be unable to understand the examples in context, as there is too much information to read through on the braille notation in the moment. This provides some perspective as to the challenges of being in a performing ensemble as a visually impaired musician.

As for the technology aspect of braille music, there has been improvement. The most widely used pieces of technology for blind or visually impaired individuals are braille notetakers and readers. However, there are common issues with these items. The first barrier with this technology is cost. Even basic readers can be around $12,000. If the reader breaks or has issues repair options are limited. With initial costs in this range using a reader as an access tool is difficult. The younger the person is the easier it is for them to pick up the skill. But with this price point most children don't have access to one until it is necessary for their schooling. If students do have access, they might not be permitted to use the braille readers independently. As a result, it is often the case that visually impaired individuals put off learning how to read braille, especially braille music, because it isn't available or is too expensive to find either print or electronic braille readers. There are devices specifically designed for reading braille music notation, but there are limitations to their usefulness. Braille music readers, like the ones from *Dancing Dots*, are typically limited in terms of how much information that can be provided at once. This is fine for students in a band or orchestra setting who generally only read one line of music at a time. But a blind pianist would have a much harder time reading and memorizing the

information quickly and with enough accuracy to sight read in an ensemble setting. If available, the software and associated devices are a good starting point for blind readers and musicians.

Blind Musicians and Perception in Context: A Case-Study

To get an idea of perception in context, I talked to my friend Ashlee about how she conceptualizes music and how she uses adaptive technology in her day-to-day life. Ashlee has been blind for as long as she can remember, though she wasn't born blind. Due to medical complications as an infant, she is completely blind in her right eye and sees about 5% of light in her left eye. She has synesthesia, which is quite common in the world of blind people but is especially common in blind musicians. Ashlee's type of synesthesia is slightly uncommon. Ashlee guesses that part of the way she perceives the world has to do with having been sighted as a baby, though there is no way to tell for sure. Ashlee describes her mind's eye very specifically. For example, music is correlated to shape types based on interval and quality. Essentially, the more dissonant the interval the more angular the shape. The more consonant the interval is the more rounded the angles are. For her, the interval of a 2^{nd} or 7^{th} is a very sharp angular form, though this shape doesn't have a specific name. 3rds are circles, 6ths are ovals, and perfect 4^{th} or 5^{th} s are square in nature with rounded angles. Interestingly, a unison and an octave are both straight horizontal lines. The concept is further developed when chords are introduced. If Ashlee hears or plays 3 or more notes the shapes become 3 dimensional, but the shape is still determined by the intervals in the chord. While synesthesia is typical in visually impaired individuals, it is typical that sound becomes associated with color. For Ashlee, color and taste are more closely related. A couple of examples: green is sour, blue is salty, black is

black coffee. It should be noted that synesthesia is very personal and is an *extra* way of perceiving and interacting with music. The primary sense is still sound; the experience is amplified by synesthesia.

Ashlee used synesthesia to her advantage in music school. Even though she cannot see, she was required to sight sing like her peers. The concept is quite different for braille readers, though luckily it would typically only be one line of music, so it was not impossible. Ashlee would read through the braille and map the music on a scatterplot in her head where the intervals were represented by the shapes, which stretched out horizontally to represent their rhythm in time. The shapes moved vertically to represent pitch locations within the scale. This strategy was particularly useful for Ashlee when having to sight sing because reading braille music essentially requires quick memorization of the passage to sing accurately. Her thought process might be unique, but an educator could potentially use the graphing concept to explain pitch and rhythm relationships to sighted or visually impaired students struggling with timing or intervallic concepts.

In the Music Classroom

Throughout the blind community there are, "horror stories of teachers trying their best but being misguided into using ineffective methods due to their own unconscious stereotypes about what a blind student can or cannot do" (Chriswell, p. 24, 2015). Although a typical music teacher in the k-12 setting might not frequently have fully blind children in their classroom, being aware of support, engagement, adaptation, and modification options is important. Educators should approach each student who requires adaptations or modifications with an

open mind and blank slate. Every student walks through the door into the music classroom with their own set of preexisting knowledge and abilities. Therefore, expectations and goals for each student should be set individually. The goal is to make music an equitable classroom experience. It is the responsibility of the educator to make sure that materials are accessible to students, particularly blind students, at the same time or earlier than their peers. The following section is a review of ways to accommodate blindness in the classroom according to research and the personal accounts discussed above.

Physical manipulatives are a common addition to lessons that help make content accessible to many students. For example, it might come in handy for blind and sighted students alike to have three dimensional prints of the music staff and note values to interact with. Having manipulatives available helps to provide another kinesthetic layer to the music content being presented. For example, young students who condense faster rhythms, like multiple eighth notes in a row, might benefit from being able to compare note lengths, thereby being able to see and feel that an eighth note is half of a beat in common time. Current trends in education, such as STEAM [science, technology, engineering, arts, and mathematics] make materials like 3-D printers more accessible in schools. Creating these models could be an assignment for students enrolled in music technology courses, honors music courses, computer science courses or clubs, or creation of these materials could count for volunteer hours. There are also free 3-D print files available on the internet for use in the music classroom. Websites like *thingiverse.com* allow people to share 3-D print files or download existing files to print themselves. Photo 2.A and 2.B show example music related 3-D prints.

Photo 2.A – 3-D printed ‘lego style’ rhythm blocks.

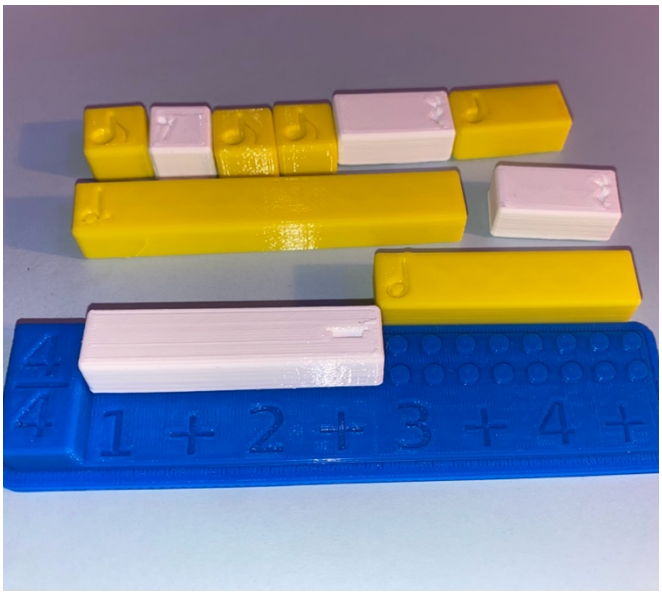


Photo 2.B – 3-D printed Rhythms with Braille

Since music teachers generally know how neurotypical students perceive and understand sound, it also makes sense that they should also know how students with visual impairments or other disabilities interpret sound. It is advantageous for music teachers to understand the way their blind students interpret sense information, particularly if they have synesthesia. With sighted students’ music teachers often relate sound concepts to feelings or colors. The same concepts could be introduced to blind students with taste, textures, or feelings. This way, they can interact with materials the same way and possibly at a deeper level then sighted peers.

Technology of course can be of use in the music classroom. The standard approach with technology would be to use recordings, either from the internet or recordings of the teacher playing the individual parts for visually impaired students to reference. Teachers could also

provide braille music, braille readers, or braille notetakers for the students to interact with music notation of some kind. Additional accommodations could be made by using technology specifically for visually impaired musicians. The *Lime Lighter*, which is a large screen tablet and associated software from the company Dancing Dots, which is for low vision musicians, might be a good option to have available in the music classroom. New technology like *Haptic Batons* could be of use if funding is available to purchase these machines. Haptic batons are motion sensitive, and the blind ensemble member would wear a bracelet that vibrates to indicate to the musician how the conductor is moving. Additionally, companies like Apple continue to make strides in technological development for those with disabilities. There are already applications that help blind people navigate the world; it is feasible that an app could be developed to act as artificial vision for musicians in the near future.

It is also important that music educators who teach blind musicians have some knowledge base in braille music. If a blind music student intends to further their study in college or wants to play with higher level ensembles, it is important that they begin interacting with braille music early and often. Music teachers might reach out to colleagues who are more familiar with braille music notation or begin learning how to read, and more importantly how to teach someone else to read braille music. The implications of not learning to read braille music are the same as a sighted musician who has not learned how to read notes on the music staff. However, it is much easier to learn how to read the music staff because the concepts of rhythm and pitch remain the same throughout the staff. Braille music notation is simply too complicated to learn to read quickly; blind music students need time and practice getting accustomed to reading and memorizing music in that fashion.

` Teachers who are looking to help visually impaired students learn to read braille music should start with resources available within their school. If they have a blind student, it is likely they already have brailling technology or a resource department for creating and purchasing braille materials. A great place to start would be with the National Braille Press, whose mission, "empowers the blind and visually impaired with programs, materials, and technology supporting braille literacy and learning through touch" (NBP - Promoting Braille Literacy, Braille Books, Braille Publications, Princeton Braillists Tactile Maps, n.d.). The organization has many free resources online as well as beginners guides to reading music braille for under twenty dollars. Also available on the website are the braille versions of common music textbooks which makes higher level music courses more accessible to those who are visually impaired.

Conclusion

Music educators have a unique place within schools to make a difference in the lives of students. In the elementary school music teachers often interact with every student throughout their time in school. Though music becomes an elective in middle and high school the arts are a common choice and sometimes even a requirement for graduation. Therefore, the education of all students, including those with disabilities, becomes a responsibility for arts educators. While not every class will have a student who is blind, a music teacher should have enough access and knowledge to make their class an accessible and equitable experience for students who do require accommodations. It is my hope that the information presented within this essay serves as a launch pad for my music education colleagues to transform their classrooms into accessible environments for their students with visual impairments.

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