Effects of Music Instruction for 3-4-Year-Old Children on Cognitive Development and Spatial Skills

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EFFECTS OF MUSIC INSTRUCTION FOR 3–4-YEAR-OLD CHILDREN ON COGNITIVE DEVELOPMENT AND SPATIAL SKILLS

A Thesis
Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Master of Music Education in The School of Music

by
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B.M.E., Northwestern State University of Louisiana, 2020
May 2024
Dedicated to God, and My Family
for their unconditional support, inspiration
and endless love during this journey
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Abstract

The impact of music instruction on child cognitive development has been examined by researchers in many contexts, but not as often in very young children. The purpose of the present study was to investigate the effects of music instruction on the spatial and cognitive skills of preschool children ages 3-4. Participants in the study were 68 three- to four-year-old students who received weekly music instruction at a private school in South Louisiana. Of the 68 participants, and using a quasi-experimental design, 30 students in three intact classes were randomly assigned to receive a movement song treatment and the other 38 were assigned to the control group to receive traditional, whole-class music instruction with no movement for the duration of the treatment period. Preschoolers in the experimental group met once a week for thirty minutes for a movement music class over eight consecutive weeks while the control group met for regular music instruction with no movement over the same eight-week period. Participants completed the Audie test of early childhood musical aptitude and a modified version of the Test of Spatial Ability (TOSA) to examine early childhood executive function and cognitive development. Results indicated that the movement intervention had a positive effect on participants’ cognitive development over time. Implications for early childhood movement in music instruction are discussed.

Keywords: cognitive development, movement, music education, preschool children, spatial skills
Chapter 1. Introduction

In recent years, there has been growing interest and recognition of the impact that music instruction can have on children’s cognitive development. Music, often referred to colloquially as a universal language, has the demonstrated ability to stimulate various cognitive processes in young learners, including memory consolidation, prompting sustained attention, and fostering creativity and emotional expression. Singing, playing instruments, listening to music, and participating in musical improvisation and creation are just a few of the many activities that make up music instruction. Children develop a variety of cognitive skills through these activities, which are essential for both academic success and lifetime learning, in addition to their musical abilities.

To learn more about how music education affects children's developing minds, researchers in music and music education have drawn on results of research in fields such as education, psychology, and neuroscience, as well as feedback from parents. The complex relationship between music education and children's cognitive development becomes clearer when we examine how music may be a highly effective teaching tool for fostering children's overall development, enabling educators to utilize its transformative capacity to improve children's cognitive, social, and emotional development with an extensive understanding of this connection.

This study examines the effects of music-movement instruction on preschool children’s cognitive development and spatial skills. The literature review will first provide an overview of the background in instructional approaches and the background of music education in the United States. Second, the relationship between music and near transfer, far transfer, and spatial skills is
discussed. Lastly, it will provide advantages of implementing music-movement instruction in the elementary music classroom.
Chapter 2. Review of Literature

Results of research utilizing young children suggest that music training has many benefits in cognitive domains (e.g., Kraus et al., 2010; Schellenberg, 2004; Schlaug et al., 2006; Patel, 2003). Music education in the United States has a rich history that spans centuries and reflects the nation's diverse cultural heritage and educational philosophies from the early establishment of singing schools and community-based music instruction to the formalization of music education programs in public schools (Mark & Gary, 2007).

Many music training programs focus on long-term training of a single instrument, with scholars suggesting attendant benefits to cognitive development (Bugos et al., 2017; Kraus et al., 2010; Schellenberg, 2004; Schlaug et al., 2006; Patel, 2003). Music training, with its multifaceted demands on auditory, motor, and cognitive processes, has been suggested to have the potential to enhance both far and near-transfer effects (Patel, 2018). Instructional approaches implemented by music teachers refer to the methods, strategies, and techniques used to facilitate learning and achieve educational goals. These approaches encompass a wide range of pedagogical practices and instructional design principles tailored to meet the diverse needs of learners across different subjects, grade levels, and learning environments.

2.1. The Education of Young Children

The National Association for the Education of Young Children (NAEYC, 2006) lists three dimensions of child development: (1) what is known about child development and learning, (2) what is known about the strengths, interests, and needs of each child in the group, and (3) what is known about the social and cultural contexts in which children live. The preceding dimensions are further broken into the nine principles of early childhood development:
1. Development and learning are dynamic processes that reflect the complex interplay between a child’s biological characteristics and the environment, each shaping the other as well as future patterns of growth.

2. All domains of child development—physical development, cognitive development, social and emotional development, and linguistic development (including bilingual or multilingual development), as well as approaches to learning—are important; each domain both supports and is supported by the others.

3. Play promotes joyful learning that fosters self-regulation, language, cognitive and social competencies as well as content knowledge across disciplines. Play is essential for all children, from birth through age eight.

4. Although general progressions of development and learning can be identified, variations due to cultural contexts, experiences, and individual differences must also be considered.

5. Children are active learners from birth, constantly taking in and organizing information to create meaning through their relationships, their interactions with their environment, and their overall experiences.

6. Children’s motivation to learn is increased when their learning environment fosters their sense of belonging, purpose, and agency. Curricula and teaching methods build on each child’s assets by connecting their experiences in the school or learning environment to their home and community settings.

7. Children learn in an integrated fashion that cuts across academic disciplines or subject areas. Because the foundations of subject area knowledge are established
in early childhood, educators need subject-area knowledge, an understanding of the learning progressions within each subject area, and pedagogical knowledge about teaching each subject area’s content effectively.

8. Development and learning advance when children are challenged to achieve at a level just beyond their current mastery and when they have many opportunities to reflect on and practice newly acquired skills.

9. Used responsibly and intentionally, technology and interactive media can be valuable tools for supporting children’s development and learning.

The nine principles given by the NAEYC are a broad-based review of research literature findings in early childhood education which focus on informing developmentally appropriate practices and strategies that could potentially benefit classroom instruction. These principles guide educators, caregivers, and parents in selecting and using literature that supports children's holistic development, including their cognitive, language, social-emotional, and cultural growth (Florh, 2005). By following these principles, adults can create rich learning experiences that nurture children's curiosity, creativity, and love of learning.

The NAEYC principles are relevant to music education because they provide a framework for promoting high-quality early childhood music experiences that support children's holistic development. National Association for the Education of Young Children principles emphasize a child-centered approach to education, which aligns with the philosophy of many music educators who prioritize meeting the developmental needs and interests of young children (NAEYC, 2006). The National Association for the Education of Young Children advocates for developmentally appropriate practices, ensuring that music activities are aligned with children's developmental capabilities and needs. Additionally, NAEYC principles underscore the
significance of integrated, interdisciplinary learning experiences that connect music with other areas of development, such as language, literacy, mathematics, and social-emotional skills.

The NAEYC principles offer a guiding framework for music educators to create high-quality, developmentally appropriate music experiences that promote children's musical, cognitive, social-emotional, and physical development. By aligning music education practices with NAEYC principles, educators may ensure that all children have access to enriching and empowering music experiences that lay the foundation for lifelong musical learning and enjoyment. Understanding early childhood education lays the groundwork for exploring various learning theories that support pedagogical practices and shape our understanding of how children acquire knowledge and skills.

2.2. Learning Theories for Early Childhood Education

According to Florh (2005), learning theories for early childhood have existed since the late 1900s and were cultivated by scholars and philosophers to gain a deeper understanding of how children grow emotionally and cognitively. Those who have developed ideas and models that aid in the explanation of how people learn are known as learning theorists; they have made a considerable impact on the fields of psychology and education. Table 1 provides an overview of some prominent learning theorists and their key ideas, some of which have stood up to empirical examination (e.g., Piaget, 1952; Vygotsky, 1978), and other theories, such as Multiple Intelligences, that have not (Gardner, 1993)
Table 1. Instructional Approaches for Young Children

<table>
<thead>
<tr>
<th>Approach</th>
<th>Developer(s)</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructivist</td>
<td>Piaget, DeVries, Kohlberg</td>
<td>Children are active learners and interact with the environment to bring personal meaning to the topic. Teacher may structure student experiences to connect disparate aspects of curricula.</td>
</tr>
<tr>
<td>Socio-constructivism</td>
<td>Vygotsky</td>
<td>The learning process occurs at the level of potential development. It consists of developing cognitive structures that can only advance with assistance from or cooperation with others. Teacher may scaffold experiences based on prior student knowledge.</td>
</tr>
<tr>
<td>High/Scope</td>
<td>David Weikart</td>
<td>Children participate in key experiences in cognitive, social, and physical development. The initial focus was providing quality programs for low-income children.</td>
</tr>
<tr>
<td>Multiple Intelligence</td>
<td>Howard Gardner</td>
<td>Eight different intelligences account for a broader range of human potential in children and adults. Has not stood up to empirical scrutiny.</td>
</tr>
<tr>
<td>Montessori</td>
<td>Maria Montessori</td>
<td>Observation, individual liberty, and preparation of environment are stressed. Teachers work to control environment rather than children.</td>
</tr>
<tr>
<td>Progressive Project</td>
<td>John Dewey</td>
<td>Children learn from participating in projects both in and out of classroom involving in-depth study.</td>
</tr>
<tr>
<td>Reggio Emilia</td>
<td>Malaguzzi, parents and teacher in Italy</td>
<td>Children learn from participating in projects and investigations with teachers as partners in learning and children document that learning through art projects.</td>
</tr>
<tr>
<td>Waldorf</td>
<td>Rudolph Steiner</td>
<td>Curriculum balances academic subjects with artistic, spiritual, and practical activities.</td>
</tr>
</tbody>
</table>
While there is no single accepted theory of child development in the field of education, due to the complexity and uniqueness of learning, constructivist theory offers a framework by which instruction for young children can begin to be conceived. The constructivist theory states that children learn best when they are active learners and interact with the environment. Piaget’s (1952) insights about the early development of children hold particular relevance for music educators. Piaget believed children acquire effective ways to act, react, and communicate through action (Piaget, 1951) and is known primarily for his theory of cognitive development, which outlines four stages of cognitive growth in individuals:

- **Sensorimotor Stage**: The first stage occurs from birth to around two years of age. Infants and young children rely primarily on their sensory experiences and motor actions to explore and make sense of the world. Infants develop the ability to mentally represent objects in their minds and understand that objects have an existence independent of their perception; a concept known as object permanence, which according to Piaget, is a crucial milestone in an infant’s cognitive development.

- **Preoperational Stage**: This stage spans from ages two to seven. Children in this stage begin to use symbols and language to represent objects and concepts. However, their thinking is egocentric, and they struggle with perspective-taking. Preoperational children often exhibit centration, focusing on only one aspect of a situation or object while ignoring others. One of the key characteristics of the preoperational stage is a lack of conservation, the understanding that certain properties of objects, such as quantity, mass, or volume, remain the same even when their outward appearance changes. The preoperational stage is characterized by rapid language development, as children acquire vocabulary, grammar, and syntax at a rapid rate.
Concrete Operational Stage: This stage occurs between the ages of seven and 11. Children in this stage start to think more logically and concretely. They can perform mental operations understanding conservation and reversibility. They are also more capable of understanding concepts like time, space, and causality. Children in this stage can classify objects based on shared attributes or characteristics. Concrete operational thinkers understand the concept of conservation of numbers, recognizing that the quantity of objects remains the same even when their arrangement or appearance changes. Children in the concrete operational stage become less egocentric and can consider multiple aspects of a situation simultaneously. They can consider different perspectives and understand that others may have different viewpoints or interpretations. For example, they can consider both their point of view and that of a friend when solving a problem or resolving a conflict.

Formal Operational Stage: The fourth stage, which begins around age 11 and continues into adulthood is the formal operational stage. In this stage, individuals can think abstractly, hypothetically, and in a systematic way. Individuals are capable of complex problem-solving, considering multiple perspectives, and using deductive reasoning. In addition to developing the idea of the "four stages" of a child's mental development, Piaget also identified the ability of infants and early children to "conserve" (Schmitt, 1971). According to Piaget (1952), conservation is the awareness of the invariant aspects or properties of objects despite some transformation. Conservation refers to remembering a phenomenon, where an individual is undistracted by nonessential changes, in order to make a judgment that the given phenomenon stays the same. For example, in music, a child who can conserve melody hears the same melody even when another aspect such as the harmony is changed.
The theoretical basis that Piaget's theory of cognitive development has provided is a framework for understanding how kids learn and grow cognitively. By incorporating Piaget's theories into music instruction, educators might improve their effectiveness and give students a more engaging and developmentally appropriate learning environment. Connections between music education and Piaget's theory of cognitive development have been examined by researchers, including (1) teaching methods adjusted based on the child's stage of cognitive development (Campbell, 1994; Gordon, 1998) and (2) young children benefiting from music activities that stimulate their senses and promote discovery through movement, small instruments, and vocalization, especially in the early sensorimotor and preoperational stages (e.g., Campbell, 1994).

Piaget emphasized the value of experiential and active learning in the educational process. Students can enhance their understanding of musical principles by actively engaging with music through improvisation, ensemble playing, and creative composition—approaches that align with the principles of Orff-Schulwerk (developed in 1920). While Piaget’s cognitive development theory emphasizes individual exploration and discovery, Vygotsky’s (1962) socio-constructivist theory emphasizes the role of social interaction and cultural context in cognitive development. Socio-constructivism is a learning theory that emphasizes the social and cultural factors that influence cognitive development and knowledge construction.

According to socio-constructivism theory, learning is a social process that happens as a result of social contact and engagement in cultural activities. Vygotsky (1962) refers to the zone of proximal development (ZPD) in his theory. The ZPD refers to the difference between what a learner can do independently and what they can achieve with the assistance of a more knowledgeable other. Teachers and peers provide scaffolding and support to help learners move
beyond their current level of understanding and reach higher levels of competence. From learning theories for early childhood education to the relevant research literature in music education, it is important to examine how these theoretical frameworks relate to empirical studies that explore the impact of music instruction on young children's cognitive development.

2.3. Relevant Research Literature in Music Education

Music education is the most extensively studied form of arts education, offered in more than 90% of public schools nationwide (e.g., Elpus & Abril, 2018; Southgate & Roscigno, 2009). In the 1800s, music education was influenced by educational reformers such as Pestalozzi (Mark & Gary, 2007). During this time, music education placed significant emphasis on singing (Mason, 1834), with the main focus being on sight singing and music theory (Crews, 1973). It was believed that singing would evoke happiness among students and provide a delightful and satisfactory experience, encouraging them to express their feelings. It was not until Dewey's school (1882-1953) opened that the emphasis on ear training, rhythmic exercises, notation, singing songs, and song composition began to gain prominence (Shiraishi, 1995), leading to the curricular format that most elementary general music classrooms still adhere to today. According to Music in the Law (2002), the U.S. music education system is still fighting for recognition of educational values and an improved music curriculum overall, though some progress was made with the adoption of the Every Student Succeeds Act in 2015, which recognized music as a core subject in schools for the first time.

Teachers in elementary general music classrooms typically have the autonomy to select the method and curriculum for their classroom, and they may opt to specialize in a particular method or integrate multiple approaches (Florh, 2005). The methods employed by elementary music teachers are influenced by their own musical backgrounds, teaching skills, preferences,
and the individual differences among their students. Traditional methods that were developed before the 1960s continue to be used to this day and are famous across the globe, including those created by Dalcroze, Kodaly, Gordon, and for the purposes of this study, Orff.

The Orff Schulwerk approach, developed by German composer Carl Orff and his colleague Gunild Keetman, is a widely used and highly regarded method of music education that emphasizes creativity, improvisation, and active participation. Its major instructional goal is improvisation and the creation of music. The fundamental idea is to teach music that follows historical development, starting with chant and simple instruments, and progressing to more complex compositions.

Orff Schulwerk (Shamrock, 1997), promotes active, experiential learning through movement, singing, playing instruments, and improvisation. Students are encouraged to engage with music through hands-on experiences, which enhances their understanding and appreciation of musical concepts. One of the hallmarks of the Orff approach is its emphasis on creativity and improvisation. Students are given opportunities to explore and create music using their ideas and imaginations, fostering a sense of ownership and self-expression. Orff Schulwerk integrates music with movement, rhythm, and dance, providing a holistic approach to music education. The movement activities help students internalize musical concepts, develop coordination, and express themselves physically while making music.

When implementing the Orff approach students utilize a variety of percussion instruments, such as xylophones, metallophones, glockenspiels, and drums. These instruments are accessible and easy to play, making them suitable for students of all ages and abilities. Playing instruments in ensemble settings fosters cooperation, teamwork, and listening skills. Previous research suggests that students in a music-movement program based on the
developmental approach of Orff Schulwerk helped teachers enhance inhibitory control in preschool children (Suppalarkbunlue et al., 2023). Teachers can modify activities and materials to meet the needs of individual students, allowing for differentiated instruction and accommodating various learning styles and abilities. Teachers can also integrate music activities with content from other subject areas, enhancing students' understanding and retention of key concepts (D’Souza et al., 2018; Habibi et al., 2018). Further, it is important to look into the link between educational experiences and cognitive development and spatial skills, specifically in the context of music learning.

2.4. Cognitive Development & Spatial Skills

Active engagement with music instruction can induce cortical reorganization, which may produce functional changes in how the brain processes information (Zuk & Gaab, 2018). Children who studied music for fifteen months showed anatomical changes in the frontal, temporal, and parieto-occipital regions of the brain, and these changes were associated with improved performance on auditory and motor tasks (Hyde et al., 2009). The earlier this occurs in a child’s development, the more likely alterations in the brain development are to become hard-wired and affect permanent changes in how information is processed (Schlaug et al., 2006). Weinberger (2008) compared regular English perception to the structure of music perception. Music requires more precise auditory processing, including aspects such as pitch, frequency, and rhythm, among other elements. These elements serve as predictive cues that direct children's attention toward listening to music.

Results of research support the idea that listening to music, speaking, and writing share brain resources, such as attentional networks (Patel, 2012). This theory supports the association between participation in music, auditory skills, and language, and the way they can translate into
reading and literacy skills (Benz et al., 2016; Bugaj & Brenner, 2011; Dege & Schwarzer, 2011; Hallam, 2016; Kraus & Chandrasekaran, 2010; Moreno et al., 2011). Additionally, musical training enhances auditory discrimination related to reading comprehension and phonemic skills (Lamb & Gregory, 1993). This finding raises the possibility that prefrontal executive control functions in both the musical and linguistic domains (Slevc & Okada, 2015; Thaut et al., 2019).

The link between music education and spatial reasoning is among the strongest associations that researchers have documented (Hallam, 2010). According to Verdine and colleagues (2014), Spatial skills are used by children to understand the world around them, which might include visualizing how objects fit together, and these skills can be practiced using spatial assembly activities, spatial skills are part of a big umbrella called overall intelligence and have been related to success in other subjects such as mathematics (Graziano et al., 1999; Hetland, 2000; Holmes & Hallam, 2017; Rauscher & Hinton, 2011; Rauscher & Zupan, 2000). Spatial-temporal reasoning is a process in which a person is required to mentally maintain images without the assistance of a physical model and combine the images in a way to create a whole. Musicians utilize an ability with very similar characteristics in the execution of musical tasks (Tramo et al., 1998).

According to Satlow (1998), preschoolers’ spatial knowledge can be understood by the completion of geometrical shapes, and spatial assembly activities such as puzzle solving, and block building. Even in kindergarten and elementary school, music training has been linked to performance on tests of spatial abilities (Rauscher & Hinton, 2011). A two-year study of music training (2-3 hours per week) conducted by Portowitz and colleagues (2009) at an after-school center for at-risk children, with a control group of children in similar conditions with no interventions, suggests that musically trained children exhibited greater improvements in
remembering and reproducing a complex line drawing. Mix and Cheng (2012) claim that the relationship between spatial ability and mathematics exists and that they are related. The large body of literature supports this link in both children and adults (e.g., Cheng & Mix, 2012).

In response to the lack of research on spatial skills development in preschool children, Verdine and colleagues (2014) developed a new measure to test spatial skills in 3-year-olds called Test of Spatial Ability (TOSA). This test is designed for 3-year-old children to capture a spectrum of early spatial skills. Children are asked to complete 2-D and 3-D trials asking them to copy the designs presented to them. The scores from the trials are combined after completion, which allows a wider range of scores and provides extra stability in assessing 3-year-olds. The scoring system gives credit for trial designs even if they are not completely correct which provides children with multiple possible points for each design and to receive partial credit for each trial.

Music instruction has also been known to prompt the transfer of knowledge in young learners (Bigand & Tillmann, 2022). Two types of transfer, near transfer (the transfer of abilities within the same domain) and far transfer (the transfer of skills within an unrelated domain), are experienced in learners by music instruction (Patel, 2018). Near transfer refers to the application of skills or knowledge learned in one specific area of music to another closely related area (Strait et al., 2015). Far transfer involves the application of skills or knowledge learned in music to unrelated domains, such as using enhanced auditory processing skills gained from music training to improve language comprehension (Thompson et al., 2012). Thus, music instruction not only enhances musical abilities but also has the potential to impact a wide range of cognitive skills beyond the realm of music. Research with musicians suggests near-transfer effects on areas such as auditory processing (Strait et al., 2015) and pitch processing (Bidelman et al., 2013).
Music is an excellent candidate for far-transfer training because it engages a wide neural network which may have "transformational power" over the brain (Patel, 2018). Far transfer skills were found in executive functions such as processing speed and working memory (Bugos et al., 2007). According to the OPERA hypothesis (Overlap, Precision, Emotion, Repetition, and Attention; Patel, 2011), learning music has numerous positive effects on the way speech is encoded in the brain. This hypothesis suggests that there is significant overlap in the neural networks involved in processing both music and speech, particularly in areas related to auditory processing, motor control, and cognitive processing. As individuals engage in music training, they develop enhanced auditory processing skills, including the ability to distinguish subtle changes in pitch, rhythm, and timbre. These refined auditory skills not only contribute to musical proficiency but also have a positive impact on phonological awareness (Rauscher & Hinton, 2011).

2.5. Movement and Music Instruction

Music and movement education have been implemented in schools and emphasize the importance of rhythmic ability in fundamental motor skills (Marigliano, 2011). Fundamental motor skills, such as locomotor skills, object control skills, and balance and stability, are developed in the early elementary school years and are critical because once learned, they are retained for life (Chaddock et al., 2011). From as early as five months of age, infants exhibit more rhythmic movement when listening to music or to rhythmically engaging sounds than to speech prosody (Zentner & Eerola, 2010). Children are predisposed to the sound of music; they spontaneously move to recorded and live music (Flohr, 2004). Bruner (1960) proposed different ways of learning about music through movement, in which learners translate their experiences into a model: enactive (sensing, doing, and acting, on the environment), iconic (imaging the
experience through visual or other sensory icons that look like what the concept means), and symbolic (representing the experience through language or another system). The Early Childhood Music and Movement Association (ECMMA), advocates the idea that every child should experience music and movement instruction from birth to age seven.

One of the first proponents of music and movement, Dalcroze (1921), believed that rhythm is the primary element in music and the source for all musical rhythm may be found in the natural rhythms of the human body such as heartbeat, the rhythm of breathing, etc. He specified eight qualities of rhythm and movement instruction: (1) rhythm is movement; (2) rhythm is essentially physical; (3) every movement involves time and space; (4) musical consciousness is the result of physical experience; (5) the perfecting of physical resources results in clarity of perception; (6) the perfecting of movements in time assures consciousness of musical rhythm; (7) the perfecting of movements in space assures consciousness of plastic rhythm; and (8) the perfecting of movements in time and space can only be accomplished by exercises in rhythmic movement. Dalcroze saw the link between the mind and the body and how it might promote students to music expressiveness and involvement in music-movement experiences (Florh, 2009).

Weikart (1998) brought ideas from kinesiology into music movement and presented the key movement experiences for preschoolers: (1) acting on movement directions; (2) describing movement; (3) moving in nonlocomotory and (4) locomotor ways (which include moving to music); (5) moving with objects; (6) expressing creativity; (7) feeling and expressing steady beat, and (8) moving in sequences to a common beat (Weikart & Carlton, 1995). Weikart (1995) suggested that children three to five years old should not be asked to count repetitions and move at the same time, as doing two things at this age is not developmentally appropriate.
Researchers have investigated the effects of a developmentally appropriate music and movement program and compared it to commensurate physical education programs (Chaddock et al., 2011; Suppalarkbunlue, et al., 2023; Zachopoulou et al., 2004). The results of this research suggest that the implementation of a music movement program can positively impact motor skills such as jumping and dynamic balance of preschool children that are generally achieved in school physical education programs (Chaddock et al., 2011). Additionally, Suppalarkbunlue and colleagues (2023) investigated the impact of music-movement activities on children’s inhibitory control. Following a training period, results suggested the music-movement groups showed improvement in the performance of the inhibitory task compared to the control group; however, there were no significant differences in working memory and cognitive flexibility between the groups.

2.6. Purpose of the Study

Results of research support that music instruction in young children provides numerous benefits for multiple cognitive domains (e.g., Bugos, 2017). However, the majority of the literature focuses on long-term music training or training on private one-on-one instruction (Suppalarkbunlue et al., 2023) and there is little research on the benefits of music instruction in preschool children. Therefore, the purpose of this study was to examine whether music-movement instruction benefits children between the ages of three and four and how it enhances their developing spatial and cognitive skills. The guiding research question was: What is the impact of weekly exposure to music-movement instruction on students' visuospatial skills, and does this exposure also lead to an enhancement in their musical aptitude? Sub-questions were: (1) Does the exposure to music-movement instruction for thirty minutes weekly effect any
change in students’ visuospatial skills? and (2) Does exposure to music-movement instruction for thirty minutes weekly promote any improvement in student’s musical ability?
Chapter 3. Method

3.1. Participants

68 preschool children, all between three and four years old, were drawn from a convenience sample at a private school with music instruction in South Louisiana. Participants consisted of \( (n = 34) \) boys and \( (n = 34) \) girls. Approximately 91% of the participants were White, 6.8% African American, 1.1% Asian or Asian/Pacific Islander, and 1.1% with two or more races. Following approval from the Louisiana State University Institutional Review Board (Appendix A), school administrators provided written consent for the students to participate in this experiment (Appendix B). Informed written consent was obtained from all parents and/or legal guardians of the participating students and verbal assent was obtained from preschool children following the policies of the LSU Institutional Review Board (Appendix E). In this study, I assumed the dual roles of both teacher and researcher, implementing the music-movement instruction curriculum while simultaneously conducting data collection and analysis.

An online software program called Random Group Generator (2023) was used to randomize intact classroom groups. Participant classes were assigned to either a music-movement training intervention or traditional whole-class music instruction. Of the 68 participants, 30 in three intact classes were assigned to receive a “Music-Movement” treatment, and the other 38 in the remaining three intact classes were assigned to the control group who received traditional, whole-class music instruction from their classroom music teacher. After the eight-week treatment period, participants in the control group received music-movement instruction for the remainder of the school year to conform to IRB ethical guidelines.

3.2. Procedure

A quasi-experimental, pretest-posttest control group design was used to investigate the impact of the music-movement training (MMT) on spatial skills. Participants were divided into
two groups: the experimental MMT group \((n = 30)\) and the control group \((n = 38)\). No students with mobility issues or special needs were reported in either the experimental or control group. Before the treatment period, all participants were assessed with two cognitive tasks related to music audiation and spatial skills. The eight-week intervention consisted of 30-minute music classes once a week. The MMT instruction was the experimental condition while the whole-class music instruction served as a comparable attention-related control task. The sessions were designed to involve the children’s motor systems in response to the music presented to draw their attention to different musical elements such as pitch and rhythm and to increase melodic memory. A research assistant helped conduct both tests. When necessary, schoolteachers would accompany the students to the testing room. For each session, participants visited the music room, which featured a colorful rug positioned in the center of the classroom. Upon entering, students selected their desired spot on the rug. A piano stood at the back of the room, while a long table showcased a variety of musical instruments, including tambourines and xylophones, among others, ready to be used. Additionally, a teacher's cart filled with more instruments and puppets was located near the teacher’s chair. Classroom rules posters and musical posters adorned the walls, contributing to a visually pleasant atmosphere. Two large windows allowed students to observe nature from inside the music classroom, and as the students entered, the music room came alive with their eagerness and excitement to begin musical activities.

3.3. Program

The content of the music and movement program was based on the rhythmic education principles of Orff Schulwerk (Shamrock, 1997). The lessons presented in each session came from the curriculum in the books *Kids Can Listen, Kids Can Move* (Kleiner, 2003; Appendix G) and *Sing Dance and Play* (Kleiner, 2011; Appendix F). The training did not focus on playing
instruments but rather, encouraged students to play with rhythm and control their body movements while listening to the music played. The emphasis was given on singing games, percussion movements (pat, clap, tap) rhythmical movements accompanying the music, listening activities emphasizing visual and auditory stimuli, and activities focused on creating movements. Instruments such as egg shakers, tambourines, hand drums, and maracas were used to keep a steady beat, and rhythmic movement patterns were created (scarves, parachutes). The sessions were conducted for eight weeks, once a week, in the music classroom. Each session lasted 30 minutes and included between 2-4 activities (Figure 1). Following the completion of the treatment period, students in the control group received the movement instruction previously withheld from them to comply with IRB ethical guidelines and provided movement instruction for all students in the music program.

Figure 1. Sample Music Movement Lesson Sequence

3.4. Measures

Two cognitive assessments were administered: the Audie test (Gordon, 1998) and the Test of Spatial Ability (TOSA) to examine executive functions. For the Audie test, responses were recorded on answer sheets after each test by the researcher for later data analysis. The TOSA was adapted due to time constraints at the research site, with three 2-D trials presented to the participants for completion (Figure 4). Pictures were taken from the TOSA data set of each participant on an iPad and an iPhone of the pre and post-test for later data analysis. For the Audie
test, responses were recorded on answer sheets after each test by the researcher for later data analysis. Data from the control and experimental groups were compared to determine if a difference existed between the pre and post-test.

3.4.1. Audie

The Audie test is a developmental music aptitude test specifically designed for children ages three to four who are in the developmental music aptitude stage (Gordon, 1990). The purpose of the test is to provide teachers and parents with both standard and distinct information that will help them give children the most appropriate informal and formal musical guidance as early as possible. It consists of two subtest games, Tonal and Rhythm, each lasting 10 minutes and may be completed in a single session or on different days. The present study completed the rhythm section in a single day with each participant (Figure 4). When a certain "special song" (Figure 2) is played repeatedly, the child is to respond with YES, and when a rhythmic variation (Figure 3) of the special song is played the child is to respond NO accordingly.

Figure 2. Audie Special Song
The test provides two different game sheets one for the melody and one for the rhythm game (Figure 5). The test administrator checks the “yes” and “no” boxes according to the child’s response, and if the child gives no answer or doubts the question mark (?) column needs to be marked. The maximum number of points a child can get is 10 from each subtest. Children who achieve 9–10 correct responses are considered to have a high musical aptitude, while those with 6–8 correct responses are considered average, and those with 0–5 correct responses are considered to have low musical aptitude (Gordon, 1990).

Previous research on music audiation has primarily focused on children from kindergarten and upper grades. The Audie test, however, has not been utilized in research on preschoolers thus far and therefore has not been validated, but has served as a valuable guide for teachers and parents in directing children's musical development.
Song 1. *(music)...Did you say “yes”? That was my special song.
Song 2. *(music)...Did you say “no”? That was not my special song.
Song 3. *(music)...Did you say “yes”? That was my special song.
Song 4. *(music)...Did you say “no”? That was not my special song.
Song 5. *(music)...Did you say “no”? That was not my special song.
Song 6. *(music)...Did you say “yes”? That was my special song.
Song 7. *(music)...Did you say “yes”? That was my special song.
Song 8. *(music)...Did you say “no”? That was not my special song.
Song 9. *(music)...Did you say “no”? That was not my special song.
Song 10. *(music)...Did you say “yes”? That was my special song.

Figure 4. Audie Rhythm Test

<table>
<thead>
<tr>
<th>GAME SHEET</th>
<th>GAME SHEET</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AUDIE-R</strong></td>
<td><strong>AUDIE-R</strong></td>
</tr>
<tr>
<td>Child’s Name (first and last)</td>
<td>Child’s Name (first and last)</td>
</tr>
<tr>
<td>Birthdate</td>
<td>Birthdate</td>
</tr>
<tr>
<td>Today’s Date</td>
<td>Today’s Date</td>
</tr>
<tr>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
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<td>5</td>
<td>0</td>
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<td>6</td>
<td>0</td>
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<tr>
<td>7</td>
<td>0</td>
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<tr>
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<td>0</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

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Figure 5. Audie Test Sheet
3.4.2. Test of Spatial Ability (TOSA)

The TOSA test was a project used to examine geometric-spatial abilities and their potential correlations with mathematical ability over time in preschool children of diverse socio-economic statuses. The work was designed to diagnose, analyze, and understand the role of spatial assembly skills in early mathematical competency. Verdine & Golinkoff (2014) reported findings with 3-year-olds between the ages of 37 and 48 months, for which the psychometric properties of the test yielded an internal reliability of $\alpha = .747$.

The test assesses spatial skills in three-year-olds and the first half of the four-year-old age to capture individual differences and study their relationship to early mathematics (Verdine et al., 2014). Early results suggest that the task works well in predicting later spatial skills at ages four and five. This match-to-sample spatial assembly task requires participants to complete 12 trials where they copy a target arrangement of geometric shapes (2-D trials) or interlocking blocks (3-D trials). Children's ability to use individual pieces to reproduce a target design is assessed in the two-dimensional (2-D) and three-dimensional (3-D) trials that make up the TOSA.

In this study, only three-2D figures were presented to the participants (Figure 6). Children received trials in the same order, starting with the training trial and proceeding. Each board had a model picture at the top and the component shapes placed randomly at the bottom of the board, nearest the child. The experimenter pointed to the shape pieces and indicated that he/she was “going to try to make my pieces look just like this picture [experimenter points to model].” To determine whether the child understood the task, the experimenter placed the shape pieces incorrectly two times, confirming that the child could identify a non-matching design. The experimenter then placed the shapes in the correct formation and corroborated the match with the
child. Finally, the experimenter placed the shape pieces in front of the child and instructed the participant to “make [his/her] pieces look just like the picture.”

Scores were based on how closely the children's models resemble the design and the number of mistakes made, with totals calculated accordingly. A simplified scoring scheme, suggested by the test’s authors (Verdine et al., 2014), was used as a “quick and dirty” method of scoring the test. This basic coding scheme asked, “Was the participant’s reconstruction 100%, correct?” The following rules help determine a participant’s basic score for each trial:

For the component piece, did the participant have less than 1 cm. (10mm.) of error for adjacent pieces, less than 30 degrees of rotation error, and receive a point for a piece relationship, horizontal and vertical direction, and relative position? If yes, the component piece receives a basic score of 1. If no, the component piece receives a basic score of 0. Did all component pieces receive a basic score of 1? If yes, the Item Basic Score is 1. If no, the Item Basic Score is 0.

Children received each magnetic board sequentially with the target design visible throughout a trial and no feedback. The task was untimed, and the participant indicated the completion of each design. The designs were then stacked and, before resetting the boards for the next child, photographed for later, offline coding of construction accuracy. The researcher or research assistant captured test completion with a 10.9-inch iPad Air camera or iPhone 13 camera for later data review and analysis. Baseline examination suggested no significant differences between groups in the Audie test ($t = -.136, p > .05$) and no significant differences between groups in the TOSA test ($t = .658, p > .05$).

![Figure 6. 2-D Examples from TOSA test](image)
3.5. Data Collection and Analysis

Through a pre-posttest control and experimental design, this study analyzed data through multiple tests. The independent variable was the type of music instruction: music movement instruction or regular music instruction, while the dependent variables were the scores in the TOSA test and the Audie test. To determine if differences existed between the experimental and control groups, the researcher administered a pre and post-test and compared the groups by using both independent-samples $t$-test to determine point-in-time differences between groups, and a dependent-samples $t$-test to determine differences over time for control and experimental groups. The independent samples $t$-tests were calculated between the pre-test scores of the two groups, as well as between the post-test scores. A dependent samples $t$-test was run to determine if the triaging period had any effects on the participants. Since participants were part of different preschool classes, the data were collected at different dates and times. The data was imported to the Statistical Package for Social Science [SPSS] for analysis.
Chapter 4. Results

Before conducting independent-samples \(t\)-tests, results of Levene’s test determined that the data met the assumptions of normality for both the Audie \((F = 2.34, p = .13)\) test and the TOSA test \((F = .56, p = .46)\). Results of an independent samples \(t\)-test on the pre-test results (Table 1) indicated no significant differences existed between the control \((M=1.8 \text{ out of } 3, SD=1.05)\) and experimental \((M=1.6 \text{ out of } 3, SD=.97)\) groups in the TOSA scores \((t = .66, df = .66, p = .51)\). Results of an independent samples \(t\)-test on a pre-test (Table 2) indicated no significant differences between the control group \((M=6.3 \text{ out of } 10, SD=2.7)\) and the experimental group \((M=6.4 \text{ out of } 10, SD=2.2)\) in the Audie test scores \((t = -.136, df=.66, p = .89)\).

Likewise, examination of the TOSA post-test scores (Table 2) of the control \((M=1.8 \text{ out of } 3, SD=1.1)\) and experimental groups \((M=1.9 \text{ out of } 3, SD=1.0)\), and the Audie scores of the control \((M=6.4 \text{ out of } 10, SD=2)\) and experimental \((M=6.3 \text{ out of } 10, SD=2.4)\) groups revealed no significant differences in the participant’s audition and spatial skills.

Table 2. Pre-test independent \(t\)-test results of the Audie Test and TOSA test

<table>
<thead>
<tr>
<th>Group</th>
<th>Audie Pre-Test</th>
<th>TOSA Pre-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(M)</td>
<td>(SD)</td>
</tr>
<tr>
<td>Control</td>
<td>6.3</td>
<td>2.7</td>
</tr>
<tr>
<td>Experimental</td>
<td>6.4</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Table 3. Post-test independent \(t\)-test results of the Audie Test and TOSA Test

<table>
<thead>
<tr>
<th>Group</th>
<th>Audie Post-test</th>
<th>TOSA Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(M)</td>
<td>(SD)</td>
</tr>
<tr>
<td>Control</td>
<td>6.4</td>
<td>2</td>
</tr>
<tr>
<td>Experimental</td>
<td>6.3</td>
<td>2.4</td>
</tr>
</tbody>
</table>
The findings do not suggest practical significance or statistical between the groups on the pre-test and post-test. However, the results of a dependent samples t-test suggest that participants in the experimental group scored higher in the TOSA post-test than they did in the pre-test ($t = -1.99$, $df=29$ $p<.001$). Cohen’s $d$ indicates an effect size of $d=.031$, suggesting a very small effect size.
Chapter 5. Discussion

In this study, the relationship between music movement instruction and spatial skills in three- to four-year-old students was explored. The guiding research question was: what is the impact of weekly exposure to music-movement instruction for thirty minutes on students' visuospatial skills, and does this exposure also lead to an enhancement in their musical aptitude? Sub-questions were: (1) Does the exposure to music-movement instruction for thirty minutes weekly effect any change in students’ visuospatial skills? and (2) Does exposure to music-movement instruction for thirty minutes weekly promote any improvement in students’ musical ability? Previous research on this subject has examined older children (e.g., Bugos et al., 2017) but this is the first study to apply those methods with this age group. Results suggest that there were no significant changes from the pre-test to the post-test; however, the experimental group seemed to benefit from the music-movement instruction noticing a slight significant increase in the individual scores in the TOSA post-test compared to the pre-test scores.

Music instruction provides benefits to young children that can be associated with multiple cognitive domains (Bugos et. al, 2017) including spatial reasoning (Hallam, 2010) auditory discrimination related to phonemic skills (Lamb, 1993), verbal intelligence, overall IQ (Moreno et al., 2011; Schellenberg, 2004), phonological awareness (Degé & Schwarzer, 2011), verbal memory (Bugos & Mazuc, 2013; Ho et al., 2003; Rickard et al., 2010), and spatial-temporal skills (Rauscher & Zupan, 2000). The findings of this study may give educators more confidence to implement music-movement instruction in their classrooms and to find teaching techniques that best suit the students. For instance, the study by Chaddock and colleagues (2011) investigated the effects of a developmentally appropriate music and movement program and compared it to physical education programs. This study suggests that the implementation of a
music movement program can positively impact motor skills, such as jumping and dynamic balance, in preschool children. Music movement instruction implemented in this study aligns closely with the principles outlined by the National Association for the Education of Young Children (NAEYC, 2006), which advocates for high-quality early childhood education. NAEYC emphasizes the importance of providing developmentally appropriate and engaging learning experiences that promote the holistic development of young children. Music movement instruction embodies these principles by offering dynamic and interactive activities that cater to children's diverse needs and interests. Through music and movement, children can explore various concepts such as rhythm, coordination, and spatial awareness while engaging their imaginations and creativity.

The tool used to evaluate students’ musical aptitude was the Audie test. The test helps to determine pupils' musical potential and guide music teaching (Gordon, 1990). There has been debate over the Audie and other music education aptitude assessments (Hanson, 2019). Music educators argue that these exams might not fully assess a person's musical aptitude or potential, omitting other components of musicality like creativity, expressiveness, and understanding of culture (Stamou et al., 2010). While aptitude tests such as the Audie test can offer valuable insights into a person's musical aptitude at a particular moment in time, their ability to predict long-term musical success or achievement is questionable. Despite these concerns, the Audie and other musical aptitude exams are still used in different educational contexts as instruments for evaluating students' musical potential and directing pedagogical approaches (e.g., Bugos, 2017); however, it is important that researchers and educators consider the limitations and possible biases of these measures and combine them with a comprehensive method of teaching music that values a variety of musical experiences and promotes the emergence of a musical growth.
Comparing the TOSA pre- and post-test scores from the experimental group, the music-movement treatment prompted a small, significant increase in the spatial skill test. Participants in the present study may have benefited from the two types of music instruction: music-movement and whole-class instruction. Bugos (2017) suggests that music training in early childhood that incorporates the use of both-hand coordination may help to enhance inhibition performance on complex tasks. In this case, traditional whole-class music instruction may not differ much from music-movement instruction and how the students benefit from it. Children in the present study enjoyed music-movement instruction because it provided a dynamic combination of songs, rhythm, and movement. They were drawn into a creative world of sound and motion through engaging games and entertaining activities. They gained joy and excitement from discovering different movements, clapping along with beats, and dancing to fun tunes. The music sessions allowed them to freely express themselves through dance and movement stimulated their imaginations and encouraged the development of performers, which also helped them feel more confident in the music classroom. Further research is necessary to determine if music-movement instruction benefits children in different aspects other than regular general music instruction. It is necessary to research the frequency and how often music-movement activities should be incorporated in music instruction to determine if there are positive effects in young children like previous research suggests with long-term music instruction and one-on-one single-instrument lessons.

Results of previous research suggest that children who are involved and engaged in creative movement promote problem-solving skills, interact with peers socially, learn to think before acting, and compare experiences from their past (Marigliano & Russo, 2011; Benz et al., 2016; Bugaj & Brenner, 2011; Dege & Schwarzer, 2011; Hallam, 2015; Kraus &
Chandrasekaran, 2010; Moreno et al., 2009; Moreno et al., 2011). The results of the present study could be explained by the fact that there is a rising number of curricula based on music-movement instruction and an increasing number of free online resources for music educators and it is unclear what music-movement curriculum works best in the classroom (Music in the Law, 2002).

5.1. Limitations and Directions for Future Research

There were several limitations to the present study. First, it should be noted that the results and the data collected are based on a relatively small sample size. Future research utilizing an *a priori* power analysis with a program such as G-Power could determine the appropriate threshold for statistical significance and suggest a larger sample size. Second, participants were drawn from a convenience sample from one school in particular and were not necessarily an accurate representation of the general population of music students. Third, participants’ attendance was unpredictable for the eight weeks that the experiment was conducted which made it difficult to control all the students receiving consistent music instruction for the duration of the treatment period.

As both the teacher and the researcher there is a risk of bias that may have influenced the study. The teaching strategies, interactions with students, and interpretation of the findings may unintentionally be influenced by the teacher's personal values, interests, and expectations. Participants may have been aware that they were being watched, prompting a possible Hawthorne effect. When a researcher doubles as a teacher, students may change how they behave or perform because they are being observed, which could distort the findings. Because of this impact, it may be difficult to distinguish between changes that are attributed to the intervention under study.
The treatment period in this study, which lasted for eight weeks, may not have been sufficient to observe significant changes in spatial skills among preschoolers across various tasks. Studies that look at how music training affects other, more closely linked domains (such as phonological awareness) use long-term training paradigms that last between 15 and 20 weeks (Bolduc, 2009; Degé & Schwarzer, 2011). Further research is needed to determine the optimal duration of training required to observe music-movement benefits in preschool-aged children.

Future research could replicate the present study with a diverse and larger sample size and is necessary to determine if music movement affects children’s spatial skills over a longer period of instruction. More research should be conducted to compare music movement instruction groups with no music instruction groups across multiple sites. This would help determine whether the type of instruction has any effect on children's spatial skills. Music movement instruction benefited participants individual scores in one of the spatial skills assessments. Children in both groups seemed to benefit and enjoy music instruction despite the type of instruction utilized for the group.

5.2. Implications for Music Teaching and Learning

This study provides support and further context for extant literature suggesting that preschoolers' cognitive development may be enhanced by music-movement training. Student participation and engagement may be increased by integrating movement into music education. Learning becomes more dynamic and kinesthetic through movement exercises, which also accommodate students' different learning preferences and styles. Integrating various domains of cognitive development, music movement teaching promotes holistic learning, and helps students connect and comprehend musical ideas on a deeper level. These activities allow learners to become more proficient in timing, coordination, and musical expression by having them
physically embody musical phrases and rhythms. Additionally, by encouraging students to express themselves artistically via gesture and movement, music movement education gives them a nonverbal way to react to music. It is important to carefully evaluate each student's requirements and abilities when implementing music-movement teaching for students who have physical or mobility issues. Teachers ensure that all students, regardless of physical limitations, can participate actively and benefit from music-movement instruction by modifying activities, integrating assistive devices, encouraging self-expression, facilitating peer interaction, creating accessible environments, and promoting a meaningful experience in the music classroom for all students.

Teachers can be confident that if they integrate music movement into their curricula, they are likely to promote holistic growth across a variety of domains in addition to increasing their students' enjoyment and engagement with the learning process. A dynamic, multimodal learning environment that accommodates students' different learning preferences and styles can be created by incorporating music movement activities. In addition, this type of integration can promote an environment in the classroom that is welcoming and inclusive, inspiring kids to work together and contribute actively.
Appendix A. Institutional Review Board Approval

TO:          David Joseph Saccardi
            LSUAM | Col of MDA | Music | CC00229
FROM:        Alex Cohen
            Chairman, Institutional Review Board
DATE:        15-Sep-2023
RE:          IRBAM-23-0916
TITLE:       Effects of music instruction on 3-4-year-old children in
cognitive development and spatial skills.
SUBMISSION TYPE: Initial Application
Review Type:  Expedited Review
Risk Factor:  Minimal
Review Date:  15-Sep-2023
Status:       Approved
Approval Date: 15-Sep-2023
Approval Expiration Date: 14-Sep-2024
Expedited Categories: 07
Requesting Waiver of Informed Consent: No
Re-review frequency: Annually
Number of subjects approved: 68
LSU Proposal Number:

By:          Alex Cohen, Chairman

Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
8. SPECIAL NOTE: When emailing more than one recipient, make sure you use bcc. Approvals will automatically be closed by the IRB on the expiration date unless the PI requests a continuation.

* All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/research

Louisiana State University       O 225-578-5833
131 David Boyd Hall              F 225-578-5983
Baton Rouge, LA 70803            http://www.lsu.edu/research
Appendix B. Recruitment Letter

August 7, 2023

Dear Mrs. Palmer,

My name is Veronica Perez and I am a music education Graduate student at LSU. I write to you in the hopes of securing your permissions regarding a possible research study I would like to conduct in your school with the help of Pre-K teachers and students.

At LSU I take a research thesis course in early music education, and I am conducting research in music education and early childhood for my final project. The study I am proposing aims to examine the effects of music instruction on 3-4-years old children and the positive effect in the cognitive development and spatial skills.

This intervention will take place preferably over a nine-week period sometime during the fall 2023 semester. There is no risk posed to the students by taking part in this study, and parental consent forms will be collected prior to any treatment being administered as per University’s ethical guidelines. This study will also pose minimal disruption to the Pre-k teacher’s curriculum, as it will utilize music classes period.

Ideally, half of the Pre-K classes will “get a movement” treatment music class and the other half of the Pre-k classes will get the “regular music instruction” treatment. By comparing the average scores of the students from the two classes, we’ll potentially have a better idea regarding if early music instruction could potentially help children with spatial skills and cognitive development.

I welcome any questions or concerns you may have regarding the implementation of this study. Should you choose to approve my request, I would require some form of official documentation of said approval to submit to my institutional review board. Thank you for your thoughtful time and consideration.

Sincerely,

Veronica Perez Espinosa – Graduate Student
Louisiana State University
vper14@lsu.edu
Appendix C. Informed Administrator Form

Trinity School Administrator Form

1. Study Title: Effects of music instruction on 3-4-year-old children in cognitive development and spatial skills.

2. The study I am proposing aims to examine the effects of music instruction on 3- to 4-year-old children and if there is any significant change in cognitive development and spatial skills. This intervention will take place preferably over a nine-week period sometime during the fall 2023 semester. This study will also pose minimal disruption to the Pre-K teacher’s curriculum, as it will utilize music class periods. Of the 68 participants, 27 will be randomly assigned to receive a “Movement” song treatment, and the other 28 will be randomly assigned to the control group and will receive traditional, whole-class music instruction. Participants in both groups will complete the Audie test and test of Spatial Ability to examine executive functions through a pre-test and a post-test.

3. Risks: There are no known risks.

4. Benefits: Ideally, half of the Pre-K classes will “get a movement” treatment music class and the other half of the Pre-K classes will get the “regular music instruction” treatment. By comparing the average scores of the students from the two classes, I will potentially have a better idea regarding whether early music instruction could potentially help children with spatial skills and cognitive development.

5. Investigators:

6. If you require any additional information, please contact me or my advisor, Dr. David Saccardi.

Veronica Perez Espinosa – Graduate Student
Louisiana State University
vpere14@lsu.edu

Dr. David Saccardi
Assistant Professor of Music Education
Louisiana State University
dsaccardi@lsu.edu

7. Performance Site: Trinity Episcopal Day School

8. Number of subjects: 68

9. Inclusion Criteria: Children 3-4 years of age. The students will be drawn from a private school with music instructions weekly.

10. Exclusion Criteria: Children who do not meet the age requirements.
11. Right to Refuse: Participation is voluntary, and a child will become part of the study only if both child and parent agree to the child's participation. At any time, either the subject may withdraw from the study or the subject's parent may withdraw the subject from the study without penalty or loss of any benefit to which they might otherwise be entitled.

12. Privacy: The names and birthdates of the participants will be the only demographic information gathered. Results of the study may be published, but no names or identifying information will be included for publication. Subject identity will remain confidential unless disclosure is required by law.

13. Financial Information: There is no cost for participation in the study, nor is there any compensation to the subjects for participation.

14. Signatures:
   The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigator. For injury or illness, call your physician, or the Student Health Center if you are an LSU student. If I have questions about subjects’ rights or other concerns, I can contact Alex Cohen, Chairman, Institutional Review Board, (225) 578-8692, irb@lsu.edu, or www.lsu.edu/research. I will allow students to participate in the study described above and acknowledge the investigator's obligation to provide me with a signed copy of this consent form.

   School Administrator Signature: ____________________________ Date: ____________
15. The following section appears on the parental and participant consent forms. It appears here only for your information and your signature is not needed.

For research involving the collection of identifiable private information or identifiable biospecimens one of the following must be listed on the consent form:

Identifiers might be removed from the identifiable private information or identifiable biospecimens. After removal, the information or biospecimens may be used for future research studies or distributed to another investigator for future research studies without additional informed consent.

Yes, I give permission _____________________________________________ Signature

No, I do not give permission _________________________________________

OR

Signature

Your information or biospecimens collected as part of the research, even if identifiers are removed, may be used or distributed for future research

Yes, I give permission

Signature __________________________

No, I do not give permission

Signature __________________________
Appendix D. Parental Permission Form

Parental Permission Form

Study Title: The Effects of Music Instruction on the Development of Preschool Children

The study I am proposing aims to examine the effects of music instruction on 3-4-years old children and if there is any significant change in cognitive development and spatial skills. This intervention will take place preferably over an eight-week period sometime during the fall 2023 semester. This study will also pose minimal disruption to the Pre-K teacher’s curriculum, as it will utilize music class periods.

Of the 68 participants, 27 will be randomly assigned to receive a “Movement” song treatment, and the other 28 will be randomly assigned to the control group and will receive traditional, whole-class music instruction. Participants in both groups will complete the Audie test and test of Spatial Ability to examine executive functions through a pre-test and a post-test.

Risks: There is no risk posed to the students by taking part in this study.

Benefits: Ideally, half of the Pre-K classes will “get a movement” treatment music class and the other half of the Pre-K classes will get the “regular music instruction” treatment. By comparing the average scores of the students from the two classes, I will potentially have a better idea regarding if early music instruction could potentially help children with spatial skills and cognitive development.

Investigators: If you require any additional information, please contact myself or my advisor, Dr. David Saccardi

Veronica Perez Espinosa – Graduate Student
Louisiana State University
vpere14@lsu.edu

Dr. David Saccardi
Assistant Professor of Music Education
Louisiana State University
dsaccardi@lsu.edu

Performance Site: Trinity Episcopal Day School

Number of Participants: 68

Inclusion Criteria: Children 3-4 years of age
Right to Refuse: Participation is voluntary, and a child will become part of the study only if both child and parent agree to the child's participation. At any time, either the subject may withdraw from the study or the subject's parent may withdraw the subject from the study without penalty or loss of any benefit to which they might otherwise be entitled.

Privacy: The names and birthdates of the participants will be the only demographic information gathered. Results of the study may be published, but no names or identifying information will be included for publication. Subject identity will remain confidential unless disclosure is required by law.

Financial Information: There is no cost for participation in the study, nor is there any compensation to the subjects for participation.

Signatures:

The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigator. For injury or illness, call your physician, or the Student Health Center if you are an LSU student. If I have questions about subjects' rights or other concerns, I can contact Alex Cohen, Chairman, Institutional Review Board, (225) 578-8692, irb@lsu.edu, or www.lsu.edu/research. I will allow my child to participate in the study described above and acknowledge the investigator's obligation to provide me with a signed copy of this consent form.

Parent's Signature: ______________________________ Date: __________________

The parent/guardian has indicated to me that he/she is unable to read. I certify that I have read this consent form to the parent/guardian and explained that by completing the signature line above he/she has given permission for the child to participate in the study.

Signature of Reader: ____________________________ Date: ____________________
Appendix E. Child Assent Form

Trinity Child Assent Form

I, __________________________________, agree to be in a study to examine the effects of music instruction on 3-4-years old children and if there is any significant change in cognitive development and spatial skills. I will have to do special activities for the teacher's aide in my music class. I will follow all the classroom rules, even when I am working with the teacher's aide. I can decide to stop being in the study at any time without getting in trouble. (The classroom teacher will read the assent form to the students and will write the student’s name on the form, noting the students are 3-4 years old and do not have developed writing and reading skills)

Child's Signature: _____________________________ Age: _____ Date: ______________
Witness* ___________________________________ Date: __________________
* (N.B. Witness must be present for the assent process, not just the signature by the minor.)

Institutional Review Board

Dr. Alex Cohen, Chair
130 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.5983
irb@lsu.edu | lsu.edu/research
# Appendix F. Music Movement Lesson Plans from *Sing, Dance, and Play*

<table>
<thead>
<tr>
<th>Movement</th>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Movement** | *Five Little Leaves (New)* | - Put up the felts and count the leaves before passing out the scarves. Sing the “dut, dut, dut” part as you move the leaf down the felt board step by step, following the descending singing.  
- Count again and see how many leaves are remaining. If time, you can sing and count until there are no leaves left.  
- Pass out the scarves and practice marching to “five little leaves… town”, shaking the scarves for “the wind came blowing through the town” and throwing it up high for the “dut, dut, dut…” when the leaf falls down.  
- Repeat using the CD. |
| **Movement** | *The Spider Kept On Spinning (New)* | **The Spider Kept On Spinning:**  
Don’t use the jungle rhymes, only the spider song.  
- Move the scarves side to side and in a circular motion and throw them up in the air after “his work was done”.  
**Up So High:**  
- Sing the song slowly, without CD, and encourage the children to sing the word at the end of the phrases, using their streamer or scarf for the movement of high, low and around.  
- Let them know that the spider spins her web all the way up high and sometimes lowers herself all the way down low on her thread. Sometimes it looks like the spider is dancing. Relate the song to the spider song.  
- Repeat “The spider kept on spinning.” |
| **Movement Continued** | *Gray Squirrel* | **Gray Squirrel:**  
- Show the children the puppet or picture pointing out the nose, toes and tail of the squirrel.  
- Ask the children “Where is your nose, where are your toes, where is your tail?”  
- Say “What? You don’t have a tail? How about using a scarf and pretend that’s your tail.” Show them how to swish the scarf from side to side.  
- Sing without the CD, pausing after “wrinkle up your little ____” Encourage children to sing “nose” and “toes” and “tail.”  
- Repeat the song using the CD encouraging motions and singing. |
| **Movement** | *Peek-A-Boo* | **Peek-A-Boo:**  
- Pass out scarves to all children and teachers. Children can hide under their scarf or some may prefer to pull the scarf off their teacher’s head. |
Appendix G: Music Movement Lesson Plans from *Kids Can Listen, Kids Can Move*

**Hungarian Dance No. 6**
by Johannes Brahms (Germany, 1833–1897)

Tell this story before playing the music:
In preparation for the royal party, the queen had been instructing the young prince and princess how to walk properly into the room and politely greet their guests. As the music begins, the queen watches as the children walk, as instructed with their heads held high, holding good posture, giving a slight bow or nod, and smiling to acknowledge their imaginary guests. The queen also shows them some of the elegant dances they will perform at the ball. They are doing quite well, and the queen is pleased but explains it takes a lot of practice to get the right posture and correct manners for the big royal party. However, whenever the queen looks the other way, stops to inspect the silver, or has to leave the room, the children quickly drop their serious looks and do a fast silly dance, making funny faces! Later, the queen discovers what the children have been doing and, after hesitating, joins them in the silliness.

For a longer version, continue the story:
The king then enters and it’s back to serious work as both the queen and king demonstrate. They walk and they dance. The children laugh. They continue to dance and the children laugh again. Then the children join the king and queen, first in a serious walk and then a silly one!

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0:00–0:21</td>
<td>Serious walk</td>
</tr>
<tr>
<td>0:22–0:29</td>
<td>Silly walks and dances by the children</td>
</tr>
<tr>
<td>0:30–0:52</td>
<td>Serious</td>
</tr>
<tr>
<td>0:53–0:59</td>
<td>Silly</td>
</tr>
<tr>
<td>0:60–1:40</td>
<td>With the queen</td>
</tr>
</tbody>
</table>

This ends the shorter version. Stop CD Track 5 around 1:40. The longer version is the entire piece.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:41–2:07</td>
<td>The king enters and it’s back to work! He instructs the children to watch, and then the king and queen give a serious demonstration of the royal entrance walk.</td>
</tr>
<tr>
<td>2:08–2:16</td>
<td>The king and queen dance.</td>
</tr>
<tr>
<td>2:17–2:19</td>
<td>The children laugh.</td>
</tr>
<tr>
<td>2:20–2:26</td>
<td>They continue to dance.</td>
</tr>
<tr>
<td>2:27–2:30</td>
<td>The children laugh.</td>
</tr>
<tr>
<td>2:31–2:53</td>
<td>All walk seriously.</td>
</tr>
<tr>
<td>2:54</td>
<td>All are silly.</td>
</tr>
</tbody>
</table>

![Elegant and proper walking for the queen](image1.jpg)

![Silly dancing: no one’s looking!](image2.jpg)
Creatures of the Garden

Herbert Donaldson (U.S., b. 1918)

To begin, either tell the following story first or play the recording, and then ask the children to imagine their own story and share what they thought with the class. Then share the following story and play the music again as the children act out the story.

0:00–0:26 The little bug is buried in the sand. This happens to him often at the beach. Sand is kicked up by beachgoers or sometimes by a big bulldozer. The little bug wiggles as he shakes the sand off of his back, his shoulders, his arms, his legs, and his hair. Finally, he is able to stand up, and he shakes the last bit of sand off of himself.

0:27–0:40 Then he takes a look around as he carefully walks or tiptoes, trying to avoid others who will once again bury him in the sand.

0:41–0:46 Suddenly, he spots the big bulldozer truck coming right toward him, carrying a big load of sand. He runs and runs and . . .

0:47 Jumps over a little twig left in the sand.

0:48 Then he runs and runs and has to . . .

0:54 Jump over another little twig, which is like a log to him.

After telling the story, have the children act out the part of the little bug. Be ready to repeat this activity over and over again.

Bugs in the sand

Shake off the sand.

Look to see who's coming.
Prelude to Act I
from Carmen (Theme 1)
by Georges Bizet (France, 1838–1875)

This exciting music can be used for the parade that takes place in The Story of Ferdinand by Munro Leaf. The students can make up a dance using scarves (red scarves are most appropriate if you are using this music for Ferdinand), or use the following directions:

- Students stand in a circle and march forward right, holding the scarves, alternating arms up and down for 32 beats.
- Then change direction and march forward left for 32 beats.
- March into the circle for eight beats.
- March out of the circle for eight beats.
- March into the circle for eight beats.
- March out of the circle for eight beats.
- Turn around for four beats.
- March forward right around the circle for 32 beats.

March with scarves.
Kangaroos

Jump, jump, jump, jump, jump, jump, jump. LOOK, LOOK!
(Listen to the recording. You'll hear the jumping music and the long "look" notes.)

Optional prop: kangaroo and joey puppets

This is the pattern heard in the music as the mommy jumps from place to place, looking for her joey. Children are encouraged to jump like kangaroos when they hear the jumping music in the recording. On the long notes, the kangaroos (all the children) turn their heads to one side and then the other as they try to find their babies. At the very end of the song, the kangaroos have big smiles as they find their joeys. This is also fun to play with a kangaroo puppet. One child has the mommy kangaroo and must figure out who has the baby. The children pass the baby after each sequence so many have a chance to jump with the joey puppet. At the end, the baby is returned to the mommy's pouch and everyone smiles.


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Vita

Veronica Perez is a native of Cartagena, Colombia. At the age of ten, she began studying music and chose to learn the flute, a familiar instrument she heard on the radio every Sunday while listening to “Charanga” with her family. Music has become her passion and life since the beginning of the journey. That passion, enthusiasm, and drive remain the same up to this day.

One of her major accomplishments was earning a scholarship in the Spring of 2016 to study Music Education in the United States at Northwestern State University of Louisiana. During this time in college, she had the great opportunity to be part of the SON marching band, Wind Symphony, Chamber Ensembles, and Symphony. This experience helped her recognize the importance of being a versatile musician and adapting to various musical environments. She realized her desire to share with the world all the knowledge and skills she had acquired through music education. After graduation in December 2020, she decided to teach general music full-time in an elementary school in Louisiana. Her love for teaching and music continued to grow and decided to continue her education by enrolling in the Master of Music Education program at Louisiana State University in Baton Rouge, Louisiana. She expects to graduate in May 2024 and continue her career as a music educator.