A COMPARISON OF MUSICAL APTITUDE WITH READING ABILITY AND LANGUAGE DEVELOPMENT AMONG 1ST AND 2ND GRADE STUDENTS

A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF MASTER OF MUSIC

IN THE GRADUATE SCHOOL OF THE

TEXAS WOMAN'S UNIVERSITY

DIVISION OF MUSIC

COLLEGE OF ARTS AND SCIENCES

BY

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DENTON, TEXAS

MAY 2023

DEDICATION

To my husband, Matthew, for supporting me from start to finish and for the constant encouragement in the pursuit of my passions.

ACKNOWLEDGEMENTS

I would like to acknowledge the many people who have helped and encouraged me throughout these years of study. Thank you to my mentor, Dr. Baker, for her unwavering support over the years and for her constant guidance and inspiration to challenge myself. Thank you to my committee members; to Dr. Lozada, for his guidance, encouragement, and for his patience in helping me make sense of the statistical side of this project, and thank you to Dr. Thomas for his time and expertise. Thank you to the parents who so graciously allowed me to include their children in this study, and who have greatly contributed towards the field of research in this area. Thank you to the reading support specialist for providing me with valuable information prior to testing, and thank you to my headmaster and assistant headmaster for allowing me to conduct this testing at school. Finally, I am grateful to my friends and family for their constant support in the achievement of my goals, especially to my parents for instilling in me a love for music. Most importantly, I would like to thank my husband, who has been with me every step of the way.

ABSTRACT

MARY FOUGEROUSSE AUMEN

A COMPARISON OF MUSICAL APTITUDE WITH READING ABILITY AND LANGUAGE DEVELOPMENT AMONG 1ST AND 2ND GRADE STUDENTS

MAY 2023

The purpose of this study was to examine the relationships of music aptitude with literacy skills for English Language Learner (ELL) and native English speaker students in the first and second grade. This quantitative study follows a correlational design with a comparative component. This study was limited by a small sample ($N = 28$) of first and second grade students from one elementary school. Testing instruments for this study included rhythm and tonal music aptitude tests from the Intermediate Measures of Music Audiation (IMMA) and literacy measures from the Dynamic Indicators of Basic Early Literacy Skills (DIBELS), including phonemic segmentation fluency (PSF), nonsense word fluency (NWF), word reading fluency (WRF), and oral reading fluency (ORF). Results indicated that positive relationships existed between Tonal Audiation, Rhythmic Audiation, and the IMMA composite. The IMMA Composite, the Rhythmic Audiation Test, and the PSF from the DIBELS were statistically significant, favoring native English speakers over ELLs.

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CHAPTER I

INTRODUCTION

Language acquisition and reading ability are at the heart of educational programs in the United States. Evidence of the priority of the study of literacy is demonstrated by the number of states who have adopted policies that ensure teachers are trained in proven methods of reading instruction, and the reading curriculum is based on the latest findings, which prioritize and support student literacy (Schwartz, 2022). While music does not rank at the same level of curricular importance as reading, research has shown that the study of music parallels language acquisition because they use the same part of the brain (Gromko, 2005), share auditory impact (Kraus & Banai, 2007), and teach phonological awareness (Hallam, 2010). Hallam (2010) explained that music lessons are particularly impactful on the language and literacy development of children due to the active state of their brains' development. Research indicates that phonological awareness, understanding of the alphabetic principle, and the ability to name letters without hesitation–three signs of reading success–are strongly associated with music aptitude (National Early Literacy Panel, 2008).

Phonological awareness, the ability to distinguish the sounds of language through words as well as through phonemes (Degé & Schwarzer, 2011), is a vital skill towards reading development. Music lessons reinforce phonological awareness in that they frequently use literary elements of rhyme and alliteration, as well as ask students to segment words into parts, to blend, and to recognize individual phonemes (Darrow, 2008). Music aptitude consists of two components, tonal and rhythmic (Gordon, 2002). Research indicates that both tonal and rhythmic aptitude share a connection with literacy development and reading ability (David et al., 2007; Gordon et al., 2015). A child's music aptitude is developed until the age of 9 and is greatly

affected by outside influences and musical encounters (Gordon, 2007). The critical years for the development of children's reading proficiency are kindergarten through third grade (Spear-Swerling & Sternberg, 2000), culminating at the same age as the development of music aptitude. The relationship between music and language acquisition opens the door to potential partnerships between the reading teacher and music specialists. The impetus for this study was to determine what my role, as an elementary music educator, could be in supporting the language and reading development of my students.

Statement of the Problem

It has been established that a relationship exists between music aptitude and the components of reading ability, namely, phonemic awareness (Gordon et al., 2015; Rubinson, 2010). While much research has focused on the connection shared between music aptitude and phonological awareness overall, not many have aimed to understand the relationships between tonal and rhythmic aptitude and the subtests within the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) to determine which specific connections exist among first and second grade students (Rubinson, 2010). Further, an examination of the research shows that previous studies have focused on infants, pre-school, and kindergarten-aged students (Degé & Schwarzer, 2011; Gromko, 2005; Hansen & Milligan, 2012; Patscheke et al., 2019; Rubinson, 2010; Standley, 1998). A few studies have addressed the musical impact of phonological awareness among first and second grade students separately, but not collectively (Balkin et al., 2005; Culp, 2017; Lozada, 2022). Further, studies comparing the relationships between overall music aptitude, rhythmic aptitude, and tonal aptitude with reading ability in first and second grade English Language Learner (ELL) and native English speaker students only exist for

specific language groups such as Spanish-English (Lozada, 2022) and do not address a broad range of languages.

Purpose of the Study

The purpose of this study was to examine the relationship between music aptitude and literacy skills for ELL and native English speaker students in the first and second grade. The scores of native English speakers and ELL students on subtests within the DIBELS assessment and subtests within the Intermediate Measures of Music Audiation (IMMA) assessment were compared to ascertain if there was a difference in their phonemic awareness, word reading skills, and letter recognition, as related to their rhythmic and/or tonal recognition skills. This study determined what the relationship between tonal and rhythmic aptitude was for students with varying reading ability. This investigation will enable music educators to better understand the influence that pitch and rhythmic perception have on literacy and language acquisition, thus equipping them to design lessons to specifically support language and reading development.

Research Questions

The following research questions guided this study:

1. What is the content validity for the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) and the Intermediate Measures for Music Audiation (IMMA)?
2. What relationships exist among music aptitude and reading measures from the DIBELS, including Phonemic Segmentation Fluency, Nonsense Word Fluency, Word Reading Fluency, and Oral Reading Fluency?
3. How do native English speakers compare to English Language Learner students on their musical aptitude and reading measures?

Study Variables

The dependent variables used for this study were the scores on the IMMA, Rhythmic and Tonal Subtests, which assessed levels of music aptitude and reading level as demonstrated by the individualized subtests within the DIBELS which assessed phonemic awareness as well as alphabetic understanding through phonemic segmentation fluency (PSF), nonsense word fluency (NWF), word reading fluency (WRF), and oral reading fluency (ORF). Independent variables included grade levels (first and second) and primary language (native English speakers vs. ELL).

Definition of Terms

The following list of terms is based on the testing instruments used in this study– DIBELS and IMMA Rhythmic and Tonal Subtests.

Developmental music aptitude: Developmental music aptitude is defined as a child's potential for musical ability, as affected by the conditions of the environment, and ends at 9 years of age (Gordon, 2007).

Music aptitude: Music aptitude is the capacity for accomplishment in music (Gordon, 2012). "Music aptitude is a product of both innate potential and early environmental experiences" (Gordon, 1999, p. 44).

Audiation: "Audiation is to music what thought is to language" (Gordon, 1999, p. 42). "Audiation takes place when we hear and understand in our minds music what we have just heard performed or have heard performed sometime in the past" (Gordon, 1999, p. 42). Audiation involves interpreting the sound after initially hearing it (Gordon, 1999). "Sound

becomes music only through audiation, when, as with language, you translate the sounds in your mind to give them context" (Gordon, 1999, p. 42). "Audiation is the basis of music aptitude" (Gordon, 1999, p. 43).

Intermediate Measures of Music Audiation (*IMMA*): The IMMA consists of a set of musical phrases which test rhythmic and melodic (tonal) perception in identifying which rhythms or tonal patterns are the same and which are different. While everyone has the ability to learn music, some have more musical aptitude than others. This assessment helps music educators identify their students' level of aptitude and adjust their curriculum accordingly (Gordon, 1986).

The student listens to two musical examples and must make an immediate decision as to whether or not the two choices heard are the same or different. Due to the speed required of the response, the child must use their ability to audiate. The rhythm and tonal samples are played on a Moog Sonic 6 synthesizer and a Moog Rhythm programmer. The tonal tests are without rhythm and the rhythmic tests are unpitched (Gordon, 2007).

Rhythmic aptitude: Rhythmic aptitude is the ability to learn rhythm (Gordon, 1971).

Tonal aptitude: Tonal aptitude is the ability to learn melody (Gordon, 1971).

Dynamic Indicators of Basic Early Literacy Skills (DIBELS): According to the DIBELS Eighth Edition Handbook (Biancarosa et al., 2021), DIBELS is a measurement of early literacy development that assesses phonemic awareness, the alphabetic principle, fluency, and reading comprehension. In order to track progress, DIBELS assessments are given three times a year; at the beginning, middle, and end of the school year. The tests feature different questions each time. The tests used for the purposes of this study were administered at the end of the school year. Originally, the DIBELS assessments were used to assess literacy levels amongst only kindergarten and first grade students; however, DIBELS have since been expanded to include additional subtests and grade levels. The individual subtests of which two of them have two

components for first and second grade are valid methods of assessing student achievement in the areas of literacy development as well as identifying students who may be needing more attention in this area (Biancarosa et al., 2021). These subtests may aid in understanding the progress of students and provide an evaluation for understanding whether objectives are being met as well as detect signs of dyslexia (Biancarosa et al., 2021).

Phoneme: A phoneme is the smallest unit of spoken language; it can be made up of more than one letter (Armbruster et al., 2003).

Phonemic awareness: Phonemic awareness is the ability to recognize and manipulate individual phonemes (Armbruster et al., 2003).

Phonemic Segmentation Fluency (PSF): PSF is the ability to separate the smallest units of speech (phonemes). The test administrator reads a list of words and students are given one minute to sound out the individual sounds within each word (Biancarosa et al., 2021). For example, if given the word "car," the student would say "/c/ /a/ /r/" and earn three points. This test is only given to children in kindergarten and first grade (Biancarosa et al., 2021).

Nonsense Word Fluency (NWF): asks that students either read the nonsense word as a whole or break the word down to their individual letter sounds. Students are presented with a list of nonsense words and are given one minute in which to sound out each individual letter sound or read the word as a whole (Biancarosa et al., 2021). If the word is read as a whole, the student gets credit for one whole word read correctly (WRC) and is given points for each letter sound. If the word is read by sounding out each individual letter sound, the student is given points towards the correct letter sounds (CLS). The scores are calculated separately as NWF-WRC (Words Re-coded Correctly) and NWF-CLS (Correct Letter Sounds). NWF gives an evaluation

as to whether or not students understand the alphabetic principle, which is the capacity to identify letters and match them to their individual sounds (Biancarosa et al., 2021).

Word Reading Fluency (WRF): WRF assesses the students ability to accurately read from a list of words with both regular pronunciations (decodable words like “run” and “yes”) and irregular pronunciations (non-decodable words like “are” and “one”). Students must be able to blend the phonemes to read the words (Biancarosa et al., 2021).

Oral Reading Fluency (ORF): ORF assesses the capacity for reading words in connected text. The student is given one minute to read a passage from a story as accurately as possible. If there is a 3 second or more pause, then the words are not counted as correct. However, students who change their answer to the correct one in under 3 seconds may be counted towards their total score. The total number of words re-coded and read correctly or self-corrected make up the final scores. Students are scored in two areas: total words read and words re-coded or read correctly in 60 seconds (Biancarosa et al., 2021). This is because ORF assesses both reading accuracy and reading fluency. Reading fluency is measured by the number of words read correctly in 60 seconds. For the purposes of this study, only the number of words read correctly in one minute, which was a measure of reading fluency, were assessed.

CHAPTER II

LITERATURE REVIEW

Music education can have a profound influence on many aspects of students' lives, including their ability to hear and read words they encounter in all disciplines. Several studies have been conducted on the impact music lessons have on the brain and auditory systems, which, in turn, can promote language and phonemic development (Gromko et al., 2009; Hansen & Milligan, 2012; Kraus & Banai, 2007; Patscheke et al., 2019; Shahin, 2011). Research shows that a connection exists between the study of music and reading achievement (Lamb & Gregory, 1993, McMahon et al., 2003; Standley & Hughes, 1997).

The National Association for Music Education (NAfME, 2014) lists 19 benefits of having music in schools, including the development of language and reasoning, a mastery of memorization, increased coordination, emotional development, pattern recognition, auditory skills, teamwork promotion, and creative thinking skills. Interestingly, the first item listed is: "Musical training helps develop language and reasoning: Students who have early musical training will develop the areas of the brain related to language and reasoning" (NAfME, 2014, para. 2).

Extra-Musical Benefits of Music Training

While the objective of music training is building musical skills, there are a number of extra-musical benefits, such as increased literacy, effects on linguistic capabilities such as vocabulary, brain plasticity, and second language acquisition skills. Gardner's (1993) theory of multiple intelligences indicated that music education addresses a variety of intelligences, including bodily-kinesthetic, musical, mathematical, linguistic, interpersonal, spatial, and intrapersonal. He goes on to say that the subject matter of songs that students sing in the

classroom may connect to other aspects of the curriculum, and students may connect what they are learning in music to other subject areas. In addition, Gardner explained that the literary elements of songs, such as rhyming words and alliteration have a direct impact on reading ability.

Gordon (2007) maintained that the early elementary grades were vital for growth in all areas of academics, especially prior to the age of 9. A study of first graders conducted by Balkin et al. (2005) revealed that music aptitude and academic performance are related. They found that first graders who underwent 30 extra minutes per week of Kodály instruction for 1 year, in addition to their regularly scheduled music classes, had higher reading scores on the Metropolitan Achievement Test (MAT) than those who did not undergo the extra music training. The first grade teachers worked together to enhance learning, with the reading and math teachers infusing their lessons with musical skills and music teachers strengthening and supporting academic concepts within their music lessons. In addition, Balkin et al. (2005) noted that teachers helped students relate punctuation in written work to pitch in musical works.

Impact of Music Instruction on Reading Ability

Music instruction can impact a student's reading ability, especially through the inclusion of singing (Hansen & Milligan, 2012). Singing can positively impact phonemic awareness and pitch awareness (Hallam, 2010; Yopp & Yopp, 1996). Additionally, if a student is familiar with the lyrics of a song, it is more likely to improve their reading ability (Towell, 1999). Singing has been known to have a positive impact on reading ability by creating more ways for the student to connect with the written text of what they are singing (Cochran, 2008). Gambill (1999) discovered that singing games had a positive impact on language and literacy achievement in

students and suggested that it could be due to the student's focus on reading the lyrics while they sang.

Reading books inspired by song lyrics, making up rhymes, and substituting words in place of others increases phonemic awareness and teaches sound isolation (Towell, 1999). Additionally, books may be used to teach rhythmic concepts through chant and speech patterns (Gauthier, 2005). Syllabic division can be learned in music classes by attaching the sounds heard to the symbols seen, much like letters and language (Hansen & Bernstorf, 2002).

The ability to perceive rhythm is also related to language skills and children who have deficits in rhythmic perception will most likely have trouble with fluent reading (O'Herron & Siebenhaler, 2007). Students demonstrate reading fluency when they read with expression, and this can be taught by teachers who model proper pausing and inflections (Armbruster et al., 2003). Suggestions for teaching oral reading fluency include reading aloud regularly and receiving instructional feedback, as well as reading in groups chorally, reading with a partner, reading along with a tape recorder, or even readers theater (Armbruster et al., 2003).

Cole (2011) reported that the amount of music training that a student has impacts his/her reading ability because the cognitive skills which are being developed are shared in both reading music and in reading books. Brain imaging technology has shown us that the corpus callosum is responsible for reading ability and connects the left and right hemispheres of the brain (Cole, 2011). Fallin (1995) explained that "children's literature can complement lessons from other disciplines, but within the music curriculum it can encourage creativity, reinforce music skills and knowledge, enhance listening, and expand multicultural awareness" (p. 24). The knowledge that the study of music impacts cognitive ability and helps students learn to read is extremely valuable to music educators (Cole, 2011).

Just as with reading ability, the type of music a child is exposed to and the level of participation in music making the child experiences will influence their future involvement in music (Gordon, 1986). Gordon (1986) posited that children should listen to instrumental music regularly, both live and recorded, and that tone quality was of the utmost importance, along with a variety in dynamics and timbre. Standley (1998) agreed that instrumental music has a substantial impact on language development because students who can hear pitch and feel rhythm are better equipped to understand language. Rubinson (2010) stated, "As with the development of language, children learn to comprehend tonal and rhythmic aspects of music by giving sounds context and meaning" (p. 9). Language and music share a similar learning process and both utilize four distinct sequential vocabularies: listening, speaking or performing, reading, and writing (Gordon, 2007).

Phonemic Awareness and Music Aptitude

Phonemic awareness, one aspect of phonological awareness, is the ability to recognize and manipulate individual phonemes, the smallest unit of speech (Armbruster et al., 2003). Musical study strengthens phonemic awareness, due to the connections between musical patterns and phrases in spoken language, as well as pitches and notes to phonemes (Overy, 2003; Sloboda, 1985). Creating rhymes is the beginning of phonemic awareness and making a connection between poetry and music by pointing out the rhyming words within music classes can have a positive impact on the auditory discrimination abilities required for reading (Bryant, 1990). Studies indicate that there is a strong relationship between skills needed to perform rhythm and rhyme (Cheong-Clinch, 1999; Goswami, 1994).

Alphabetic understanding comes after phonemic awareness is developed, then phoneme segmentation is developed (O'Herron & Siebenhaler, 2007). Singing allows for natural blending

and segmenting of phonemes through breaths (O'Herron & Siebenhaler, 2007). Rubinson (2010) added that music makes an impact on the literacy skills of children and advocated that "chanting, clapping, tapping, dancing, and playing rhythm instruments and body percussion can teach students to feel and understand the segmentation of language necessary for phonemic and phonological awareness" (p. 52).

Phonological awareness involves the ability to identify beginning and ending sounds, distinguish individual words within a sentence and individual sounds within a word, along with an understanding of syllabic division (Ehri et al., 2001; Snow et al., 1998). Degé and Schwarzer (2011) defined phonological awareness as "the ability to analyze and manipulate language on both the word level, namely, phonological units, and on the phoneme level, namely, the individual sound units within a word" (p. 1). Reading fluency depends on the ability to decode phonemes, which is the act of matching letters to their proper sounds to sound out words (Phillips & Torgensen, 2006; Rubinson, 2010). It is from building this ability to speak that children learn to read and write, as well as understand the structure of language (Gordon, 1999).

PSF is the only true measure of phonological awareness within DIBELS, whereas the other subtests measure different aspects of reading ability, such as alphabetic understanding, reading fluency, and reading comprehension (Biancarosa et al., 2021). Phonological awareness testing may also contribute towards early recognition of reading disabilities (Good et al., 2002). Overy's (2003) study of dyslexic children revealed that lessons which emphasize rhythmic practice could increase their phonological awareness leading to a higher level of reading achievement.

Phonological Awareness and Music Aptitude

Music aptitude is related to phonological awareness (Rubinson, 2010). In a study conducted by Culp (2017), second graders were given a phonological test and a music test and the resulting scores were closely related. Rubinson's study (2010) revealed connections between PMMA (Primary Measures of Music Audiation), Rhythm Raw Scores, and DIBELS PSF. Further, Rubinson found both strong and moderate-sized positive correlations between tonal aptitude and phonemic awareness, but no significant connection was found between DIBELS NWF and music aptitude. She also found that pitch discrimination skills positively impact reading lessons and phonemic understanding. The correlation between phonological awareness and tonal discrimination was significantly higher than between phonological awareness and rhythmic ability (Rubinson, 2010).

In Lozada's (2022) study of the relationships shared between phonological awareness and music aptitude in first grade bilingual Spanish and English-speaking students, he found a statistically significant correlation between music aptitude and phonological awareness in Spanish-speaking children. However, although there was a correlation between phonological awareness and music aptitude in English-speaking children as well, it was not statistically significant.

Pitch and rhythm discrimination skills are related to reading ability (Lamb & Gregory, 1993). A study conducted by Lamb and Gregory (1993) showed that the ability to make distinctions between pitches strongly impacts reading ability. Patchsecke et al. (2019) completed a study in which they looked into the separate effects that lessons in rhythm and lessons in pitch would have on phonological awareness. They found that, in preschoolers between the ages of 4 and 6, lessons in pitch had a positive impact on their phonological awareness skills. Hansen and

Milligan (2012) agreed that phonological awareness was developed by understanding sound; this is why ear training is so important.

David et al.'s study (2007) showed a correlation between first grade students' rhythm and phonological awareness, and when they tested the same students 4 years later, a connection was still found between rhythm and reading achievement. When the musical phrase is broken down to its smallest units, a pitch or rhythmic note, it is analogous to a phoneme within a word (Sloboda, 1985). Douglas and Williatts (1994) administered spelling, vocabulary, and reading tests to groups of 7 and 8 year olds, then compared those scores to their rhythmic discrimination ability and found a connection between the students' ability to identify differing rhythms and the ability to read and spell.

Familiar songs are a useful way to encourage and engage a child by asking them to recognize the rhythm and pitch of certain songs (Gordon, 1986). Gordon (1986) maintained that the best way for students to develop audiation skills and aptitude is to allow them to work independently and experiment with pitches and rhythms. He added that it is far more enriching for students to improvise and analyze than to be accurate. Hansen and Milligan (2012) explained that musical training helps students understand pitch and rhythm and that these skills can easily translate to understanding phonemes. Research indicates that both singing and playing musical instruments can positively impact a student's phonological awareness (Culp, 2017; Degé & Schwarzer, 2011).

Research indicates that the development of musical aptitude ends by the age of 9, thus increasing the urgency for beginning music training early (Culp, 2017). Degé and Schwarzer (2011) completed a study on the impact a music program had on preschooler's phonological awareness and found a direct correlation between children who were exposed to the music

program and their phonological awareness. They claimed that this was due to a direct correlation between phonemes and music notes. The preschoolers who were part of the music program did see an increase in their phonological awareness.

In a study of kindergarten students, Gromko (2005) found that skills learned in music transferred to children's performance on phonemic awareness tasks. Hansen and Milligan (2012) conducted research on presenting the sound to kindergarteners before showing them the related symbol. They found that kindergarten students who received the sound before symbol instruction had higher phonemic fluency than those that did not. Lucas and Gromko (2007) agreed that music instruction helps students hear the individual sounds in words. They also supported the sound-to-symbol Kodály approach to teaching music.

Auditory Impact of Music on Language

Babies are exposed to the sound of their mother's voice prenatally, but Gordon (1986) explained that when they are born, they are surrounded by language, which they hear unconsciously and absorb, even if they are not responsive to it. He goes on to say this unconscious absorption of the language prepares children to develop their language capabilities. Gordon stated that reading aloud to children daily can give them quality exposure to language as well as develop speech abilities. He added that, as with unconscious absorption through reading, children should hear many different musical styles, so that they may absorb as much as they can even without understanding it. Gordon further recommended that children should move and sing along to the music.

In her study of music benefits for premature infants, Standley (1998) found that when parents sing lullabies to their children, it helps them develop language skills. She also discovered that the fetus could perceive both pitch and rhythm while in the womb. Valerio et al. (2006)

discovered that toddlers can learn to think in music and found that this mental vocabulary is different than other types of vocabulary. Valerio et al. also noted that toddlers are able to hear differences in tone and rhythm patterns when the melody is being repeated or improvised.

According to research, infants have a very high level of musicality (Brand, 1985). Brand (1985) posited that pre-school-aged children benefit primarily from music education because it is similar to language acquisition. He argued that "infants need to be exposed to music so that they can unconsciously absorb it" (p. 29). Based on the child's vocal development, he emphasized that the early years of a child's life are the most impactful, because they are beginning to form language and listening skills. This is why music classes are so important at a young age.

Phonemes, like pitch, are processed auditorily, which all affect expressive and fluent reading (O'Herron & Siebenhaler, 2007). Cheong-Clinch (1999) also discovered a connection between pitch discrimination and phonemic awareness. Music and language are both perceived auditorily, therefore, the way in which music is perceived shares a relationship with reading ability (O'Herron & Siebenhaler, 2007). A study done by McMahon et al. (2003) found that auditory discrimination skills, as well as expressive language skills, were more strongly linked to students who had studied music. Sound recognition begins in infancy (Kuhl, 2007). As babies become older they gain the ability to mimic the sounds they hear, without necessarily understanding what it is they are mimicking (Kuhl, 2007).

Degé and Schwarzer (2011) noted that the parts of the brain that process sound and music also impacted the children's language skills. They found that these "auditory processing mechanisms were shared" (p. 2), thus verifying that the learning systems for language and

music are similar. In their study of how phonemic awareness skills relate to pitch perception in children, Loui et al. (2011) tested children between the ages of 7 and 9 and found a positive relationship between pitch perception and phonemic awareness in both their production and in their neural mechanisms. They chose this age range because it is the "earliest time when measurable deficits in literacy development can be identified" (Loui et al., 2011, p. 2).

In their research on auditory processing, Kraus and Banai (2007) found that students' speech disabilities could be related to their ability to process sound. Fallin (1995) agreed that sounds from books can "come alive" in music class, as students feel the rhythm of the words they are reading (p. 27).

Music and Multilingualism

Research indicates that there is a relationship between music and learning a second language. Trollinger's study (2010) of second-language acquisition revealed that musicians learn new language more proficiently and expressively than non-musicians and suggested that it may be connected to tone detection in various languages. Research in bilingualism indicates that the brain maps all languages in both Broca's and Wernicke's area (Trollinger, 2010). In the same way, language processing and music perception share a relationship between Broca's area, which is connected to the grammatical side of the brain, and Wernicke's area, which helps the brain process vocabulary (Trollinger, 2010). When concentrating on reading the words of the song, the temporal region in the left side of the brain, where Broca's and Wernicke's areas are located, is more engaged, but when learning the melody, the right side is more engaged (Trollinger, 2010).

The brain connects what is known to what is new; it processes the new language by connecting it with languages already mastered (Curtis & Fallin, 2014). Curtis and Fallin (2014) explained that the areas of the brain used to learn a new language are more highly developed through playing a musical instrument or singing, thus musicians are poised to learn another language more easily.

The ability to learn languages might be directly impacted by one's musical ability (Schön & François, 2011). Much like language, music asks the perceiver to "segment the stream of tones into relevant units and be able to recognize these units when played with different timbres, tempos, keys, and styles" (Schön & François, 2011, p. 3). Through various experiments and tests, the researchers successfully confirmed that musicians have a "more efficient brain network involving both auditory and more integrative processing" (p. 6).

Music and language share neural connections (Levitin & Menon, 2003); thus, studies have shown that musical individuals are able to discern the sound structure of foreign languages more easily (Sleve & Miyake, 2006). Both music and language contain discrete abilities within a hierarchical structure (Patel, 2003). Young children's music learning processes are similar to those in language acquisition; therefore, it is important for teachers and parents to combine music and books to ensure music literacy as well as reading literacy (Piro & Ortiz, 2009). Children begin with acculturation, a process of being immersed in sounds of language or of music (Scott, 2004). The next step is assimilation, whereby children sing with correct breath-control while moving their bodies to the beat (Scott, 2004).

Music and language share a universal bond (Patel, 2003) and the language of a culture has an impact on the music of that culture (Patel & Daniele, 2003). Patel and Daniele (2003) found that the rhythm of a language often translates to the type of rhythms present within the

music of that culture. Musicians perceive the sounds of languages differently than non-musicians because they are more receptive towards the melodic contour of the language (Patel, 2009). Patel (2011) explained how music lessons can impact learning another language through the OPERA hypothesis:

- Overlap: Music and language perception overlap in the brain.
- Precision: The precision required in music is processed neurologically in the same way language is processed.
- Emotion: Music brings about emotional responses which can aid in learning and memory recall.
- Repetition: Music lessons require students to repeat and reinforce concepts they have already learned.
- Attention: Attention must be given towards learning music.

When all of these factors are engaged, neural plasticity takes effect and changes are made within the brain (Patel, 2014).

Neural Impact of Music and Reading

The areas of the brain that process music and reading tend to overlap and work together (Trollinger, 2010). Trollinger (2010) stated that melody and rhythm perception within both speech and music are processed in similar neural pathways. She explained that language processing and music perception share a relationship between Broca's area, which is connected to the grammatical side of the brain, and Wernicke's area, which helps the brain process vocabulary. Trollinger maintained that singing activates the whole brain, but certain parts of it are more engaged when learning specific aspects of a song. She provided the example when the singer concentrates on learning the words of a song, the temporal region in the left side of the

brain, where Broca's and Wernicke's areas are located, is more engaged, but when learning the melody, the right side is more engaged.

Neural Impact of Music and Language

Music has an unequivocal power over human emotion and cognition. With a better understanding of how music is perceived cognitively and the effects that music has on the brain, music educators may better equip themselves with teaching methods which would reinforce brain strengthening musical activities. Music plays an important role in our humanity. Music is inherent in our DNA (Scott, 2004). The auditory and visual regions of our brain work together to communicate through music. Over the years, scientists have made great progress towards understanding the human brain and we now have more methods than ever before of understanding the development and structures of the brain (Glascott Burriss & Strickland, 2001). The brain has shared neural passageways which understand and absorb music and language abilities (Koelsch et al., 2005). Ultimately, the way that music affects the brain proves the amount of influence and importance that music education has in our lives.

Standley (1998) agreed that the left side of the brain takes longer to develop and that it is this side in which language is developed. Research has shown that music training increased the size of the part of the brain that understands sound. This is another reason why music training should start very young, because this is when children's brains are still developing (Hansen & Milligan, 2012).

Hallam (2010) agreed with Ho et al. (2003), who found that verbal memory was related to music experience because they are both positioned in the left part of the brain. Gromko et al. (2009) stated that working memory allows children to learn nonsense words and tones. This helps us understand how children perceive music and how it relates to their phonemic

awareness (Lucas & Gromko, 2007). Jentschke (2005) discovered that the ERAN (early right anterior negativity) was linked to musical activities, and the ELAN (early left anterior negativity) was linked to language processing in the brain. Jentschke also discovered that these two processors are located in a similar part of the brain.

Music training has been proven to positively impact the child's brain, which directly impacts their musical and linguistic abilities (Shahin, 2011). Regarding the neurophysiological connection between speech and musical training, Shahin (2011) found that music and speech are similar from a psycho-acoustical and neuro-physiological standpoint, because they are processed in the same part of the brain and pass through the same auditory passage. This is why music practice and speech practice can impact brain stem processing (Shahin, 2011). Working memory is shared in both areas of the brain, so language and music can both be processed in the same way (Reifinger, 2018).

Music lessons impact neural processing abilities (Hallam, 2010; Munte et al., 2003). Further, Hallam (2010) found that these neural changes depended on the type of musical activity being done. For instance, violinists perceive pitch from the front of their brain, whereas drummers are able to memorize the structure of a song more easily, and conductors demonstrated that they have the strongest auditory capabilities (Munte et al., 2003). Shahin's (2011) study revealed evidence that music and speech exercises have the same impact on the same parts of the brain, namely the brain stem and the auditory cortex. Shahin also proved that the way that rhythm is understood in the brain is similar to the way that speech is understood. Therefore, musical practice helps promote the child's brain development (Hallam, 2010; Munte et al., 2003).

Due to advances in technology and science, researchers have found that music plays a tremendous role in impacting the brain's functions. Studies have discovered that those who study music before they are seven, have a larger auditory cortex (Cochran, 2008)

Electroencephalographic brain mapping revealed differences between people who were musically educated and those who were not (Petsche et al., 1993). Through the use of magnetic resonance imaging (MRI), Schlaug et al. (1995) found that musicians' corpus callosum was 15% larger than non-musicians, and musicians' cerebellum, the rhythmic center of the brain, was 5% larger in musicians than non-musicians. Musacchia et al. (2007) added that individuals who have studied music have more powerful auditory and audiovisual processing abilities within the brain than those who did not study music.

Brain Plasticity

Brain plasticity is the idea that the brain can change as it experiences new things (Wan & Schlaug, 2010). New musical experiences cause the brain to adjust and grow and thus have a tremendous impact upon the way the brain is formed (Wan & Schlaug, 2010). A study done with both monkeys and humans showed mirror neurons within the brain that are activated by what we see and hear (Trollinger, 2010). The brain is most adaptable earlier in life (Flohr, 2010). This is why learning to play an instrument from a young age changes the structure of the brain and results in a larger corpus callosum (Wan & Schlaug, 2010). A larger corpus callosum allows the frontal lobes to work together, which in turn affects motor activities (Glascott Burriss & Strickland, 2001).

In a study comparing musicians with non-musicians, keyboard players proved to have more gray matter throughout their brain (Flohr, 2010). Additionally, musicians have organizational differences in the white matter part of their brains (Trollinger, 2010). The

environment that the musician was exposed to throughout life and the level of training they have completed all have an influence on brain development (Trollinger, 2010). With each new experience the brain changes. Dendrites are created as the brain's neural network grows through exposure to new things (Curtis & Fallin, 2014). Curtis and Fallin (2014) explained that dendrites help to process neurotransmitters by spreading information to various regions in the brain. They explained that when students review something, or experience it repeatedly, a fatty coating called myelin is built on the cell's axon. This process is called myelination and it helps the brain to understand new things. According to recent studies, both sides of the brain process language and music (Curtis & Fallin, 2014).

Neural Pathways of Learning

There are many neural pathways by which information is gathered and learned. The semantic pathway of the brain focuses on words and terminology and the episodic pathway triggers memory recall (Walter & Walter, 2015). Repetition strengthens both the automatic memory pathway and the emotional pathway (Walter & Walter, 2015). In Curtis and Fallin's (2014) study, musician groups performed better on motor-sequencing and rhythmic tasks, leading them to conclude that instrumental music training significantly changes the brain in the temporal and frontal lobe as well as in the cerebellum. Walter and Walter (2015) found that when the brain learns something, a synapse occurs, meaning electrical nerve impulses occur between the neurons. They also discovered that as the brain engages in repetitive motions, or review of material, synaptic relationships are created. Then myelination occurs, meaning the glial cells coat the myelin around the axons. Walter and Walter went on to explain that, as the axons are covered with myelin, the brain can control the speed of neuron transmission so that the messages from around the brain are carried to the right synapse. The synapse then passes the

message on. They explained that if the timing is off, the synapse may lose the message and myelination may fail to occur.

Music and Linguistic Development

Music is deeply ingrained in us and is a means of expressing ourselves. Music was used as a means of expression when the vocabulary to express oneself did not exist yet (Trimble & Hesdorffer, 2017). Plato also reflected on the emotions associated with each of the musical modes (Trimble & Hesdorffer, 2017). Langer (1951) believed that music is symbolic of emotional experience and reveals what words cannot.

Both active and passive participation in a music lesson invariably affect the brain. Naturally, active participation has a larger impact on the brain than passive participation does; however, even passive participation can affect the memory (Weinberger, 2000). Scott (2004) underscored Pestalozzi's stance on the school music curriculum when she stated that children must be fully engulfed in the subject through a curriculum built on discovering music for oneself through independent play. Scott explained that during independent play the child is actively participating in the lesson through self-discovery. She added that children crave order and, when given the chance to improvise with instruments, children naturally brought structure to the notes. Scott maintained that improvisation is one of the best ways to bring about independent learning.

Language and music are both developed by listening and doing (Scott, 2004). Scott (2004) explained that to learn to speak, children must first form a strong foundation of vocabulary; likewise, to become musically literate, children must first have a true understanding of how to read and write music. Scott maintained that students ought to mirror what they hear from the music teacher to gain true understanding. Scott compared the way a baby beginning to

babble does not understand what is being said, but simply mimics the sounds around her, to the way children ought to mimic the sounds of music. Scott stated the music mimicking process, or acculturation, leads to students assimilating what they hear, thus beginning the development of musical understanding.

Gordon (1999) established a music learning theory that likened the learning of music to the learning of language. Initially, infants cannot speak and must therefore spend time listening to the language around them, then as they grow, words become meaningful and they begin to mimic what they hear as well as gain the ability think in words. After this stage, enough vocabulary has been introduced to them in order for them to begin to read and write and eventually they learn the grammatical aspects of language; A similar process takes place when children learn music (Gordon, 1999).

According to Piaget's theory, children go through four stages of cognitive development: the sensorimotor stage (birth to 2 years), the preoperational stage (2 to 7 years), the concrete operational stage (7 to 11 years), and the formal operational stage (11 years onward; Driscoll, 2005). Driscoll (2005) pointed out that during the preoperational stage, between the ages of 2 and 7, children's language skills increasingly develop and children become more self-expressive, thus making this time period critical for reading acquisition.

Impact of Home Music Environment

Music aptitude can be affected by the quality of children's musical activities, both at home and in an educational setting (Gordon, 2007). Gordon (2007) posited that music aptitude can be found in all children to a certain degree, but it is the child's home environment which affects the development of their musical abilities. Family plays an important part in a child's sense of self (Creech, 2009). Research shows that many families share in a joint musical

identity and the support from parents and the importance placed upon musicianship by the parents influences the students' musical identity (Borthwick & Davidson, 2002). Ultimately, parental involvement affects the level of student's musical achievement (Isbell, 2008).

Mehr (2014) investigated the relationship between those who had received musical experiences in their youth and the impact this had on the frequency of their music-making in adulthood and found an intergenerational connection between the two. He found that the amount of musical experiences his participants had acquired in their youth impacted the quality and frequency of the musical experiences they provided to their own children. Mehr's study revealed that there was no significant correlation between those who had early childhood experiences in music classes and adult music making, but those who had musical experiences in a home environment as a child were significantly more likely to continue their musical participation into adulthood as well as provide musical experiences to their own children.

Harding (1989) investigated third grade students and their musical backgrounds and discovered that there was a significant relationship between students who had many musical experiences in their youth and their language skills past second grade. Harding analyzed the effects that early exposure to music had on the language skills of third grade students, in the areas of mechanical and expressive language capabilities as well as reading and spelling abilities. Harding found that a relationship does exist between those who had early music exposure and their language and reading abilities, specifically in the areas of expressive language, reading, and spelling. Gordon (1986) recommended that a child be encouraged to succeed musically and be exposed to music regularly in their home environment, including hearing, composing, and practicing music regularly.

Music and Movement

Nadon-Gambrion (1984) found that music and movement relate to language learning; rhythmic elements of playing an instrument and moving to music help the student to understand and feel a phrase. She explained that clapping and becoming kinesthetically aware can help with understanding the phonemic relationship of the words. In her research on the effects of rhythmic movement, Hallam (2018) found that movements such as stamping and clapping while singing or chanting strengthens literacy development. The child should not only listen to music regularly to allow for absorption, the child should also sing and move to music rhythmically (Gordon, 1986). Students are most engaged in lessons when teachers use call-response, walking fast to the music, and repetitive gross movement (Cooper, 2010).

Implications for Music Teachers

According to Gordon (2007) a student's musical aptitude is in the developmental stage until the age of 9 years old. Therefore, formal and informal music lessons are most important in the younger grade levels as they bear the most influence on musical aptitude prior to the age of nine (Gordon, 2007).

In the same way pitch and tone are the basis for auditory sound symbol relationships, so, pitch and solfege, which are like the musical alphabet, are the key musical elements used to promote phonological awareness (Patscheke et al., 2019). Patscheke et al. (2019) suggested that music training focused on rhythm could be beneficial for children with dyslexia or for children considered to be at risk due to their deficiencies in phonological awareness. Furthermore, Patscheke et al. agreed with Verney (2013), who found that training in rhythmic activities led to increased phonological awareness, especially rhymes and syllabic awareness. The music

teacher ought to model singing of songs in the proper vocal range, recite chants and rhymes, and demonstrate rhythmic control (O'Herron & Siebenhaler, 2007).

Music educators may use songs in their curriculum that initially enforce simple rhythmic and melodic elements but grow in difficulty throughout the year (Cochran, 2008). In order to affect a student's music aptitude, spontaneous singing is recommended because they are asked to respond in the moment (Gordon, 1986). Gordon (1986) suggested that students and teachers sing instructions throughout the lesson and encourage students to respond in song. It is the teacher's duty to model correct pitch, and rhythm so that the student, in turn, imitates the correct pitch and rhythm (O'Herron & Siebenhaler, 2007).

Gordon (1986) understood that all children have the capacity to speak; therefore, they ought to have the ability to learn to sing. However, Gordon purported that just as children must be taught to speak by exposing them to language, so must they be taught to sing by exposing them to proper technique. He maintained that proper singing position, both while seated and standing, as well as breath control, are skills which students must be taught. The recommendations for proper breath control and posture can be found within the IMMA handbook (Gordon, 1986). The National Standards for Music Education (Music Educators National Conference [MENC], 1994) propose that singing is a valid way in which to enrich musical development.

Independent singing develops tonality (Gordon, 1986). Gordon (1986) stated that the teacher ought always to give the correct starting pitch and tempo prior to inviting the class to join in singing. He proposed that tonal phrases be taught independently from rhythm and rhythmic phrases should be taught using a single pitch. Further, Gordon believed that rhythmic and tonal patterns should be practiced separately, as well as within songs. Overy (2003) found

that rhythm practice influences auditory, visual, and motor skills, which aid the brain in processing information more quickly, thus helping to develop phonological awareness. Overy (2003) also determined that singing and rhythmic practice affect phonological awareness levels in both neuro-typical students as well as those who struggle with dyslexia. Findings from a study done by Rubinson (2010) supported the notion that music classes which emphasize rhythm skills have a positive impact on both spelling and phonological awareness. Additionally, Goswami (1994) found that good rhythmic sense is related to recognition of rhyme and alliteration.

Teachers should be open to collaborating amongst grade levels, especially in the areas of language arts, reading, and music. It would be fruitful for language arts teachers as well as music teachers to undergo training with one another in which aspects from each discipline are presented so that each are prepared to reinforce skills in the classroom, such as appropriate music-modeling as well as emphasis on steady beat, poetic fluency using chant, and articulation and tone quality for young students (O'Herron & Siebenhaler, 2007). All teachers in the school must have the desire to work together in order to make a significant difference on the student's level of achievement (O'Herron & Siebenhaler, 2007).

Small group work during music class is good practice for students in working together to build musical and literacy skills (Gardner, 1993). In a study conducted by Cheong-Clinch (1999) it was concluded that lessons which distinguish between pitch and rhythm ought to be included in language lessons to foster phonemic awareness. Adams and Bruck (1995) recommended the inclusion of songs, chants, and word games to train the students' ear toward the structure of language.

Teachers may help their students grow in phonemic awareness by organizing their lessons from most easily grasped to most difficult. For example, teachers might begin with

something familiar such as rhyming words, and then move on to syllabic division, and lessons which teach onset and rime, and eventually activities that emphasize individual phonemes (Yopp & Yopp, 2000). Yopp and Yopp (2000) recommended that "activities should be organized by the size of linguistic units emphasized such as rhyme, syllables, onset rime units, or phonemes" (p.135). Yopp and Yopp (2000) encouraged activities such as asking students to match, isolate, or blend sounds. They added that auditory cues (e.g., when students are invited to clap the number of syllables in a word and relate that to musical note rhythm) are also excellent ways in which to help students grow in their literacy and musical development. Yopp and Yopp (2000) also recommended having phonemic awareness activities in both the music and literature classrooms. These activities could include a classroom scavenger hunt in which students are given a bag with a letter on it and a picture of something that begins with that letter, then students are tasked with finding things in the classroom that begin with that same letter sound.

Music Education Advocacy

Research on music and the brain has come to the forefront over the past few decades and the positive impact of music on the brain has been used as an advocacy tool by music educators (NAfME, 2014). Music instruction strengthens the brain in geometrical and spatial reasoning (Cole, 2011). Modern brain imaging allows researchers and teachers to prove that music activates the whole brain (Cooper, 2010). Additionally, it has long been established that the brain undergoes changes while practicing music (Cole, 2011).

Children who are immersed in music and language are more prepared to listen and are more receptive (Cooper, 2010). Cooper noted that music teachers are encouraged to model good singing habits and enunciate the words of songs. He added that by emphasizing vocal tone

colors, children can understand the importance in understanding the tone of a piece and its effects on the music. Cooper (2010) pointed out that improvisation, which is an important part of any elementary music classroom, causes the brain to be more active than when reproducing music.

Through repetitive practice the brain's neural circuits work together to internalize the music (Scott-Kassner, 1999). Scott-Kassner (1999) explained that singing in a group can reinforce this as well as using movement to reinforce the rhythm and beat. Research indicates that music aptitude is correlated to reading achievement in young children (Cheong-Clinch, 1999; Lamb & Gregory, 1993). Quality music instruction has been proven to have an effect in other academic areas which helps promote the use of music in the classroom for the benefit of all academia (Gordon, 2007).

Singing has been proven to increase the vocabulary of English language learners (Cochran, 2008). This finding promotes the use of singing games in the classroom as it allows the English language learner to connect with the words they are singing (Cochran, 2008). Hock et al. (2009) found that "more than eight million adolescents have not mastered the reading skills necessary for them to successfully respond to the demanding secondary school requirements or compete for meaningful jobs in the workplace" (p. 22). In order to mitigate this, teacher training ought to take an integrative approach and incorporate music training for reading teachers and literacy training for music teachers to incorporate them both into lessons (Barry, 2008). Barton (1997) agreed that music teachers must be versed in "content area reading strategies" in addition to their own field (p. 23).

CHAPTER III

METHODOLOGY

The purpose of this study was to understand the relationship between music aptitude and literacy skills for ELL and native English speaker students in the first and second grade. The scores of native English speakers and ELL students on subtests within the DIBELS assessment and subtests within the IMMA assessment were compared to ascertain if there was a difference in their phonemic awareness, word reading skills, and letter recognition, as related to their rhythmic and/or tonal recognition skills. This study determined whether those with high tonal and rhythmic aptitude performed better on reading assessments than those with low tonal and rhythmic aptitude.

Reading ability was assessed using a collection of standardized subtests, DIBELS (Biancarosa et al., 2021). The tests measure phonemic awareness, alphabetic recognition, and fluency, which all impact reading ability (Hintze et al., 2003). These subtests may aid in understanding the progress of students as well as provide an evaluation for understanding whether objectives are being met (Biancarosa et al., 2021).

The IMMA (Gordon, 1986) is an instrument that measures both tonal and rhythmic aptitude. The student listens to two musical examples and must make an immediate decision as to whether or not the two choices heard are the same or different. Due to the speed required of the response, the child must use their ability to audiate. The tonal tests are without rhythm and the rhythmic tests are unpitched (Gordon, 2007).

Data were used to understand the relationships between music aptitude and reading proficiency of first and second grade students. Upon receiving approval from the Texas

Woman's University Institutional Review Board (IRB), permission slips and the link to the home language and musical background survey were emailed to parents of students who were randomly selected to participate.

The population for this study was a public, charter elementary school in Texas. Students who returned a signed informed consent form indicating parental permission to participate were included in the research study. Twenty-eight first and second grade students were chosen for this study because studies have shown that this is a period in which substantial musical growth takes place (Gordon, 1986). Additionally, research among this age group regarding developmental music aptitude and reading ability is lacking.

Participants

Participants ($N = 28$) included first grade students ($n = 13$) and second grade students ($n = 15$), ages 6 to 8 years old, enrolled in a public charter school in Texas. Both ELL and native English speakers from each grade level were randomly selected. Random selection occurred by inputting all students' names into a random name generator. A recruitment email was sent to the parent or guardian of the students whose names were selected (Appendix A). To indicate their willingness for their child to participate, the parent/guardian emailed back the researcher to give their consent. Then the parents reviewed and signed the consent forms and returned them to the researcher (Appendices B and C). Students' participation was contingent upon receipt of consent from the students' parents or guardians. One consent form was signed by the parent on behalf of the student and the other was signed by the parent on behalf of himself or herself. Students also signed an assent form, which was read to them.

Collection of Data

This research was approved by the Texas Woman's University IRB prior to recruitment. As soon as IRB approval was granted, the researcher asked permission from the school headmaster and assistant headmaster to use students enrolled in the school for the study. Once permission was granted, an email was sent to randomly selected parents of first and second grade students (Appendix A). Once parents indicated they were interested in joining the study, informed consent letters on behalf of the parent participant and the child participant were sent home to be signed (Appendices B and C). The sample for this study consisted of randomly selected first and second grade students in the Spring semester of the 2021-2022 school year. Parents or guardians of each student had to return a signed consent form on behalf of themselves and a separate consent form on behalf of their child prior to testing. These forms gave information regarding the rights of the students as well as of the parents involved in the study. All students who were given permission to participate in the research study were read an assent form to which they could verbally agree to take part in the study (Appendix E). Students were then evaluated using IMMA and DIBELS subtests. Identification as an ELL or native English speaker was determined by the students' permanent records as well as information from the parent survey.

Instrumentation

Music aptitude was assessed using the IMMA (Gordon, 1986) to identify tonal, rhythmic, and overall developmental music aptitude, and the DIBELS (Biancarosa et al., 2021) was used to assess participants' reading ability.

Dynamic Indicators of Basic Early Literacy Skills

Verified by research from the National Reading Panel (NRP, 2000), and the National Reading Council (NRC; Snow et al., 1998), DIBELS is a set of measured subtests which assess the development of early literacy skills. These subtests assess phonological awareness, the alphabetic principle, fluency, and reading comprehension (Biancarosa, et al., 2021).

Intermediate Measures of Music Audiation

IMMA is used to assess developmental music aptitude for students in 1st through 4th grade (Gordon, 1984). IMMA is made up of two subtests: Tonal and Rhythm. Each subtest consists of 40 pairs of short tape-recorded tonal or rhythm patterns, lasting about 12 minutes each. The tonal patterns are played without rhythm. The durations of the pitches are of equal length so that test subjects can focus only on the tonal aspects of the patterns. The rhythmic patterns are void of melody with all patterns played on only one pitch. This enables test subjects to focus on only the rhythmic aspects of the patterns. Children deciphered between the same and different tonal and rhythmic patterns and gave their answer by circling two happy faces if the rhythms or tones were the same, or one happy and one sad face if the pairs were different (Gordon, 1986). Each student's IMMA scores were compared to their DIBELS scores to determine if there was a correlation between musical ability and phonological awareness. Further, ELL scores were compared to the scores of native English speakers in their same grade level.

A home language assessment and musical background survey was emailed to parents/guardians (Appendix D). A set of IMMA subtests was used to test individual student’s rhythm and tonal aptitude. Three scores were recorded within the IMMA: tonal, rhythm, and composite. The composite consists of the combination of tonal and rhythm scores and measures

the complete music aptitude. A set of DIBELS subtests was used to assess reading ability and phonemic awareness.

DIBELS eighth edition is updated with the latest educational standards by which knowledge is measured. The tests are developed based on the latest educational standards to "promote the validity of interpretations of test scores" (Biancarosa et al., 2021, p. 22). The sequence of questions in the subtests within the DIBELS become more challenging with each subtest (Biancarosa et al., 2021). Unlike the NWF subtest and the ORF subtest, studies have shown that the WRF subtest is a good way to discover whether students may be considered to be struggling readers (Biancarosa et al., 2021).

"The subtests offered in specific grades are aligned to curriculum and instruction typical for each grade" (Biancarosa et al., 2021, p. 8). The alphabetic principle is the ability to recognize, write, and sound out letters in the alphabet (Baker et al., 2018). This skill may be taught by sequential instruction, where the student first learns the sounds of individual letters then practices blending them to make words (Baker et al., 2018). The alphabetic principle is integral for reading success because students must have the ability to understand letters and their sounds in order to understand and produce the words they are reading (Baker et al., 2018).

One of the goals of DIBELS was to catch early signs of dyslexia, this was done by frequent testing, as well as to gain an understanding of the way that students were developing their reading skills, and to give teachers a starting point in determining how to track their skills by using "benchmark goals and timelines" (Biancarosa et al., 2021, p. 12). Data were calculated using Statistics for Social Sciences (SPSS) software.

Design of Study

In this descriptive, quantitative study, IMMA subtests were administered by grade level, and the results were compared to DIBELS subtests scores by grade level and analyzed by inputting data into a chart or a graph. The dependent variables were the scores on both exams. The results were reported in terms of their scores on both DIBELS and IMMA testing and were displayed in a chart. Parents of the student participants took a home language and musical background survey (see Appendix D).

Participants, first and second graders, ($N = 28$) enrolled in a public charter school in Texas each took various DIBELS subtests. First graders were assessed on their Phonemic Segmentation Fluency (PSF), NWF - Correct Letter Sounds (NWF-CLS), NWF – Words Re-coded Correctly (NWF-WRC), WRF and ORF. Second graders were assessed on their: NWF-CLS, NWF-WRC, WRF, and ORF.

Students were then given a music audiation test (IMMA). When compared to the DIBELS, the two IMMA subtests on tonal aptitude and rhythmic aptitude demonstrated the relationship between musical aptitude and phonological awareness. The subtests pertained to rhythm and tonal perception of similar and different patterns. Students listened to two recordings, one which pertained to rhythm and one which pertained to tone. Each recording was 12 minutes long. The students were asked to decide whether pairs of tonal or rhythmic patterns they heard sounded the same or sounded different. They indicated their choice by simply drawing a circle around two happy faces if the pair was the same, or one happy and one sad face, if the pair was different. The tests were scored and the results were put into a chart or a graph for comparison. Each student's IMMA scores were compared to their DIBELS scores to determine if there was a correlation between musical aptitude and reading ability. Further, ELL

scores were compared to the scores of native English speakers in their same grade level to determine if there was a difference in their musical aptitude and reading ability. The IMMA subtests lasted about 22 minutes and the DIBELS subtests took about 10 minutes, a total of 32 minutes for completion.

Procedure

Once parental and student consent forms were signed (Appendices B and C), the researcher read the student assent form individually to students prior to testing them (Appendix E). Once assent was confirmed, participants, first and second graders, ($N = 28$) enrolled in a charter elementary school in Texas took a series of DIBELS subtests. First graders were assessed on their PSF, NWF-CLS, NWF-WRC, WRF, and ORF. Second graders were assessed on their: NWF-CLS, NWF-WRC, WRF, and ORF. In order to track progress, DIBELS assessments are given three times a year; at the beginning, middle, and end of the school year. The tests feature different words each time. The tests used for the purposes of this study were administered at the end of the school year. After instructions were given, students heard a practice question for each subtest in order to become acquainted with the tests. For both the DIBELS and IMMA, there are scripted instructions for the test administrator to adhere to. Practice questions are provided prior to the beginning of the test in order to ensure the student understands the questions. For the DIBELS, the timer runs for 60 seconds per subtest (Biancarosa et al., 2021).

PSF is the ability to separate the smallest units of speech (phonemes). The test administrator reads a list of words aloud and students are given one minute to sound out the individual sounds within the word (Biancarosa et al., 2021). For example, if given the word "car," the student would say "/c/ /a/ /r/" and earn three points. This test is only given to children in kindergarten and first grade (ages 5-7; Biancarosa et al., 2021).

NWF asks that students either read the nonsense word as a whole or break the word down to their individual letter sounds. Students are presented with a list of nonsense words and are given 1 minute in which to sound out each individual sound or read the word as a whole (Biancarosa et al., 2021). If the word is read as a whole, the student gets credit for one whole WRC and is given points for each letter sound. If the word is read by sounding out each individual letter sound, the student is given points towards the correct letter sounds CLS. The scores are calculated separately as NWF-WRC and NWF-CLS. NWF gives an evaluation as to whether or not students understand the alphabetic principle, which is the capacity to identify letters and match them to their individual sounds (Biancarosa et al., 2021).

WRF assesses the students ability to accurately read from a list of words with both regular pronunciations (decodable words like “run” and “yes”) and irregular pronunciations (non-decodable words like “are” and “one”). Students must be able to blend the phonemes to read the words (Biancarosa et al., 2021).

ORF assesses the capacity for reading words in connected text. The student is given 1 minute to read a passage from a story as accurately as possible. If there is a 3 second or more pause, then the words are not counted as correct. However, students who change their answer to the correct one in under three seconds may be counted towards their total score. The total amount of words re-coded correctly or self-corrected make up the final score (Biancarosa et al., 2021).

Students are scored in two areas: total words read and words re-coded or read correctly in 60 seconds (Biancarosa et al., 2021). This is because ORF assesses both reading accuracy and reading fluency. Reading fluency is measured by the number of words read correctly in 60

seconds. For the purposes of this study, only the number of words read correctly in 1 minute (reading fluency) was assessed.

Students were then given a music aptitude test, IMMA (Gordon, 1986). This test contained two subtests pertaining to rhythm and tone perception and is designed to measure musical aptitude. Students listened to each recording for 12 minutes, one pertaining to rhythm and the other to tone. Before the tone or rhythm example was played, students were given the name of an object that is associated with the question. The student listens to two musical examples and must make an immediate decision as to whether or not the two choices heard are the same or different. Due to the speed required of the response, the student must use their ability to audiate. Images are used for student responses, rather than words, so students are not required to read in order to take the Tonal and Rhythm Audiation Subtests (Gordon, 1986). Students hear examples in the key of C major played twice, with a 5-second interval between for audiation (Gordon, 1986). Students circle two smiley faces if the tones or rhythms are the same and circle one happy and one sad face if they sound different (Gordon, 1986). The composite score is made up of the total points scored among both subtests. The raw scores are made up of the amount that the child got correct in 1 minute.

Both the Rhythm and Tonal Audiation Subtests were administered either before or after school to avoid missing any instructional time. The tests were scored and the results were compared. Parents took a home language and musical background survey (see Appendix D). The IMMA testing lasted about 22 minutes and the DIBELS testing lasted about 10 minutes, totaling 32 minutes.

Data Analysis Method

The assessments from the IMMA (Gordon, 1986) and DIBELS (Biancarosa et al., 2021), were used to measure music aptitude as it relates to reading achievement in first and second grade ELL and native English speaker students.

To answer research question one, which was to determine the content validity for the DIBELS and the IMMA, a Pearson correlation was conducted. This was done on all tests because it met all the assumptions, with the exception of PSF, in which the Spearman rho correlation was used because it did not meet the assumptions of the Pearson correlation.

To answer research question two, which was to identify the relationships among music aptitude and the reading measures from the DIBELS, including PSF, NWF, WRF, and ORF, a correlation coefficient was used. A Pearson correlation for parametric data and Spearman's rho for nonparametric data was used to determine how music aptitude related to literacy skills (see Figure 1).

Figure 1

Correlation Coefficients of Music Aptitude and Reading Ability Variables

Correlation Coefficients of Music Aptitude and Reading Ability Variables

	Rhythm	Melody	DIBELS Composite	PSF	NWF-CLS	NWF-WRC	WRF	ORF
IMMA Composite	r = .685** p < .001	r = .846** p < .001	r = .033 p = .866	ρ = -.184 p = .548	r = .162 p = .410	r = .156 p = .428	r = .346 p = .077	r = .170 p = .386
Rhythm		r = .192 p = .327	r = .033 p = .866	ρ = -.092 p = .766	r = .231 p = .237	r = .227 p = .246	r = .378 p = .052	r = .188 p = .339
Melody			r = -.059 p = .765	ρ = -.223 p = .464	r = .049 p = .803	r = .044 p = .822	r = .181 p = .367	r = .093 p = .640
DIBELS Composite				ρ = .440 p = .133	r = .655** p < .001	r = .678** p < .001	r = .701** p < .001	r = .692** p < .001
PSF					ρ = .652* p = .016	ρ = .601* p = .030	ρ = .230 p = .450	ρ = .155 p = .614
NWF-CLS						r = .989** p < .001	r = .800** p < .001	r = .566** p = .001
NWF-WRC							r = .778** p < .001	r = .581** p < .001
WRF								r = .771** p < .001

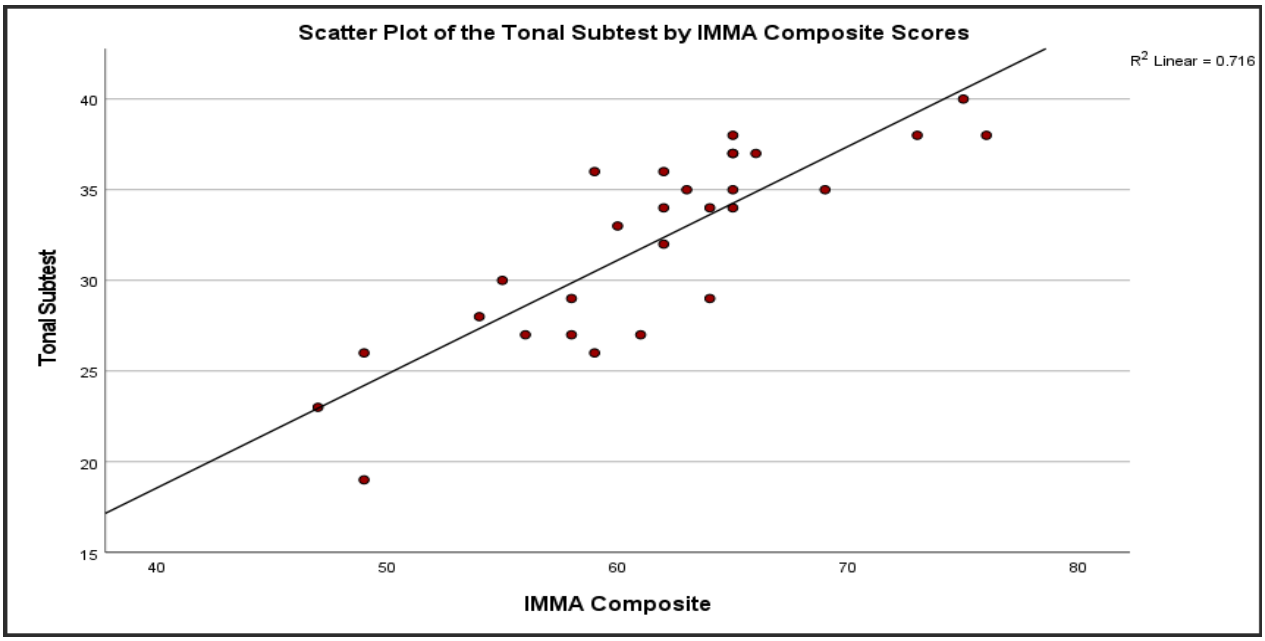
Music Aptitude: Composite, Rhythm, and Melody relationships
Literacy Skills: Composite, relationships between subtests within DIBELS
Relationships between/among the IMMA and the DIBELS
A *p*-value less than 0.05 is statistically significant.

Note. Numbers with an asterisk meant that their p-value was lower, thus increasing the probability of a positive correlation.

To answer research question three, which was a comparison between how native English speakers compare to ELL students on their music aptitude and reading measures a one-way Analysis of Variance (ANOVA) was conducted for each of the variables with the exception of the PSF (see Figure 2). Since the PSF had a lower sample size, the Spearman Rho was used.

Figure 2

Variability in Scores on Tonal Subtest



Scoring

The alpha-level was set at (.05), which is aligned with previous research in this area (Cohen, 1992). Data were calculated using SPSS software.

CHAPTER IV

RESULTS

Participants ($N = 28$) included first graders ($n = 13$; 46%) and second graders ($n = 15$; 54%). A survey was administered to the parents to identify the language(s) spoken in their home. Parents indicated that a total of 16 participants only spoke one language, while 11 participants spoke more than one language. One parent did not respond to the survey. According to the ESL data provided by the school, eight of the participants were enrolled in the ESL program, including five first grade students and three second grade students (see Table 1).

Table 1

Language Status of Participants by Grade Level

Grade level	Language status	No. of participants	% of all participants
1	Native English Speakers	8	28%
1	English Language Learners	5	18%
2	Native English Speakers	12	43%
2	English Language Learners	3	11%

In addition to English ($n = 5$), 41% of parents reported a total of nine languages spoken in the homes of the participants, including German ($n = 1$), Hindi ($n = 2$), Malayalam ($n = 1$), Nepali ($n = 1$), Russian ($n = 1$), Spanish ($n = 1$), Tamil ($n = 2$), Telugu ($n = 2$), and Urdu ($n = 1$). When asked the predominant language spoken in the home, responses included English ($n = 16$), German ($n = 1$), Hindi ($n = 1$), Malayalam ($n = 1$), Nepali ($n = 1$), Russian ($n = 1$), Spanish ($n = 1$),

Tamil (n = 2), Telugu (n = 2), and Urdu (n = 1). One answer from the survey indicated that they did not speak more than one language at home; however, when asked which language was predominant in their home, they said it was their native language. This would indicate that they spoke more than one language, English at school, and another language at home. This response could have been due to a misinterpretation of the way the questions on the survey were worded or brought on by a language barrier.

Additionally, the survey asked questions regarding the participants' musical background. When asked whether their child took music lessons outside of school, 11 said yes and reported piano (n = 7) and singing (n = 4) to be their focus of after-school study. Fifty-five percent of the participants' parents said that members of their family either sang or played musical instruments. Family members' involvement in music included: singing (n = 8) , guitar (n = 4), clarinet (n = 1), trumpet (n = 1), flute (n = 1), piano (n = 7), carnatic music (n = 1), tin whistle (n = 1), violin (n = 1), and drums (n = 1), with many reporting that they play more than one instrument at home.

This descriptive, quantitative study was administered to understand the correlation between music aptitude and literacy skills among first and second grade ELL and non-ELL students. The variables of tonal aptitude and rhythmic aptitude were compared to the reading scores from the DIBELS subtests of first and second grade students, including PSF, NWF, WRF, and ORF. Developmental music aptitude was determined from the composite scores which were a combination of both tonal and rhythm aptitude scores of IMMA (Gordon, 1986). Reading ability was measured by using individually-administered subtests of DIBELS (Biancarosa et al., 2021).

Demographic Sample Characteristics

Participants ($N = 28$) in the study were first grade ($n = 13$) and second grade ($n = 15$) boys and girls who attended a public charter school in Texas in the 2021-2022 school year and were given parental approval to participate in the study. English was the primary language spoken by 59% of participants, while 41% primarily spoke a language other than English at home (see Table 1).

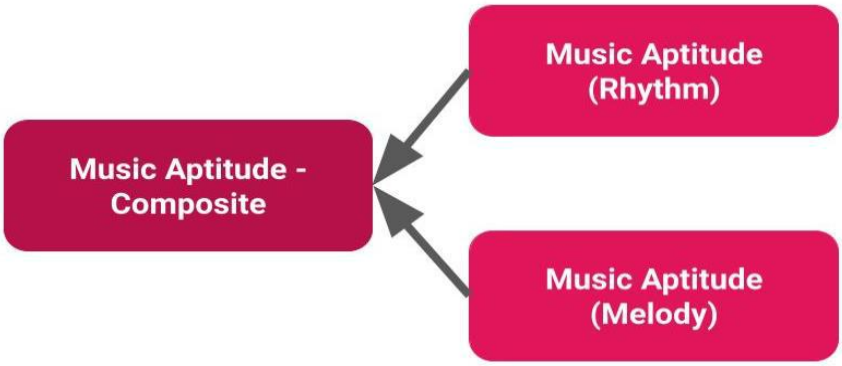
Research Question One

Research question one – "What is the content validity for the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) and the Intermediate Measures for Music Audiation (IMMA)?" A Pearson correlation was conducted on all the IMMA and DIBELS tests with the exception of the PSF. This was done on all tests because it met all the assumptions, except for PSF, which was calculated using the Spearman rho.

Both subtests for the IMMA correlated with the total score (see Figure 3). The Rhythm Subtest had a large positive relationship with the total score ($r = .685$, $p < .001$) while the Tonal Subtest had a substantial positive relationship ($r = .846$, $p < .001$; Cohen, 1992). This test was highly correlated, thus meaning that the test validity of the IMMA can be inferred. The tonal (melody) and the rhythm contribute to the total composite score as they are both aspects of it; however, they are not related to one another. Therefore, a student who earns a high score on the Rhythm Subtest is not guaranteed to also have a high score on the Tonal Subtest. Each test stands alone as a discrete ability.

Figure 3

Subtests Within the IMMA Assessment

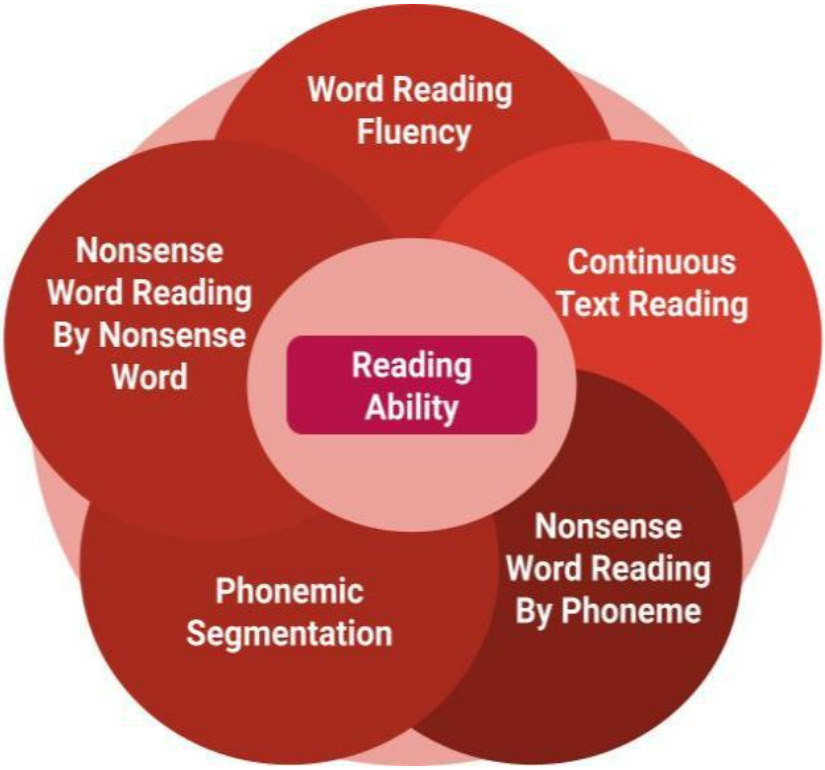


The subtests for the DIBELS correlated with the total score except for the PSF, for which a Spearman's rho correlation was used ($\rho = .420$, $p = .135$). The NWF-CLS ($r = .655$, $p < .001$), NWF-WRC ($r = .678$, $p < .001$), and ORF ($r = .692$, $p < .001$) had large positive relationships with the total score. All the subtests within the DIBELS were calculated to build the composite score (see Figure 4). Data indicated the DIBELS subtests were strongly correlated, with a p-value < .05, except for the PSF. Only first graders took the PSF, resulting in a smaller participant pool and an insufficient number of data points. Thus, the Spearman rho was used to calculate correlation.

Figure 4 is labeled by the construct that was tested, therefore, Reading Ability means composite score, Nonsense Word Reading by Nonsense Word is NWF-WRC, and Nonsense Word Reading by Phoneme is NWF-CLS, Continuous Text Reading is ORF, which is the ability to read sentences fluently in the context of a story. Each subtest that was tested contributes to the overall composite, which is Reading Ability.

Figure 4

Subtests Within the DIBELS Assessment



Research Question Two

Research question two – "What relationships exist among music aptitude and reading measures from the DIBELS, including Phonemic Segmentation Fluency, Nonsense Word Fluency, Word Reading Fluency, and Oral Reading Fluency?"

To identify the relationships among music aptitude and the reading measures from the DIBELS, including PSF, NWF, WRF, and ORF, a correlation coefficient was used. A Pearson correlation for parametric data and Spearman's rho for nonparametric data was used to determine how music aptitude related to literacy skills (see Figure 1). No statistically significant relationships were found between music aptitude and literacy measures. This could have been due to the small sample size or the nature of the DIBELS assessment.

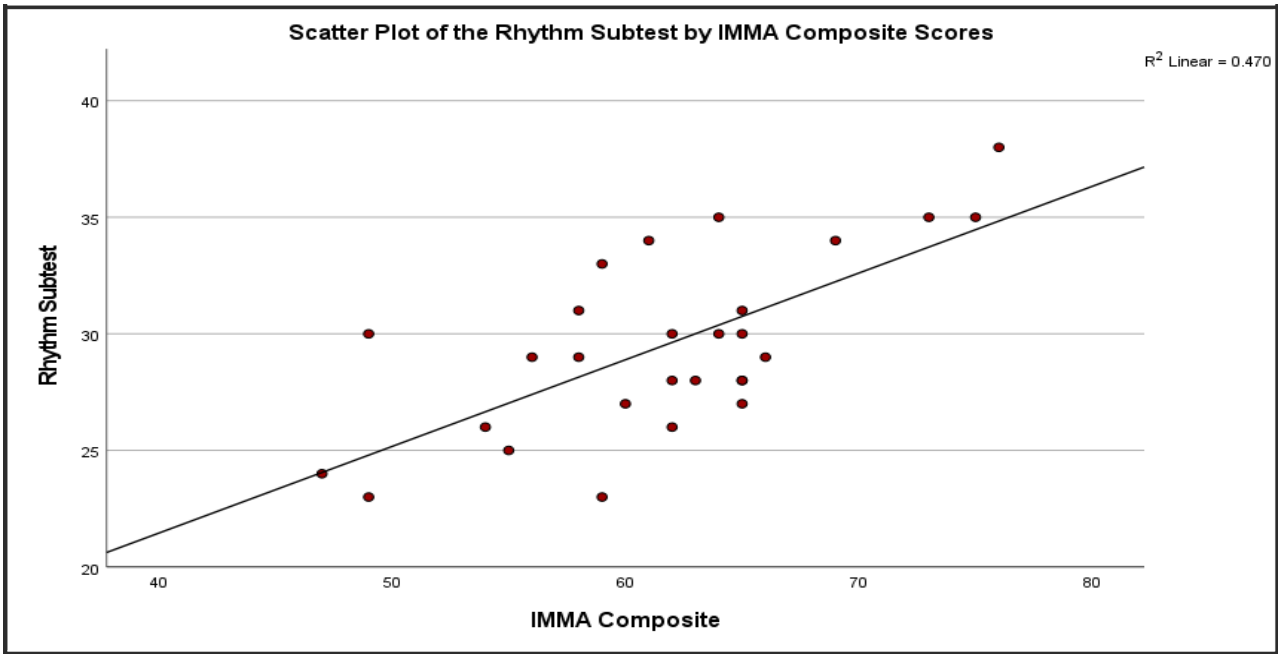
None of the relationships shared between the IMMA and the DIBELS were statistically significant. The DIBELS was not a robust measurement for reading ability because each of the subtests were not discrete but correlated with each other. In other words, the variables each had a strong relationship with one another.

Seventy-one percent of the variability in the scores could be accounted for by their Tonal Subtest as shown on the scatterplot. There were more students who were on the line of best fit for the Tonal Subtest (see Figure 2).

Forty-seven percent of the variability of the scores was explained by the Rhythm Subtest; therefore, it was more dispersed (see Figure 5). Those on the line of best fit were within the trend. There was a positive relationship between the Tonal Subtest and IMMA composite and the Rhythm Subtest and IMMA composite.

Figure 5

Variability in Scores on Rhythmic Subtest



Research Question Three

Research question three – "How do native English speakers compare to English Language Learner students on their musical aptitude and reading measures?"

A one-way ANOVA was conducted for each of the variables to compare how native English speakers compare to ELL students on their music aptitude and reading measures (see Figure 6). The Spearman Rho was used for the PSF, due to a lower sample size since only the first graders took this subtest, and there was no statistical significance. The tonal score for the IMMA did not show statistically significant differences between ELL and native English speaker students. This may have been due to the fact that in identifying whether the tones were the same or different, the instructions were not as clearly understood or the students may have been

distracted. The DIBELS composite, NWF-CLS, NWF-WRC, and ORF did not show statistically significant differences between ELL and native English speaker students. One participant was missing data due to not taking one portion of the DIBELS. However, the participant's composite score was not affected because it was taken into account by the testing instrument that the student did not need to take that portion of the assessment.

For the IMMA composite, there was a statistically significant difference, $F(1,27) = 5.570$, $p = .026$, favoring native English speakers ($M = 63.5$) over ELL ($M = 57$) students. This may have been due in part to the fact that the Rhythm Subtest on the IMMA favored native English speakers, so those scores contributed to the overall composite score and made it greater for native English speakers. For the Rhythm Subtest there was a statistically significant difference, $F(1,27) = 4.257$, $p = .049$, favoring native English speakers ($M = 30.4$) over ELL ($M = 27.25$) students (see Figure 6).

Figure 6

Correlation of Mean IMMA and DIBELS Scores Between ELL and Native English Speakers

Language Status	IMMA	Rhythm	Tonal	DIBELS Composite	PSF	NWF-CLS	NWF-WRC	WRF	ORF
ELL	57*	27.25*	29.75	478.13	43.60*	116.00	35.25	57.00	91.63
Native English Speakers	63.5*	30.40*	33.10	487.55	61.75*	121.25	38.10	66.65	115.95

*$p < .05$

The composite raw score is a good predictor of music aptitude and may be used to determine which students have high music aptitude (Gordon, 1986). If the composite raw score is the same or higher than the criterion composite raw score for IMMA, then the student is thought to have high overall music aptitude (Gordon,1986). Additionally, if a student achieves the criterion score for the Rhythm or Tonal Subtest and the composite, he or she is considered to have high overall music aptitude (Gordon, 1986). Comparison between the students' raw

composite score and the criterion composite raw score determines the level of music aptitude the student possesses (see Table 2; Gordon, 1986). Only three second grade students scored at benchmark or above on both the DIBELS composite and criterion level of IMMA composite. Students who scored at the benchmark goal or above for DIBELS composite were considered to be low risk for reading complications (Biancarosa et al., 2021).

Table 2

Percentage of Students who Scored at Benchmark level for DIBELS or Criterion level for IMMA

Measurement	1st Graders out of 13	% of 1st Graders	2nd Graders out of 15	% of 2nd Graders
Scored at Benchmark or above on DIBELS Composite	10	76%	10	66%
Scored at or above Criterion Level of IMMA Composite	0	0%	3	20%
Scored at benchmark or above on both DIBELS Composite and Criterion Level of IMMA Composite	0	0%	3	20%
Scored at Criterion Level for Tonal	3	23%	6	40%
Scored at Criterion Level for Rhythmic	1	7%	1	7%

Interestingly, 66% of second grade students who scored at benchmark or above on DIBELS composite reported having either taken music lessons outside of school or came from a musical family. Additionally, all three second graders who tested at the criterion level for music aptitude demonstrating that they had exceptionally high music aptitude either came from a musical family or took music lessons outside of school as reported by the Home Language and Musical Background Survey. All others who tested above average benchmark on DIBELS came from a musical family. While no first graders scored highly on both IMMA composite criterion and DIBELS benchmark, 76% of first grade students who scored at benchmark or above on the DIBELS composite also reported having musical family members, or reported taking music lessons outside of school. Only three first grade students reported not coming from a musical family and not taking music lessons outside of school, but they did report speaking a second language.

CHAPTER V

DISCUSSION

The purpose of this study was to understand the relationships between music aptitude and literacy skills for first and second grade ELL and native English speaker students. Several studies have pointed to the relationship between music aptitude and reading achievement (Douglas & Williatts, 1994; Gromko, 2005; Lamb & Gregory, 1993), but this study added the component of ELL and focused on first and second grade, critical years in a child's acquisition of reading skills and development of musical talent.

Based on the results from the Home Language and Musical Background Survey, it was discovered that home music environment and additional music lessons outside of school do have an impact upon reading ability and music aptitude as many of those students scored above criterion level on their IMMA music aptitude tests and above benchmark on their DIBELS reading tests. This idea that music in the home environment is predictive of greater musical achievement is supported by previous research (Gordon, 2007; Isbell, 2008). This study indicated that students who live in a musical environment and take music lessons also excel in their reading ability.

These data provided mixed results about content validity. The IMMA testing revealed positive relationships between tonal audiation and rhythmic audiation and the IMMA composite. Each subtest relationship was not statistically significant, which suggests they are discrete abilities. For the DIBELS subtests, there were large positive relationships observed except with the PSF; however, each subtest had a substantial or large positive relationship with another subtest, which suggests these are not discrete abilities, but are highly correlated. These results

should be viewed with caution, due to the small sample size and the way in which the DIBELS is constructed, as well as the small portion of subtests used in this study.

There were statistically significant differences between ELL and native English speaker students, favoring native English speakers for the composite and rhythmic IMMA scores. The PSF subtest for the DIBELS was also statistically significant, favoring native English speakers. This may suggest that ELL and native English speaker students perform at the same levels in regard to literacy measures. However, these data suggest that ELL students may need direct music instruction for prolonged periods, especially in rhythm practice, to reap the benefits of music training on their literacy.

Music educators can enhance students' reading skills by infusing their lessons with brain-strengthening activities and using movement, singing, improvisation, and active-music-making to boost their students' cognitive skills. The knowledge that music affects brain development and language acquisition because they use the same part of the brain (Cole, 2011; Gromko, 2005), share auditory impact (Kraus & Banai, 2007), and teach phonological awareness (Hallam, 2010) gives teachers a deeper understanding of the impact of music lessons.

Research shows that both tonal and rhythmic aptitude share a connection with literacy development and reading ability (David et al., 2007; Gordon et al., 2015). Music lessons in the lower grade levels have the greatest impact upon music aptitude and literacy development, because studies have shown that music aptitude becomes fixed at the age of 9 (Culp, 2017; Gordon, 2007). Music teachers may use syllabic division to connect the sounds heard to the symbols seen, similar to letters and language. (Hansen & Bernstorf, 2002). The cognitive skills developed in music lessons have an impact on both note reading ability and word reading ability, therefore, the amount of music training received has a direct impact upon the students' level of achievement (Cole, 2011). The neural connection between music and language (Levitin &

Menon, 2003), has been shown to enable musicians to readily decipher the sound structure of foreign languages (Sleve & Miyake, 2006). The numerous extra-musical benefits that come from being exposed to a musical environment, whether inside the classroom or at home, are undeniable (Gardner, 1993).

Limitations and Recommendations for Future Study

This study was limited by the small sample ($N = 28$) of first and second grade students from only one elementary school. Due to the small sample size, statistical significance was also affected. Additional research is needed, using a larger sample size from multiple schools. Further, additional testing could be conducted on ELLs from a variety of cultures and compare their music aptitude and literacy skills with both native English speakers and non-native English speakers.

Future studies may aim to further understand the link between music aptitude and reading achievement by tracking students' progress between grade levels over the years. Research could be done in this same area, but substituting the DIBELS assessments for the PAST (Phonological Awareness Screening Test) in order to truly gain an understanding of the child's phonological awareness as compared to their rhythm and tonal aptitude, since the DIBELS only provided information regarding the student's phonemic awareness, which is a part of phonological awareness. Per Texas Education Code (TEC) §38.003, the Texas Education Agency (1995) requires DIBELS testing because it provides screening for dyslexia and gives teachers a method for monitoring their students' progress. Additionally, Gordon (1984) established that IMMA ought to be administered to students who have already taken the PMMA and who may have scored above the 80th percentile on the rhythm and tonal of PMMA. So,

further studies might compare PMMA rhythm and tonal scores to the PAST or the Phonological Awareness Test (PAT-2).

Conclusion

Music classes taught by knowledgeable and committed educators can have a positive impact on students' learning. Whether it is through their auditory cortices or their brain, music lessons impact phonological awareness, which impacts literacy and language acquisition. A positive relationship exists between music aptitude and phonological awareness (Gordon et al., 2015).

Music teachers, reading specialists, and core subject teachers may use this information to inform their lessons and work together in helping students progress in these abilities and in detecting any deficits. Special care should be taken towards developing both tonal and rhythmic audiation skills for ELL students, as well as phonemic segmentation skills, in order to build fluency in that area. Culp (2017) noted that few studies have existed which used standardized measures to understand the relationship between music aptitude and phonological awareness among students between the ages of 6-8 years old. This study could make a major contribution in the field of music education.

Results from this study aimed to establish what relationships existed among music aptitude (IMMA; Gordon, 1986) and DIBELS reading measures; PSF, NWF, WRF, and ORF (Biancarosa et al., 2021). The DIBELS test proved to not be a true measure of phonological awareness, as it only tested phonemic awareness through the PSF, which is only one aspect of phonological awareness. This study could be immensely beneficial to reading specialists, core subject teachers, and music teachers in collaborating with one another to assist first and second

grade students in acquiring phonological awareness, improving their rhythmic and tonal perception, and in their language acquisition skills.

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APPENDIX A

RECRUITMENT EMAIL TO PARENTS

Greetings,

My name is Mary Fougerousse and I am your child's Kindergarten thru Second Grade music teacher. I am also currently a graduate music education student at Texas Woman's University. Under the supervision of my professor, Dr. Vicki Baker, I am in the process of conducting research for my study entitled "A Comparison of Musical Aptitude with Reading Ability and Language Development Among 1st and 2nd Grade Students."

The purpose of this study is to understand the impact that music education in a school environment has on phonological awareness and other language acquisition skills in 1st and 2nd grade students between the ages of 6-8 years old. The aim of the study is to establish which musical experiences most strongly impact their language development. The musical experiences emphasize rhythm and pitch exploration.

Participation in this study is voluntary. There is a potential risk of loss of confidentiality in all email, downloading, electronic meetings, and internet transactions.

Please read on to find out more information about this study and let me know if you are willing to participate.

If you are interested in participating in this study, please email me at mfougerousse@twu.edu **as soon as possible** and I will send you the informed consent forms to fill out and return to me either electronically or in person at school.

Should you wish to participate in this study below you will find what will be included:

1. Parents will complete a Google Form providing information regarding their child's home language and musical background. Completion of the form will take approximately 5 minutes.

2. A set of rhythmic and tonal Intermediate Measures of Music Audiation (IMMA) subtests will be used to test individual student's rhythm and tonal aptitude.

- Children take the test by simply listening to a tonal recording and a rhythm recording. Each recording is 12 minutes long.

- Questions on the CD are identified on the answer sheet by pictures, not numbers or words. The children must decide whether pairs of tonal or rhythm patterns they hear sound the same or different. They indicate their choice by simply drawing a circle around the picture on the answer sheet. These tests require no reading skills.

- The answer sheets can be corrected quickly by using scoring masks. Raw scores are directly converted to percentile ranks in the manual.

- A profile card is used for each child for individual documentation and the interpretation of scores. The tonal and rhythm results are graphically compared for each child.

3. A set of Dynamic Indicators of Basic Early Literacy Skills (DIBELS) subtests will be used to assess reading ability and phonemic awareness. This standardized test will determine children's literacy development.

The first subtest for 2nd grade students will assess students' Nonsense Word Fluency (NWF).

NWF is a standardized, individually administered measure of the alphabetic principle. NWF is seen as a "pure" measure of the alphabetic principle because vocabulary and sight word knowledge cannot play a role in recognizing nonsense words.

NWF assesses students' ability to decode words based on the alphabetic principle. For NWF, students are presented with an 8.5-inch x 11-inch sheet of paper with nonsense words (e.g., sig, ral) and asked to verbally produce (a) the whole nonsense word or (b) individual letter sounds. For example, if the stimulus word is "hap", a student could say the nonsense word as a whole or "/h/ /a/ /p/" to receive three letter sounds correct. On DIBELS 6th Edition, if the nonsense word was read as a whole (either initially or after sounding out), the student received credit for one whole word read correctly. On DIBELS Next, the student only received credit for reading the nonsense word correctly if it was read as a whole in the initial attempt. DIBELS 8th Edition reverts to the DIBELS 6th Edition practice because it more accurately captures students' knowledge of sound-spelling patterns and the ability to blend sounds into words, which is the primary intent of NWF. Students are given one minute to read or sound out as many nonsense words as they can.

The second subtest for 2nd grade students will assess Word Reading Fluency (WRF).
WRF is a standardized, individually administered measure of accuracy and fluency with lists of words.

The new WRF subtest involves reading real words out of context. It is a standardized, individually-administered measure of accuracy and fluency in reading "sight" words. Sight words include words with irregular pronunciations (non-decodable words like "the" and "was" and "of") as well as common words with regular pronunciations (decodable words like "in" and "we" and "no"). In WRF, students are presented with an 8.5-inch x 11-inch sheet of paper with real words and asked to verbally produce the whole word. Students must blend words to receive credit. In contrast to NWF, no credit is given for individual letter sounds. Students are given one minute to read as many words as they can, and the final score is the number of words read correctly within one minute.

Tests will be administered by Ms. Fougerousse either before school as they arrive during morning carline , or after school during afternoon carline in the K-2 music classroom, so students will not miss any instructional or play time. Students will be dismissed once

their name has been called for carline.

This research study has been reviewed and approved by Texas Woman's University Institutional Review Board for the Protection of Human Subjects. The researchers will try to prevent any problem that could happen because of this research. You should let the researchers know at once if there is a problem and they will help you. However, TWU does not provide medical services or financial assistance for injuries that might happen because you are taking part in this research.

If you are interested in participating in this study, please email me at mfougerousse@twu.edu **as soon as possible** and I will send you the informed consent forms to fill out and return to me either electronically or in person at school.

Thank you for your time and for your consideration to participate in my research.

APPENDIX B

CONSENT FORM ON BEHALF OF PARENT PARTICIPATION

CONSENT TO PARTICIPATE IN RESEARCH

Title: A Comparison of Musical Aptitude with Reading Ability and Language Development Among 1st and 2nd Grade Students

Principal Investigator: Mary Fougerousse mfougerousse@twu.edu 214/404-8406

Faculty Advisor: Dr. Vicki Baker vbaker@twu.edu

Summary and Key Information about the Study

You are being asked to participate in a research study conducted by Ms. Mary Fougerousse, a student at Texas Woman's University. Under the supervision of my professor, Dr. Vicki Baker, I am in the process of conducting research for my study entitled "A Comparison of Musical Aptitude with Reading Ability and Language Development Among 1st and 2nd Grade Students."

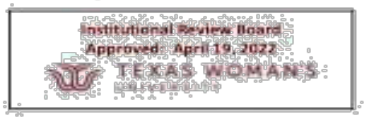
The purpose of this study is to compare musical aptitude of 1st and 2nd grade students with their phonological awareness and language acquisition skills. Further, the study will compare the scores of native English speakers and students identified as English as a second language learners to determine if there is a difference in their phonemic awareness as it relates to their rhythmic and/or tonal recognition skills. This study will enable music educators to better understand the influence that pitch and rhythmic acuity have on language acquisition, thus equipping them to design lessons to specifically support language development.

You have been invited to participate in this study because you are the parent of a 1st or 2nd grade student. As a participant, you will be asked to spend 5 minutes completing an online survey. You will complete the online Google Form after you have submitted your signed consent form. The greatest risk of this study includes potential loss of confidentiality. We will discuss this risk and the rest of the study procedures in greater detail below.

Your participation in this study is completely voluntary. If you are interested in learning more about this study, please review this consent form carefully and take your time deciding whether or not you want to participate. Please feel free to contact Ms. Fougerousse if you have any questions about the study at any time.

Description of Procedures

As a participant in this study you will be asked to spend 5 minutes completing an online survey on Google Forms. The Google Form survey will be taken after consent has been obtained. The survey will ask you to mark your responses to statements about your child's home language and musical background. You will be asked to mark yes or no for some statements and to answer a few other questions regarding the languages spoken at home and the musical experiences of your child. Some questions will be open-ended for you to provide responses. The questions in the Google Form will ask



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you to provide your name and relationship to the child as well as the child's name. The Google Form will also ask whether or not your child speaks more than one language at home and if so, to list the languages spoken at home. The Google Form will also ask you to provide which language is predominant in your home. It will ask you to answer whether or not your child takes music lessons outside of school and if so, to tell what instrument your child plays. Another question you will be asked is whether any other members of your family sing, or play instruments and if so, to please explain. The information from this Google Form will provide further information regarding the likelihood of the child having a higher musical aptitude and/or language acquisition ability prior to testing.

Student Participants will be asked to take the following tests:

- Two Intermediate Measures of Music Audiation subtests (IMMA) to determine their individual rhythm and tonal aptitude (approximately 24 minutes)
  - Children take the test by simply listening to a tonal recording and a rhythm recording. Each recording is 12 minutes long.
  - Questions on the CD are identified on the answer sheet by pictures, not numbers or words. The children must decide whether pairs of tonal or rhythm patterns they hear sound the same or different. They indicate their choice by simply drawing a circle around the picture on the answer sheet. These tests require no reading skills.
  - The answer sheets can be corrected quickly by using scoring masks. Raw scores are directly converted to percentile ranks in the manual.
  - A profile card is used for each child for individual documentation and the interpretation of scores. The tonal and rhythm results are graphically compared for each child.

- Two Dynamic Indicators of Basic Early Literacy Skills (DIBELS) subtests to assess reading ability and phonemic awareness (approximately 10 minutes)

The 1st grade DIBELS subtests include:

- Phoneme Segmentation Fluency (PSF)

PSF is a standardized, individually-administered measure of phonological awareness. PSF is a good predictor of reading achievement and is administered to students in the beginning of kindergarten through the end of first grade.

PSF assesses students' ability to fluently segment two- to six-phoneme words into their individual phonemes. In PSF, the examiner orally presents a series of words and asks a student to verbally produce the individual phonemes for each word. For example, if the examiner said "sat," and the student said "/s/ /a/ /t/", the student would receive three points for the word. After each response, the examiner presents

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the next word. Students are given one minute to segment the words into phonemes. The PSF measure has three benchmark forms and 20 alternate progress-monitoring forms for each grade in which it is available.

- Word Reading Fluency (WRF)

WRF is a standardized, individually-administered measure of accuracy and fluency with lists of words. WRF is administered to students in the beginning of kindergarten through the end of third grade.

The new WRF subtest involves reading real words out of context. Inspired by other CBMs that incorporate WRF, most especially easyCBM (Alonzo & Tindal, 2007), it is a standardized, individually- administered measure of accuracy and fluency in reading "sight" words. Sight words include words with irregular pronunciations (non-decodable words like "the" and "was" and "of") as well as common words with regular pronunciations (decodable words like "in" and "we" and "no"). WRF is administered to students from the beginning of kindergarten through the end of third grade.

In WRF, students are presented with an 8.5-inch x 11-inch sheet of paper with real words and asked to verbally produce the whole word. Students must blend words to receive credit. In contrast to NWF, no credit is given for individual letter sounds. Students are given one minute to read as many words as they can, and the final score is the number of words read correctly within one minute. The WRF measure has three benchmark forms and 20 alternate progress-monitoring forms for each grade in which it is available.

The 2nd grade DIBELS subtests include:

- Nonsense Word Fluency (NWF)

NWF is a standardized, individually-administered measure of the alphabetic principle. NWF is seen as a "pure" measure of the alphabetic principle, because vocabulary and sight word knowledge cannot play a role in recognizing nonsense words. NWF is administered to students in the beginning of kindergarten through the end of third grade.
NWF assesses students' ability to decode words based on the alphabetic principle. For NWF, students are presented with an 8.5-inch x 11-inch sheet of paper with nonsense words (e.g., sig, ral) and asked to verbally produce (a) the whole nonsense word or (b) individual letter sounds. For example, if the stimulus word is "hap", a student could say the nonsense word as a whole or "/h/ /a/ /p/" to receive three letter sounds correct. On DIBELS 6th Edition, if the nonsense word was read as a whole (either initially or after sounding out), the student received credit for one whole word read correctly. On DIBELS Next, the student only received credit for reading the nonsense word correctly if it was read as a whole in the initial attempt. DIBELS 8th Edition reverts to the DIBELS 6th Edition practice because it more accurately captures students' knowledge of sound-spelling patterns and the ability to blend sounds into words, which is the primary intent of NWF. Students are given one minute to read or sound out as many nonsense words as they can. The NWF measure has three benchmark forms and 20 alternate progress-monitoring forms for each grade in which it is available.

- Word Reading Fluency (WRF)

WRF is a standardized, individually-administered measure of accuracy and fluency with lists of words. WRF is administered to students in the beginning of kindergarten through the end of third grade.

The new WRF subtest involves reading real words out of context. Inspired by other CBMs that incorporate WRF, most especially easy CBM (Alonzo & Tindal, 2007), it is a standardized, individually- administered measure of accuracy and fluency in reading "sight" words. Sight words include words with irregular pronunciations (non-decodable words like "the" and "was" and "of") as well as common words with regular pronunciations (decodable words like "in" and "we" and "no"). WRF is administered to students from the beginning of kindergarten through the end of third grade.

In WRF, students are presented with an 8.5-inch x 11-inch sheet of paper with real words and asked to verbally produce the whole word. Students must blend words to receive credit. In contrast to NWF, no credit is given for individual letter sounds. Students are given one minute to read as many words as they can, and the final score is the number of words read correctly within one minute. The WRF measure has three benchmark forms and 20 alternate progress-monitoring forms for each grade in which it is available.

Tests will be administered by Ms. Fougerousse either before or after school in the K-2 music classroom, so students will not miss any instructional time.

Potential Risks

The researcher will ask you questions about the languages spoken at home and your child's musical background. A possible risk in this study is discomfort with these questions you are asked. You may skip any question you do not feel comfortable answering or you may take breaks. Participation in this study is voluntary and you may withdraw at any time.

Another risk in this study is loss of confidentiality. Confidentiality will be protected to the extent that is allowed by law. There is a potential risk of loss of confidentiality in all email, downloading, electronic meetings and internet transactions. There is an increased risk of loss of confidentiality because the researcher will be using a personally-owned device to collect and store data. The following are ways this risk will be mitigated: All Google Forms will be stored on the researcher's password protected computer which will be kept in a secure desk. All data collected will be viewed exclusively by the researchers listed at the bottom of this consent form. None of the students will be identified by name in the test results and the name of the school will remain confidential. Test results will be placed in a locked filing cabinet in a locked classroom in a secured building. All data will be stored on the researcher's password protected computer which will be kept in a secure desk in her home office. All data collected will be viewed exclusively by the researchers listed on this consent form.

Initials _____

An additional risk is the loss of time. Since the Google Form is online, you can complete it whenever it is convenient. To minimize this risk, you may stop at any time, take breaks, and come back to the Google Form. Students will be tested either before school or after school to avoid missing any instructional or play time. Participants' DIBELS scores will be assessed individually outside of class instruction and play time. To minimize this risk, students may stop at any time, take breaks, and may continue another day, if they choose.

An additional risk of this study is coercion since you may know and have worked with the researcher. Your decision on whether or not to participate in this study will have no effect on your relationship with the researcher, nor will it affect your relationship with or the services provided by Great Hearts Academy Irving.

An additional risk of this study is potential emotional discomfort while answering the Google Form questions. Participants can take breaks when needed or stop the study at any time without penalty.

The researchers will try to prevent any problem that could happen because of this research. You should let the researchers know at once if there is a problem and they will try to help you. However, Texas Woman's University does not provide medical services or financial assistance for injuries that might happen because you are taking part in this research.

After all identifiable information has been removed, any personal information collected for this study will not be used for future research.

Participation and Benefits

Your involvement in this study is completely voluntary and you may withdraw from the study at any time. The direct benefits to you for participating in this research are that you may determine if there is a correlation between musical aptitude and phonological awareness or language acquisition skills in your child. Your participation could also enable music educators to better understand the influence that pitch and rhythmic acuity have on language acquisition, thus equipping them to design lessons to specifically support language development.

If you are willing to participate in this study, please sign and return this form electronically to mfougerousse@twu.edu or send it with your student to school. After you have submitted your signed consent form, you will be sent the Google Form containing the Home Language Assessment and Musical Background Survey to complete. Completion of this form takes about 5 minutes.

Initials _____

Questions Regarding the Study

You may print a copy of this consent page to keep. If you have any questions about the research study you should ask the researcher; their contact information is at the top of this form. If you have questions about your rights as a participant in this research or the way this study has been conducted, you may contact them.

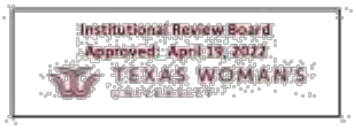
_____ _____

Signature of Parent Participant Date

*If you would like to know the results of this study tell us where you want them to be sent:

Email: _____ or Address: _____

This study has been approved by the TWU Institutional Review Board.



APPENDIX C

CONSENT FORM ON BEHALF OF STUDENT PARTICIPATION

CONSENT TO PARTICIPATE IN RESEARCH

Title: A Comparison of Musical Aptitude with Reading Ability and Language Development Among 1st and 2nd Grade Students

Principal Investigator: Mary Fougerousse mfougerousse@twu.edu 214/404-8406

Faculty Advisor: Dr. Vicki Baker vbaker@twu.edu

Summary and Key Information about the Study

Your child is being asked to participate in a research study conducted by Ms. Mary Fougerousse, a student at Texas Woman's University. Under the supervision of my professor, Dr. Vicki Baker, I am in the process of conducting research for my study entitled "A Comparison of Musical Aptitude with Reading Ability and Language Development Among 1st and 2nd Grade Students."

The purpose of this study is to compare musical aptitude of 1st and 2nd grade students with their phonological awareness and language acquisition skills. Further, the study will compare the scores of native English speakers and students identified as English as a second language learners to determine if there is a difference in their phonemic awareness as it relates to their rhythmic and/or tonal recognition skills. This study will enable music educators to better understand the influence that pitch and rhythmic acuity have on language acquisition, thus equipping them to design lessons to specifically support language development.

Your child has been invited to participate in this study because he/she is a 1st or 2nd grade student. The greatest risk of this study includes potential loss of confidentiality. We will discuss this risk and the rest of the study procedures in greater detail below.

Your child's participation in this study is completely voluntary. If you are interested in learning more about this study, please review this consent form carefully and take your time deciding whether or not you want to participate. Please feel free to contact Ms. Fougerousse if you have any questions about the study at any time.

Description of Procedures

Your child will be asked to take the following tests:

- Two Intermediate Measures of Music Audiation subtests (IMMA) to determine their individual rhythm and tonal aptitude (approximately 24 minutes)
  - Children take the test by simply listening to a tonal recording and a rhythm recording. Each recording is 12 minutes long.
  - Questions on the CD are identified on the answer sheet by pictures, not numbers.

Initials _____

or words. The children must decide whether pairs of tonal or rhythm patterns they hear sound the same or different. They indicate their choice by simply drawing a circle around the picture on the answer sheet. These tests require no reading skills.

- The answer sheets can be corrected quickly by using scoring masks. Raw scores are directly converted to percentile ranks in the manual.
- A profile card is used for each child for individual documentation and the interpretation of scores. The tonal and rhythm results are graphically compared for each child.

- Two Dynamic Indicators of Basic Early Literacy Skills (DIBELS) subtests to assess reading ability and phonemic awareness (approximately 10 minutes)

The 1st grade DIBELS subtests include:

- Phoneme Segmentation Fluency (PSF)

PSF is a standardized, individually-administered measure of phonological awareness. PSF is a good predictor of reading achievement and is administered to students in the beginning of kindergarten through the end of first grade.

PSF assesses students' ability to fluently segment two- to six-phoneme words into their individual phonemes. In PSF, the examiner orally presents a series of words and asks a student to verbally produce the individual phonemes for each word. For example, if the examiner said "sat," and the student said "/s/ /a/ /t/", the student would receive three points for the word. After each response, the examiner presents the next word. Students are given one minute to segment the words into phonemes. The PSF measure has three benchmark forms and 20 alternate progress-monitoring forms for each grade in which it is available.

- Word Reading Fluency (WRF)

WRF is a standardized, individually-administered measure of accuracy and fluency with lists of words. WRF is administered to students in the beginning of kindergarten through the end of third grade.

The new WRF subtest involves reading real words out of context. Inspired by other CBMs that incorporate WRF, most especially easyCBM (Alonzo & Tindal, 2007), it is a standardized, individually- administered measure of accuracy and fluency in reading "sight" words. Sight words include words with irregular pronunciations (non-decodable words like "the" and "was" and "of") as well as common words with regular pronunciations (decodable words like "in" and "we" and "no"). WRF is administered to students from the beginning of kindergarten through the end of third grade.

In WRF, students are presented with an 8.5-inch x 11-inch sheet of paper with real words and asked to verbally produce the whole word. Students must blend words to receive credit. In contrast to NWF, no credit is given for individual letter sounds. Students are given one minute to read as many words as they can, and the final score is the number of words read correctly within one minute. The WRF measure has three benchmark forms and 20 alternate progress-monitoring forms for each grade in which it is available.

The 2nd grade DIBELS subtests include:

- Nonsense Word Fluency (NWF)

NWF is a standardized, individually-administered measure of the alphabetic principle. NWF is seen as a "pure" measure of the alphabetic principle, because vocabulary and sight word knowledge cannot play a role in recognizing nonsense words. NWF is administered to students in the beginning of kindergarten through the end of third grade.
NWF assesses students' ability to decode words based on the alphabetic principle. For NWF, students are presented with an 8.5-inch x 11-inch sheet of paper with nonsense words (e.g., sig, ral) and asked to verbally produce (a) the whole nonsense word or (b) individual letter sounds. For example, if the stimulus word is "hap", a student could say the nonsense word as a whole or "/h/ /a/ /p/" to receive three letter sounds correct. On DIBELS 6th Edition, if the nonsense word was read as a whole (either initially or after sounding out), the student received credit for one whole word read correctly. On DIBELS Next, the student only received credit for reading the nonsense word correctly if it was read as a whole in the initial attempt. DIBELS 8th Edition reverts to the DIBELS 6th Edition practice because it more accurately captures students' knowledge of sound-spelling patterns and the ability to blend sounds into words, which is the primary intent of NWF. Students are given one minute to read or sound out as many nonsense words as they can. The NWF measure has three benchmark forms and 20 alternate progress-monitoring forms for each grade in which it is available.

- Word Reading Fluency (WRF)

WRF is a standardized, individually-administered measure of accuracy and fluency with lists of words. WRF is administered to students in the beginning of kindergarten through the end of third grade.

The new WRF subtest involves reading real words out of context. Inspired by other CBMs that incorporate WRF, most especially easy CBM (Alonzo & Tindal, 2007), it is a standardized, individually- administered measure of accuracy and fluency in reading "sight" words. Sight words include words with irregular pronunciations (non-decodable words like "the" and "was" and "of") as well as common words with regular pronunciations (decodable words like "in" and "we" and "no"). WRF is administered to students from the beginning of kindergarten through the end of third grade.

In WRF, students are presented with an 8.5-inch x 11-inch sheet of paper with real words and asked to verbally produce the whole word. Students must blend words to receive credit. In contrast to NWF, no

credit is given for individual letter sounds. Students are given one minute to read as many words as they can, and the final score is the number of words read correctly within one minute. The WRF measure has three benchmark forms and 20 alternate progress-monitoring forms for each grade in which it is available.

Tests will be administered by Ms. Fougerousse either before or after school in the K-2 music classroom, so students will not miss any instructional or play time.

Potential Risks

Your child may skip any question they do not feel comfortable answering or may take breaks. Participation in this study is voluntary and your child may withdraw at any time.

Another risk in this study is loss of confidentiality. Confidentiality will be protected to the extent that is allowed by law. There is a potential risk of loss of confidentiality in all email, downloading, electronic meetings and internet transactions. There is an increased risk of loss of confidentiality because the researcher will be using a personally-owned device to collect and store data. The following are ways this risk will be mitigated: All Google Forms will be stored on the researcher's password protected computer which will be kept in a secure desk. All data collected will be viewed exclusively by the researchers listed at the bottom of this consent form. None of the students will be identified by name in the test results and the name of the school will remain confidential. Test results will be placed in a locked filing cabinet in a locked classroom in a secured building. All data will be stored on the researcher's password protected computer which will be kept in a secure desk in her home office. All data collected will be viewed exclusively by the researchers listed on this consent form.

An additional risk is the loss of time. Students will be tested either before school or after school to avoid missing any instructional or play time. Participants' DIBELS scores will be assessed individually outside of class instruction and play time. To minimize this risk, students may stop at any time, take breaks, and may continue another day, if they choose.

An additional risk of this study is coercion since you may know and have worked with the researcher. Your decision on whether or not to participate in this study will have no effect on your relationship with the researcher, nor will it affect your relationship with or the services provided by Great Hearts Academy Irving.

An additional risk of this study is potential emotional discomfort while answering test questions. Participants can take breaks when needed or stop the study at any time without penalty.

The researchers will try to prevent any problem that could happen because of this research. You should let the researchers know at once if there is a problem and they will try to help you. However, Texas Woman's University does not provide medical services or financial assistance for injuries that might happen because your child is taking part in this research.

Initials _____

After all identifiable information has been removed, any personal information collected for this study will not be used for future research.

Participation and Benefits

Your child's involvement in this study is completely voluntary and your child may withdraw from the study at any time. The direct benefits to your child for participating in this research are that your child may determine if there is a correlation between their musical aptitude and phonological awareness or language acquisition skills. Your child's participation could also enable music educators to better understand the influence that pitch and rhythmic acuity have on language acquisition, thus equipping them to design lessons to specifically support language development.

If you are willing to allow your child to participate in this study, please sign and return this form electronically to mfougerousse@twu.edu or deliver it to school.

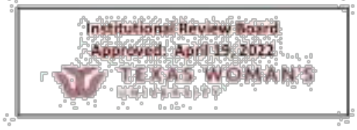
Questions Regarding the Study

You may print a copy of this consent page to keep. If you have any questions about the research study you should ask the researcher, their contact information is at the top of this form. If you have questions about your rights as a participant in this research or the way this study has been conducted, you may contact them.

_____ _____

Signature of Parent on behalf of Student Participant Date

This study has been approved by the TWU Institutional Review Board



APPENDIX D

HOME LANGUAGE AND MUSICAL BACKGROUND SURVEY

Home Language and Musical Background Survey

My name is Mary Fougerousse and I am currently a graduate music education student at Texas Woman's University. Under the supervision of my professor, Vicki Baker, Ph.D., I am in the process of collecting data for my study entitled "A Comparison of Musical Aptitude with Reading Ability and Language Development Among 1st and 2nd Grade Students."

The purpose of this study is to compare musical aptitude of 1st and 2nd grade students with their phonological awareness and language acquisition skills. Further, the study will compare the scores of native English speakers and students identified as English as a second language learners to determine if there is a difference in their phonemic awareness and rhythmic skills. This study will enable music educators better understand the influence that pitch and rhythmic acuity have on language acquisition, thus equipping them to design lessons to specifically support language development.

Participants will take two tests:

Intermediate Measures of Music Audiation (IMMA) to determine their individual rhythm and tonal aptitude (approximately 20 minutes)
Dynamic Indicators of Basic Early Literacy Skills (DIBELS) to assess reading ability and phonemic awareness (approximately 10 minutes)

Tests will be administered by a school faculty member either before or after school, so students will not miss any instructional time.

If you are willing for your child to participate in this study, complete this Google Form which contains a Home Language Assessment and Musical Background Survey and submit to indicate your consent. Completion of this form takes about 5 minutes.

While there is a potential risk of loss of confidentiality in all email, downloading, and internet transactions, confidentiality will be protected to the extent that is allowed by law. The following are ways this risk will be mitigated: All Google Forms will be stored on the researchers password protected computer which will be kept in a secure desk. All data collected will be viewed exclusively by the researchers listed at the bottom of this consent form.

An additional risk is the loss of time. Since the Google Form is online, you can complete it whenever it is convenient. To minimize this risk, you may stop at any time, take breaks, and

come back to the Google Form.

Additionally, there is a risk of emotional distress or discomfort while taking this survey. Due to the personal nature of the questions, it is recommended that you take this survey in a private location of your choosing. This risk will be minimized by allowing you the option to stop at any time, take breaks, and come back to the survey. Participation in this study is voluntary and you may withdraw at any time.

While there is a potential risk of loss of confidentiality, all measures will be taken to mitigate this risk regarding the participants' test scores. None of the students will be identified by name in the final results and the name of the school will remain confidential. Test results will be placed in a locked filing cabinet in a locked classroom in a secured building. All data will be stored on the researchers password protected computer which will be kept in a secure desk in her home office. All data collected will be viewed exclusively by the researchers listed on this consent form.

An additional risk is the loss of time. Students will be tested either before school or after school to avoid missing any instructional time. Participants' DIBELS scores will be assessed individually outside of class instruction. To minimize this risk, students may stop at any time, take breaks, and may continue another day, if they choose.

This research study has been reviewed and approved by Texas Woman's University Institutional Review Board for the Protection of Human Subjects. The researchers will try to prevent any problem that could happen because of this research. You should let the researchers know at once if there is a problem and they will help you. However, TWU does not provide medical services or financial assistance for injuries that might happen because you are taking part in this research.

If you have any questions about the study at any point in the process, or if you would like to be sent the results of this study, feel free to contact me at mfougerousse@twu.edu or Vicki Baker, Ph.D. at vbaker@twu.edu.

Thank you for your participation in my research.

You may print a copy of this consent page to keep. If you have any questions about the research study you should ask the researcher. If you have questions about your rights as a participant in this research or the way this study has been conducted, you may contact the TWU Office of Research and Sponsored Programs at 940-898-3378 or via e-mail at IRB@twu.edu.

* Required

Home Language and Musical Background Survey

1. What is your name and relationship to the child? *

____

Home Language and Musical Background Survey

2. What is your child's name? *

____

3. Does your child speak more than one language at home? Mark only one oval. If "Yes," list the languages spoken in your home. *

Mark only one oval.

- Yes
- No

4. Which language is predominant in your home? *

____

5. Does your child take music lessons outside of music class? Mark only one oval. *

Mark only one oval.

- No *Skip to question 7*
- Yes

Home Language and Musical Background Survey

6. If "Yes," what instrument does your child play?

____

7. Do any other members of your family sing or play instruments? Mark only one oval. *

Mark only one oval.

- Yes
- No

Home Language and Musical Background Survey

8. If yes, please explain. *

_____

APPENDIX E

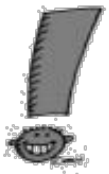
ASSENT FORM FOR CHILD PARTICIPATION IN RESEARCH

Texas Woman's University (TWU)
Assent to Participate in Research

What is a research study?

Research studies help us learn new things. We can test new ideas. First, we ask a question. Then we try to find the answer.

This paper talks about our research and the choice that you have to take part in it. We want you to ask us any questions that you have. You can ask questions any time.



Important things to know…

- You get to decide if you want to take part.
- You can say 'No' or you can say 'Yes'.
- No one will be upset if you say 'No'.
- If you say 'Yes', you can always say 'No' later.
- You can say 'No' at any time.
- We would still take good care of you no matter what you decide.

Why are we doing this research?

We are doing this research to find out more about whether or not your ability to read is related to your musical abilities or your ability to speak more than one language.

What would happen if I join this research?

If you decide to be in the research, we would ask you to do the following:

- Testing: I would say a word. After I say it, you would tell me all the sounds in the word. When I say "Begin," you would point to each word and read it the best you can. If you get stuck, I will tell you the word, so you can keep reading. In 2nd Grade: I will read you some make-believe words. You would say the sounds of the letters or read the whole word as best you can. It is okay if you get stuck. Next, I would ask you to listen to a few sounds and you would decide whether the pairs of tonal or rhythm patterns you hear sound the same or different. You would indicate your choice

by drawing a circle around the picture on the answer sheet. If the two parts sound the same, you would circle the boxes at the top with the two faces that are the same. If the two parts sound different, you would circle the boxes at the bottom with the two faces that are different. You will hear short musical statements followed by musical answers. Remember each musical statement because you will be asked to decide whether each musical answer is like each musical statement or different from each musical statement. If a musical answer is different from a musical statement, you will be asked to tell how it is different. If a musical answer is different from a musical statement it will be because there is at least one tonal change in the musical answer or because there is at least one rhythm change in the musical answer. There will never be both tonal changes and rhythm changes in a musical answer.

If a musical statement and musical answer are the same, you will circle the boxes which have the same faces.

If the musical answer is different from the musical statement because there is a rhythmic or tonal change, you will circle the box with different faces at the bottom. Be sure to listen to all of the musical parts before you choose your answer.

Could bad things happen if I join this research?

Some of the activities we ask you to do might be difficult and you might get tired. We will try to make sure that no bad things happen.
BUT, you can say NO to what we ask you to do for the research at any time and we will stop.

Could the research help me?

We think being in this research study may help us understand how to become better music teachers. We are hoping the test we use to measure can help your teachers design lessons for you and other kids like you.

What else should I know about this research?

If you don't want to be in the study, you don't have to be.

It is also OK to say yes and change your mind later. You can stop being in the research at any time. If you want to stop, please tell us.

You can ask questions any time. Take the time you need to make your choice.

Is there anything else?

If you want to be in the research after we talk, please write your name below. We will write our name too. This shows we talked about the research and that you want to take part.

Name of Participant_____

(To be written by child/adolescent)

Printed Name of Researcher_____

Signature of Researcher_____

Date_____