

**The effects of an integrated rhythmic and literacy intervention on the
development of phonological awareness and rhythm skills of preschoolers**

by

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DEDICATION

To my amazing family members, thank you for the support and encouragement.

To my daughters, mother and grandmother, strong women that value education.

To my husband, whose support never wavered.

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ABSTRACT

This study explored the impact of an integrated rhythm-literacy (IRL) intervention on the development of rhythm and phonological awareness (PA) skills in preschool children ages 4-5.5 years old. The IRL intervention draws from research that examines the role rhythm may play in the development of PA and is composed of three main events. Those events include (1) integrated rhythm-literacy text interactions, (2) integrated rhythm-literacy call and response and (3) integrated rhythm-literacy movement. The study used an experimental pretest-posttest design. A total of 43 participants took part in the study (intervention group = 23 children, comparison group = 20 children). Initial results indicate that the IRL intervention significantly improved the rhythm and rhyme awareness of the intervention group over the comparison group.

CHAPTER 1. INTRODUCTION

Background

The preschool years are critical for the development of foundational literacy skills because they have a clear and consistently strong relationship with later reading achievement (National Institute of Literacy, 2008). In addition, neural systems, which underlie auditory perceptions, attention and language develop rapidly during the first five years of life (AAP, 2014; Dickinson et al., 2006; Mol & Bus, 2011; Cunningham & Zilbulsky, 2013) creating opportunities for educators to gain ground with effective literacy interventions. The rapid development of literacy skills during the early childhood years makes it essential that educators engage young children with effective literacy practices that assist in building strong literacy foundations. One element of a strong literacy foundation is phonological awareness (PA) or the awareness of various speech sounds such as syllables, rhyme, and individual phonemes (Phillips, Clancy-Menchetti, & Lonigan, 2008).

Statement of the Problem

Currently, educational statistics note persistent gaps in literacy achievement (Lonigan & Shanahan, 2009; National Center for Education Statistics, 2013) and kindergarten readiness (Jumpstart, 2009). These gaps provide evidence that some young children are not developing foundational literacy skills that are critical for future success. The statistics emphasize a continued need for early childhood educators to examine practices and develop interventions that assist in building strong literacy foundations. Thereby, creating space for all children to achieve to their highest potential. According to Roskos, Christie & Richgels (2003), there are three

critical areas in early literacy: oral language comprehension, phonological awareness and print knowledge.

Research examining effective literacy practices illustrates that learning to read is a complex and intensive process requiring the development and coordination of numerous literacy skills. PA, or the awareness of speech apart from meaning, is one skill that is essential to this process. Research indicates that PA is correlated with early reading achievement and plays a critical role in learning to read (Adams et al., 1990; Blachman, 2000; Flanigan, 2007; National Reading Panel, 2000; Snow, Burns, & Griffin, 1998). Flanigan (2007) discusses how studies have established a strong relationship between PA and early reading ability and that PA measured in children as young as preschool age has been found to be a robust predictor of later reading achievement. Additionally, PA is a prerequisite for understanding the alphabetic principle or the understanding that letters represent sounds and are matched in a left to right sequence within printed words (Anthony & Francis, 2006; Griffith & Olson, 1992). In learning to read an alphabetic language, PA is essential, since our system of writing maps letters to phonemes. In summary, literacy research strongly suggests that PA is correlated with early reading achievement and plays an important role in building a strong literacy foundation.

Therefore, recent studies highlighting the use of rhythm interventions to support the development of PA in children have gained the attention of researchers (Bhide, Power & Goswami, 2013; Forgeard, Schlaug, Norton, Rosam & Iyengar, 2008; Linardakis, Trouli & Chlapana, 2013; Tierney & Kraus, 2013). Studies highlighting the role that rhythm may play in the development of PA point to evidence of a relationship between rhythm and PA. For example, Linardakis, Trouli & Chlapana (2013) showed that a “rhythm intervention highly enhances the phonological awareness of kindergartners” (p.52). The relationship between

rhythm and PA can also be noted in work conducted by Bhide, Power & Goswami (2013) in which they discuss the growing evidence that children with reading difficulties show impaired auditory rhythm perception and impairments in musical beat perception tasks. Their study concluded that a rhythm focused intervention produced gains of comparable effect size to a specific literacy intervention for students who were falling behind in reading development.

The relationship between PA and rhythm suggests that they may share some of the same auditory mechanisms (Degé & Schwarzer, 2011; Goswami, 2011). PA requires the listener to be able to segment speech into its component sounds and recognize those sound categories across variations in pitch, tempo, speaker and context. Rhythm perception also requires the listener to be able to segment sounds and recognize those sound categories across variations in tempo, length and duration. Degé & Schwarzer (2011) state that consequently, a relationship between language sound categories and rhythm sound categories should be evident. Empirical evidence has also supported this relationship by noting that music and language have a common basis in the early years of a child's development (McMullen & Saffran, 2004).

Research on the use of rhythm interventions to promote the development of PA, which in turn may assist in the development of a strong literacy foundation, is promising. However, there are still unanswered questions about how this research translates to the early childhood classroom and its true impact on the development of PA. Further studies are needed to continue to refine our understandings of the role rhythm may play in the development of PA and how this research can be applied by classroom teachers to improve instruction. Bhide, Power & Goswami (2013) discuss the need for further studies that (1) use a control group to explore whether gains are greater than those that occur with the natural passage of time, (2) include all children not just a specific subset, (3) have a larger sample size and (4) use a combination of literacy and rhythm

approaches. Therefore, an intervention that uses a comparison group, works with a larger sample size, accepts all students that apply to participate and uses an integrated rhythm-literacy teaching approach was designed.

Significance of the Problem

As noted earlier, there continues to be children that struggle to master foundational literacy skills such as PA. In turn, this lack of foundational skills may hinder reading development farther up the developmental pathway. To demonstrate, a lack of PA may hinder the ability to master the alphabetic code or the mapping of sounds to letters. This in turn may lead to situations in which children begin to fall behind their peers academically in kindergarten and the years beyond (Lonigan & Shanahan, 2009). Therefore, interventions that address the development of strong PA skills in the early childhood classroom, as well as other foundational literacy skills, may help to close or eliminate potential gaps and change the developmental trajectory for children (Center on the Developing Child, 2007).

The National Association for the Education of Young Children and the International Literacy Association (2009) discuss how literacy interventions must be appropriate and effective for young children, and not just adaptations of what may work in the later grades. One way to address this achievement gap is through the implementation of an intervention specifically designed for young children. This intervention would draw from research on the relationship between rhythm and PA and utilize best practice for the teaching of literacy skills in the early childhood classroom. Therefore, this study presents an opportunity to extend existing research on the role of rhythm in the development of PA. In addition, it offers a possible model of how this research can be translated to the early childhood classroom, thereby creating benefits for multiple stakeholders in early childhood education.

To begin, the study will benefit the field of early childhood research by further examining the role rhythm may play in the development of PA. It extends and refines the research through the use of an IRL intervention, a larger and more diverse sample size and an experimental design. This study in conjunction with other research will assist in the discernment of effective research based literacy practices. Second, the study will benefit early childhood educators by providing a model of theory to practice. Details on the implementation of the IRL intervention have been provided and offer educators a potential implementation roadmap for use in their own classrooms. Third, this study will benefit young children through the use and examination of an IRL intervention focused on the development of PA and rhythm skills. The study will indicate how the IRL intervention might best be used to support young learners. Altogether, there is potential for multiple stakeholders to benefit from the examination of the role rhythm may play in the development of PA in preschoolers.

As noted earlier, there are persistent gaps in literacy achievement, in particular for children from low-income families (NCES, 2013). Multiple stakeholders will be able to utilize components of this study to advance understandings on the role rhythm may play in the development of PA and how an IRL intervention can be used to support PA and rhythm skill development in the early childhood classroom. Due to the significance of the early childhood years, this study has value for multiple stakeholders. These years, although brief, greatly impact later learning and the development of life-long literacy skills.

Purpose of Study

The purpose of this study is to explore the impact of an integrated rhythm-literacy (IRL) intervention on the development of rhythm and PA skills in preschool children. In particular, it seeks to examine the impact an IRL intervention may have on the development of rhythm and

PA skills for 4-5.5 year olds. The IRL intervention draws from research that examines the role rhythm may play in the development of PA and is composed of three main events. Those events include (1) integrated rhythm-literacy text interactions, (2) integrated rhythm-literacy call and response and (3) integrated rhythm-literacy movement. Thus, the study sought to advance knowledge on the connections between rhythm and PA development. In addition, this study sought to examine how the use of an IRL intervention can assist in translating theory into practice for the early childhood classroom.

Research Questions

This study examined the impact of an IRL intervention on the development of rhythm and PA skills for preschool children. The following research questions were used to guide the study.

1. Is there a significant difference in phonological awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?
 - a. Is there a significant difference in PALS-PK Rhyme Awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?
 - b. Is there a significant difference in PALS-PK Beginning Sound Awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?
 - c. Is there a significant difference in PALS-PK Nursery Rhyme Awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?

- d. Is there a significant difference in PAT2 Syllables scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?
2. Is there a significant difference in rhythm scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?

Definition of Terms

Concept of word in text: The ability to match spoken words to printed words as demonstrated by the ability to accurately point to the words (including two-syllable words) of a memorized text (Bear, Invernizzi, Templeton & Johnston, 2012).

Phonological awareness: An awareness of various speech sounds such as syllables, rhyme, and individual phonemes (Johnston, Invernizzi, Helman, Bear & Templeton, 2015).

Phonological Awareness Literacy Screening (PALS-PK): PALS-PreK is a scientifically-based phonological awareness and literacy screening that measures preschoolers' developing knowledge of important literacy fundamentals and offers guidance to teachers for tailoring instruction to children's specific needs. The assessment reflects skills that are predictive of future reading success and measures name writing ability, upper-case and lower-case alphabet recognition, letter sound and beginning sound production, print and word awareness, rhyme awareness and nursery rhyme awareness (Invernizzi, Sullivan, Meier & Swank, 2004).

Integrated rhythm and literacy intervention: In this study, an intervention that pulls from rhythm and literacy research. Each intervention session contains 3 components: (1) integrated rhythm-literacy text interactions, (2) integrated rhythm-literacy call and response and (3) integrated rhythm-literacy movement.

Overview of the Study

The present study used an experimental pretest and posttest research design to determine the impact of the IRL intervention on the development of rhythm and PA skills in preschool children. According to Fraenkel, Wallen and Hyun (2014), this type of study when properly applied is the best type for testing hypotheses about cause-and-effect relationships. Therefore, an experimental research methodology was utilized to directly attempt to influence the development of rhythm and PA skills. In keeping with the chosen research design, the study was composed of two groups (see Table 1) from preschool located in the Midwest. The first is a comparison group or group #1. This group participated in their regular classroom activities. Group #2 was the integrated rhythm/literacy group (IRL). This group received integrated rhythm and literacy instruction for 15 minutes, 2x per week for 8 weeks. Instruction consisted of traditional rhythm activities including tapping, call and response rhythm sequences, singing, drumming on a variety of small instruments, speaking, and participating in rhythmic movement to age appropriate songs. Further details and information on the design of the intervention can be found in Chapter 3 and the attached Appendix.

Table 1

Study Groups

Group #1: Comparison	Participated in regular classroom activities
Group #2: Integrated Rhythm and Literacy (IRL)	2x per week for 15 minutes, 8 weeks

Multiple data sources were collected and analyzed to examine the impact of the IRL intervention on the development of rhythm and PA skills. Specifically, assessment data from the Phonological Awareness Literacy Screening Preschool (PALS-PK, 2014), Weikart Beat Competency Test (Weikart, 2006), Phonological Awareness Test 2 (PAT2, 2007), and a researcher created COW-T pretests and posttests was utilized. The data collected for the two groups was analyzed in two primary ways. The first was a comparison of the group's pretest mean scores and posttest mean scores. T-tests were used in the analysis to determine if the means of two groups were statistically different from each other. The second analysis used analysis of variance (ANOVA). An ANOVA is a statistical technique used for determining the statistical significance of differences among means. For this analysis, the growth over the course of the intervention was examined by calculating the mean change score.

Summary

Chapter 1 of the study has presented the background of the problem, statement of the problem, significance of the problem, purpose of the study, questions to be answered, definitions of terms, and a brief description of the methodology. Chapter 2 is a review of relevant literature. It addresses the following topics: development of phonological awareness, development of

rhythm skills and the use of rhythm events to develop PA and rhythm skills. Chapter 3 presents the methodology used in the study, including the research questions and research design. The chapter goes on to describe the procedures for data collection and the plan for data analysis. Chapter 4 presents the results of the study. Last, chapter 5 discusses and analyzes the results, culminating in conclusions and recommendations.

CHAPTER 2. REVIEW OF THE LITERATURE

Introduction

The purpose of the study was to examine the impact of an IRL intervention on the development of rhythm and PA of preschoolers. Accordingly, this chapter contains a review of literature on the development of PA, the development of rhythm, the intersections of rhythm and literacy development and the research behind the IRL intervention. To begin, an overview of reading development is provided to frame and support the development of PA. An emphasis will be placed on the emergent and early stages of this developmental process in the overview. Literature specific to the development of PA follows. Next, a review of literature on rhythm development is discussed. To conclude, the chapter examines current research on the intersection of rhythm and literacy development and presents the theoretical underpinnings that guided the present study and the creation of the IRL intervention.

Overview of Reading Development

Jeanne Chall published *Learning to Read: the Great Debate* in 1967. This classic and comprehensive review examined issues in reading and emphasized the importance of teaching phonics (Adam et al., 1990). In the publication, Chall describes six stages of reading development. The first stage or stage zero is from birth to age six. This stage is focused on prereading experiences that are a critical foundation for later reading success. From birth, children are exposed to language and accumulate knowledge about print, books, letters, words and how to communicate. In this stage, children take part in pseudo-reading behaviors. An example of this would include retelling a favorite story from memory with the aid of illustrations.

Stage one typically occurs when children are six and seven years old. In this stage, children are just beginning to learn to read and decode text. According to Chall, one of the most important tasks of this stage is “learning [an] arbitrary set of letters and associating these with the corresponding parts of the spoken words” (p.15-16). In the early part of this stage, children learn the alphabetic system and begin to read. They tend to focus on meaning in that they often supply their own words. This may be a carry-over from their pretend reading. As they progress through this stage, they shift to more of a focus on the graphic nature of print and use cues to help decode unknown words. Towards the end of the stage, children begin to focus on both the meaning and the graphic nature of the print.

Stage two of reading development is referred to by Chall as the time of confirmation, fluency and ungluing from print. Children in this stage are typically seven to eight years old. In this stage, readers are consolidating what they have learned about reading from stage one and begin to read and reread familiar texts to develop fluency. The next stage or stage 3 typically occurs between fourth and ninth grade. This is a time when most nine to fourteen year olds start to read to learn. This is a long stage that Chall proposed thinking of in two parts. Stage 3a is when one is introduced to subjects and general content knowledge while 3b is when one’s reading begins to approximate that of an adult. Reading is no longer an arduous task. Instead, it is a time to gain new information through reading. This stage is marked by a growing importance of vocabulary and prior knowledge.

The fourth stage of reading development typically occurs in high school with children aged fourteen to eighteen. In this stage, a variety of viewpoints are examined on the same subject and content is presented in greater depth. Critical thinking skills are developed and refined because the reader must interpret the information presented to create meaning. The final

stage of reading development or stage 5 typically occurs during college and beyond. In this stage, adults begin to read as a task may dictate. The skills of skimming and scanning are applied as the reader strives to determine what is important or not.

Other researchers have articulated similar but further refined developmental progressions based upon Chall's work. An example is work presented by Templeton & Gehsmann (2014). Their developmental framework includes 5 stages that are based upon the work of Chall (1996), Henderson (1981), Wolf (2007) and Bear, Invernizzi, Templeton & Johnston (2012). For the purpose of this paper, the developmental stages as described by Templeton & Gehsmann (2014) will be used. An overview of those stages can be found in Table 2.

Table 2

Overview of Reading Development

Stage of Literacy Development	Characteristics
Emergent (PK-1)	<u>Reading:</u> Pretend reading, reads from memory, developing concepts about print, developing PA
Beginning (K to early 2)	<u>Reading:</u> Reading is out loud and word-by-word, 100-150 sight words at end of phase, full COW-T
Transitional (1 to mid-4)	<u>Reading:</u> Mostly silent reading, independently monitoring, begins to understand literary devices
Intermediate (3-8)	<u>Reading:</u> Reads fluently, prefers silent reading, takes critical stance, vocabulary further develops
Skillful (6 and above)	<u>Reading:</u> Reads fluently and with expression, fully explores genres, reads and analyzes primary sources

The stages of reading development provide context for the development of PA. As noted in Table 1, children begin to develop PA as well as additional literacy skills as they work and play with language in the emergent stage. The emergent stage typically occurs for most children in preschool through grade 1 and is an important time in a child's development of reading skills. Thus, the emergent level and the development of PA within that level will now be examined in more detail.

Development of Phonological Awareness

The emergent stage of literacy development is focused on helping children learn about the functions and elements of print. This is an important time in literacy development and is characterized by pretend reading, developing concepts about print, identification of rhymes, awareness of beginning sounds and conveying messages through scribbles or letterlike forms (Bear & Templeton, 1998). The foundation of this emerging knowledge base is oral language, which typically increases substantially during the preschool years (Clark, 2003; Karmilow & Karmilov-Simth, 2001; Tomasello, 2008). As children learn more about words and increase their vocabulary, they begin to focus on the sounds within the words. This awareness of speech, apart from what it means, is referred to as phonological awareness and is essential in learning to read (Lonigan, Anthony, Burgess & Phillips, 2004; Morris, Bloodgood, Lomax & Perney, 2003; Neuman & Dickinson, 2011; Wagner, Torgerson, & Roshotte, 1994; Yopp & Yopp, 2000).

Studies have shown that there is an apparent language-universal sequence in the development of PA (Cisero & Royer, 1995; Durgunoglu & Oney, 1999; Goswami & East, 2000). This sequence begins with children becoming sensitive to rhymes and syllables. An awareness of onset (beginning element of spoken syllable) and rime (rest of syllable) develops next. An example would be the word /lag/. The /l/ is the onset, while the /ag/ is the rime. Lastly,

awareness of the smallest units of speech or the phoneme develops (Goswami, 2002). It can be suggested that the development of PA includes a child's ability to distinguish smaller and smaller word parts.



Figure 1. Developmental Sequence of Phonological Awareness

Researchers note that other literacy skills are developing simultaneously alongside PA in the emergent stage. For example, Mesmer & Williams (2015) present a model that discusses the role PA plays in the development of concept of word or the ability to repeat a line of text while accurately pointing to each word that is said. The hypothesized model starts with syllable awareness, moves to letters and sounds and finally to concept of word. The study describes how multiple literacy skills often interact and develop in parallel. Flanigan (2007) discusses how PA is part of an evolution of word recognition. This evolution begins with initial consonant knowledge, progresses to concept of word in text, then full phonemic awareness and culminates with word recognition. These studies highlight that PA does not evolve in a literacy vacuum, but is instead embedded into a highly complex and interactive developmental process. However, within these and other models the developmental sequence of moving from larger word parts to smaller word parts for PA can be noted.

Importance of Phonological Awareness

A review of the literature notes the importance of PA and how it is correlated with early reading achievement (Adams et al., 1990; Blachman, 2000; Flanigan, 2007; National Reading Panel, 2000; Snow, Burns, & Griffin, 1998). Griffith & Olson (1992) discuss how PA is a prerequisite for understanding the alphabetic principle or the understanding that letters represent

sounds and are matched in a left to right sequence within printed words. They share that in learning to read and write an alphabetic language, PA is critical, since our system of writing maps letters to phonemes. Flanigan (2007) discusses how studies have established a strong relationship between PA and early reading ability and that PA measured in children as young as preschool age has been found to be a robust predictor of later reading achievement. Moreover, Anthony & Francis (2005) discuss how four decades of research have established the importance of PA and noted that children who have difficulty detecting or manipulating sounds in words will often struggle with learning to read. They share that randomized intervention studies demonstrate that there is a causal relationship, as intensive instruction in phonological awareness improves literacy skills. An example study is the National Reading Panel's 2000 report. The report describes a meta-analysis of 52 controlled experimental studies published in peer-reviewed journals. The report concludes that phonological awareness instruction has moderate and statistically significant effects on reading and spelling abilities and that explicit instruction is beneficial for typically developing children, for young children at risk for reading difficulties, and for readers that may be struggling.

Development of Rhythm

Gordon (1997) theorizes that there are three stages of early childhood music development that parallel the stages of language development. In the first stage, Acculturation, children are bathed in musical sound and begin experimenting with sound, much like children investigate and experiment with language. Children should ideally pass through this stage no later than age 4. The second stage is Imitation. In this stage, children will attempt to imitate the musical sounds and patterns being heard, yet these imitations are incorrect. Children ideally pass through this stage no later than age five. The third state is Assimilation. In this stage, children begin to

coordinate singing with breathing and movement, tonal and rhythm skills become accurate, and they develop a sense of beat and tonal center. The Assimilation stage would ideally occurred no later than age six. According to Gordon, the goal of music instruction is audiation or hearing music in the mind when it is not physically present (Campbell & Scott-Kassner, 2014).

Rhythm development, which is embedded in musical development, is facilitated by the development of a sense of meter and a vocabulary of rhythm patterns. According to Gordon (1997), rhythm has three elements. Those elements are macrobeats, microbeats, and melodic rhythm. Macrobeats are beats that one feels to be the longest. These beats are usually paired, meaning that one macrobeat naturally goes with the next. Microbeats are shorter than macrobeats and are also paired. In most cases, macrobeats are divided into two equal length microbeats. Macrobeats in a 4/4 time signature could be thought of as quarter notes while microbeats would be eighth notes. Melodic rhythm is the ongoing series of rhythmic patterns that can be found in a piece of music. Levels of rhythm development are hierarchical with each progressive level serving as readiness for achieving the next.



Figure 2. Developmental Sequence of Rhythm

It has been suggested that rhythm and language are closely related in early development (Anvari, Trainor, Woodside, & Levy, 2002). A comparison of rhythm and PA development does show common developmental elements. First, they both progress developmentally from larger units of sound to smaller units of sound. Second, they both rely upon the auditory processing of these units of sound. Research on the intersection of these two developmental processes is examined in detail in the following section.

Intersections of Phonological Awareness and Rhythm Development

There is evidence of a relationship between rhythm and PA. Research conducted by Degé & Schwarzer (2011) found significant correlations between kindergarten students' PA and musical skills. For the study, researchers randomly assigned forty-one, 5-6 year olds to either a phonological skills program, a music program or a control group that received sports training. Participants were trained for 10 minutes daily over the course of 20 weeks. The interventions typically consisted of a short welcome and two different tasks that were approximately 5 minutes in duration. A PA test was administered prior to the intervention. At the pretest, no significant differences were found between the treatment groups and the control group with respect to confounding variables such as gender, age, intelligence and socioeconomic status. Additionally, no differences in PA were revealed. Posttest results showed that children in the PA and music groups had significant increases in PA from pre-to post-test, whereas such an improvement was not found in the control group. The data suggests that PA can be developed with a PA program as well as a music program pointing to the value of using music in early childhood literacy programs. The authors also highlight the need for further research in the area of music and PA, in particular studies examining approaches that combine music and PA.

The concept of music instruction assisting in the development of PA was also seen in a study conducted by Bolduc & Lefebvre (2012). Their study assigned eight kindergarten classes (n = 100) to one of the following conditions: 1) music; 2) language; 3) combined music and language; and 4) passive music listening. Each experimental group participated in a total of 10 sessions. The sessions were held once per week for a total of 40 minutes. The first 10 minutes of each session were the same for each group. The nursery rhyme was recited to the pupils,

vocabulary words were defined, and the text was learned with the support of illustrations. The following 30 minutes then varied per group with tasks that either focused on music, phonological awareness, a combination of music and phonological awareness or passive music listening. Results indicated that children in conditions 1, 2, and 3 significantly improved participants' PA at post-test. Children in condition 4 (passive listening) did not show significant improvement in PA at post-test. In addition, the researchers share that the magnitude effect of conditions 1 and 3 was greater than condition 2. They state that "complementing nursery rhymes . . . with musical activities seems yet more powerful" (p.500).

If rhythm, a component of music skills, is the focus of the intervention, the same correlations appear to be evident. Linardakis, Trouli and Chlapana (2013) showed that rhythm skills may improve the PA of kindergarten students. Participants consisted of 55 kindergarten children from Greece that were randomly assigned to one of two groups. The first was the control group (n = 28). The second was the experimental group (n = 27). The intervention lasted for four weeks and was an intensive program created by the researchers. Intervention activities were implemented three times per week by two research assistants. The intervention consisted of rhythm and movement activities designed to help children understand the concept of rhythm, distinguish among different auditory stimuli, graphically reproduce rhythms and learn how to play rhythmic patterns. Prior to the intervention, children were assessed for nonverbal intelligence, graphomotor skills and literacy skills. The authors conclude that including rhythm activities in the daily school program can benefit PA and additional literacy skills.

The relationship between rhythm and reading achievement can also be noted in work conducted by Bhide, Power and Goswami (2013) in which they discuss the growing evidence that children with reading difficulties show impaired auditory rhythm perception and

impairments in musical beat perception tasks. Nineteen children aged 6-7 years participated in the study. All participants were identified by their class teachers as struggling readers and were assigned to either the rhythmic music intervention group or the GraphoGame (PA instruction software) group. Participants were seen for 19 sessions of approximately 25 minutes over the course of 2 months. At the conclusion of the study, the researchers share that a rhythmic music focused intervention produced gains of comparable effect size to a specific literacy intervention for students who were falling behind in reading development.

The relationship between PA and rhythm suggests that they may share some of the same auditory mechanisms (Degé & Schwarzer, 2011; Goswami, 2011). PA requires the listener to be able to segment speech into its component sounds and recognize those sound categories across variations in pitch, tempo, speaker and context. Rhythm perception also requires the listener to be able to segment sounds and recognize variations in tempo, length and duration. Degé & Schwarzer (2011) state that consequently, a relationship between language sound categories such as phoneme awareness and musical sound categories such as notes should be evident. Empirical evidence has supported the idea that music and language have a common basis in the early years of a child's development (McMullen & Saffran, 2004). This is in accordance with the assumption that the early developing brain may process language as a type of music (Koelsch & Siebel, 2005).

Conceptual Framework

The following paragraphs continue the discussion on the relationship between PA and rhythm through the examination of the temporal sampling theory. This theory informs the conceptual framework of the study. To begin, an overview of the temporal sampling theory will be defined and described. Next, how this theory was used to underpin the study and the IRL

intervention is presented. This is followed by a discussion on the conceptual framework and literature base for each of the IRL intervention elements.

Temporal Sampling Theory

Kraus (2013) suggest that there is a theoretical basis for a link between musical training and reading ability. This is due to the overlap of neural and cognitive resources necessary for reading acquisition and music. Moreover, these researchers find extensive empirical evidence indicates that musical training can enhance reading ability. To address reading difficulties, some researchers have proposed and tested musical interventions based upon the temporal sampling theory. This theory proposes that an underlying difficulty in tapping to a beat may be one cause of the development of poor PA skills in readers (Kuppen et al., 2011). The temporal sampling theory suggests that remediation based on rhythm and music, such as matching syllable patterning to metrical structure in music (singing), and playing instruments or moving in time with rhythms or rhythmic language (e.g. metrical poetry), will impact phonology and language development (Goswami, 2011). Patel (2008) discusses how this “shared sound category learning mechanism hypothesis” (Patel, 2008) predicts comparable individual differences in language and musical abilities. The theory then supports that the building blocks of language are related to the building blocks of music (Degé & Schwarzer, 2011). A visual model of how this theory was applied to the IRL intervention can be found in figure 3.

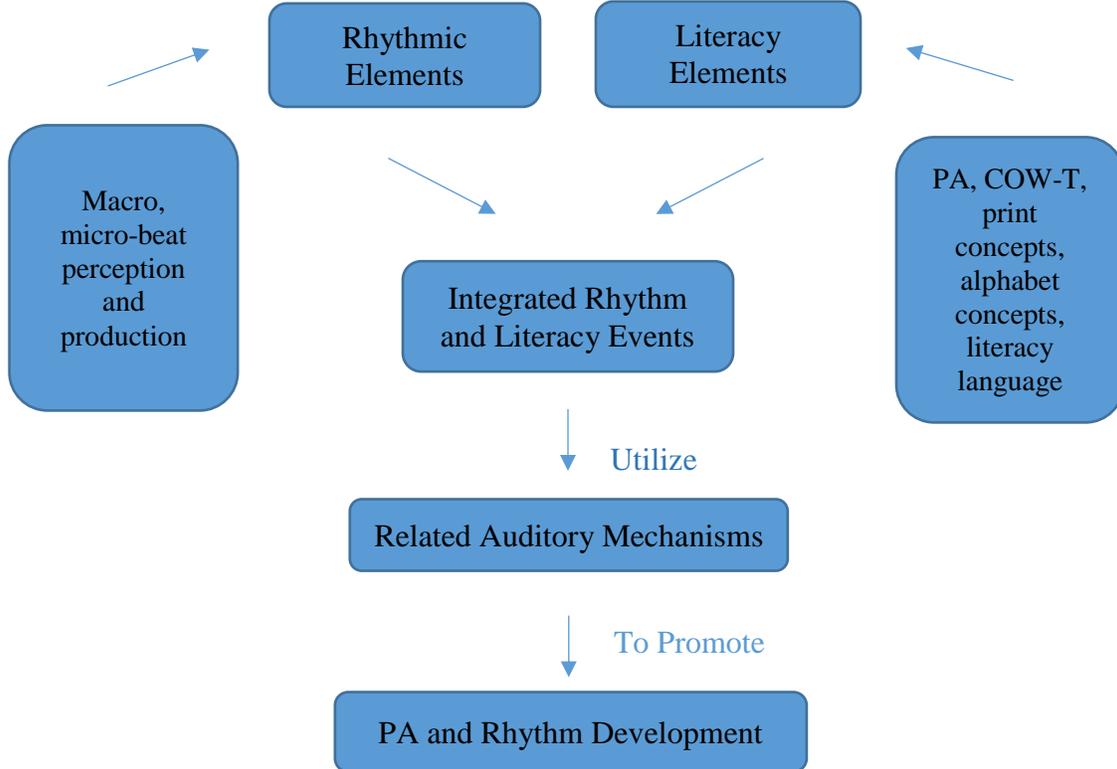


Figure 3. Integrated Rhythm and Literacy Intervention Visual Model

Development of Integrated Rhythm and Literacy Intervention

The previous conceptual framework was used to guide the development of the study research questions and the IRL intervention. The framework is evident in the utilization of integrated rhythm and literacy events to promote the development of rhythm and PA skills. The framework of the IRL intervention was also influenced by work from Justice and Kaderavek (2004). According to Justice and Kaderavek, two critical aims should be taken into consideration when selecting an intervention approach for children in the emergent stage. The first aim is to ensure that children develop skills that are highly associated with later reading achievement. Those skills include phonological awareness, oral language, alphabet awareness,

letter-sound knowledge, concepts about print and concept of word in text (Johnston, Invernizzi, Bear, Helman, Templeton, 2014; Justice & Kaderavek, 2004; Morris, Bloodgood, Lomax & Perney, 2003).

The first aim discusses the need of the intervention to develop skills associated with reading achievement. The first skill, PA, is the awareness of aspects of speech apart from the meaning the speech conveys. While the second skill, oral language refers to an awareness of language and vocabulary. The third, or alphabet awareness, references a child's ability to visually distinguish both lower and upper case letters. While the fourth, letter-sound knowledge references the awareness of the sounds the letters represent. The fifth, or concepts of print refers to an understanding of the ways print works. This includes directionality, punctuations, letters and words (Templeton & Gehsmann, 2014). The last skill or concept of word in text refers to a child's ability to point to each word accurately when reading lines of a memorized text. To clarify, full concept of word in text requires accuracy even while pointing to two syllable words.

The second aim is to promote children's development of literacy interest, which refers to a positive orientation toward literacy learning (Kaderavek and Sulzby, 1988). To address these two areas simultaneously, the embedded-explicit model can be used to "balance the use of directive, explicit interventions emphasizing socially embedded, highly contextualize, self-initiated literacy interactions to promote children's positive orientation and instrumental knowledge of literacy" (Justice & Kaderavek, p.6, 2004). Therefore, the IRL intervention was designed in the space created by the intersections of literacy, rhythm and early childhood research. A visual image of this space is provided in figure 4.

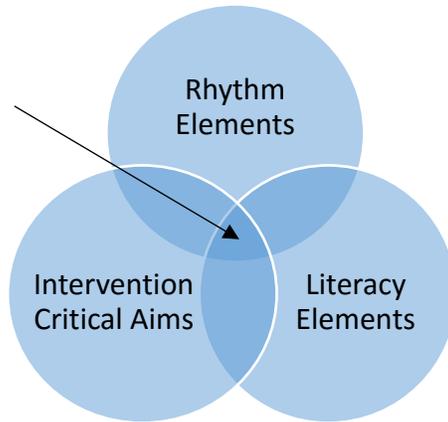


Figure 4. Integrated Rhythm and Literacy Intervention Underpinnings

Integrated Rhythm and Literacy Intervention Curriculum

The IRL intervention curriculum was developed after a review of research and is comprised of two main elements. The first element is the instructional framework or lesson planning template for each intervention session. The second element is the content or the literacy and rhythm skills embedded and taught through the instructional framework. Both the framework and the content were reviewed by a professional music educator and performer with more than 30 years of experience. This allowed for research team to receive feedback from a professional currently working in the field.

Integrated rhythm and literacy instructional framework. Each IRL intervention session was guided by the IRL instructional framework. The framework was developed to assist in the delivery of consistent intervention sessions. Each session was comprised of the following three events: integrated text interactions, integrated call and response, and integrated rhythm-focused movement. The three events and their research base are described in more detail in the following sections.

Integrated text interactions. Children took part in reading events focused on rhythmic texts. An example might include having students repeat or sing a nursery rhyme in time to a clapped beat. This intervention element is based on research conducted by Bolduc & Lefebvre (2012) and Goswami (2011). Bolduc & Lefebvre (2012) showed that if nursery rhymes were supplemented with musical activities the experimental group showed significant improvement in PA. Goswami (2011) discussed how traditional educational practices such as learning metrical poetry or singing nursery rhymes may assist in the development of brain areas related to phonological processing. Therefore, nursery rhymes and texts that mimic the main components of that genre (rich with rhyming words and an underlying rhythm) were used.

Integrated call and response. Children will mimic a rhythmic sentence with embedded literacy components using the body or small instruments. An example might include presenting a letter sound (such as the letter b) in a specific clapping pattern (3 quarter notes followed by 2 eighth notes) and asking students to repeat that pattern and sound. The end goal of the integrated call and response event is for the children to create an original rhythmic sentence for the group. The integrated call and response uses the gradual release of responsibility model (Fisher & Frey, 2013). This model call for the researcher to first demonstrate (I do), the group to practice with the researcher (we do) and then the child to independently use the demonstrated skill (you do). Weikart (2006) discusses how children can be taught the skills necessary to engage in steady beat activities. She advocates for children to take part in a sequence of interrelated and increasingly complex steady beat activities. Therefore, initial rhythmic sentences were kept simple and utilized the macrobeat. The rhythmic sentences grew progressively complex over the course of the intervention. Recent studies also point to the value of actively taking part in

musical experiences. The studies indicate that the process of learning to make music (rhythm) may be the key to improving how the brain processes sound (Kraus, 2016).

Integrated rhythm-focused movement. Children took part in rhythmic movement events with embedded literacy components. An example might include creating a list of animals and then moving like those animals in time to the specific song. The use of movement is encouraged by many educators and researchers as a vehicle for facilitating learning (Vazou & Smiley-Oyen, 2014; Weikart, 2006). In addition, the use of integrated rhythm-focused movement was utilized by the researchers to gauge the development of rhythm skills. This component was intentionally placed last in the instructional framework. Thereby, giving young children the chance to get up and move towards the end of the intervention session and researchers a chance to collect formative assessment data pertaining to rhythm.

Integrated rhythm and literacy instructional content. The second element of the IRL intervention curriculum refers to the content the intervention sought to teach. There are two main content areas focused on by the IRL intervention. The first is emergent literacy skills. Those skills include: PA, oral language, alphabet awareness, letter-sound knowledge, concepts about print and concept of word in text. The second area of focus is emergent rhythmic skills. Those skills include: nonlocomotor movement in macrobeat, locomotor movement in microbeat and rhythmic sentence production.

In table 3 below, the core intervention elements and references for their inclusion are shown.

Table 3

Integrated Rhythm and Literacy Intervention Concepts

Core Intervention Concept	Literature Basis for Inclusion
1. Emergent Literacy Skills With Emphasis on PA <ul style="list-style-type: none"> • PA (listed in developmental order): rhyme/syllables, onset, rime and phoneme • Oral language, concepts and vocabulary • Alphabet awareness • Letter-sound knowledge • Concepts about print • Concept of word in text 	Bear & Templeton, 1998; Blachman, 2000; Cisero & Royer, 1995; Durgunoglu & Oney, 1999; Goswami & East, 2000; Morris, Bloodgood, Loman, & Perney, 2003
2. Emergent Rhythmic Skills <ul style="list-style-type: none"> • Nonlocomotor movement in macrobeat • Locomotor movement in microbeat • Rhythmic sentence production 	Dalcroze, 1980; Gordon, 1997; Goodkin, 2013 (Orff Method); Weikart 2006; Zachopoulou, Chatzopoulos & Ellinoudis, 2003

Summary

This chapter reviewed literature pertaining to literacy development, the development of PA and the development of rhythm skills. It examined the overlap between PA and rhythm development. In addition, it discussed the theoretical underpinnings of this overlap. Last, it

presented how research informed the design and implementation of the IRL intervention. The next chapter will discuss the methodology used to answer the research questions. These questions sought to determine the impact an IRL intervention may have on the development of rhythm and literacy skills of preschool children.

CHAPTER 3. METHODOLOGY

Introduction

As described in Chapter 1, the purpose of this study was to determine the impact of an integrated rhythm-literacy (IRL) intervention on the development of phonological awareness and rhythm skills of preschoolers. The chapter begins by presenting the research questions. A description of the study design follows.

Research Questions and Hypotheses

The study was guided by two main research questions. These questions sought to determine the impact of an IRL intervention on the development of PA and rhythm skills in preschool children. These questions and any sub-questions are listed in the following section.

1. Is there a significant difference in phonological awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?
 - a. Is there a significant difference in PALS-PK Rhyme Awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?
 - b. Is there a significant difference in PALS-PK Beginning Sound Awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?
 - c. Is there a significant difference in PALS-PK Nursery Rhyme Awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?

- d. Is there a significant difference in PAT2 Syllables scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?
2. Is there a significant difference in rhythm scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?

It was hypothesized that scores for both PA and rhythm would improve significantly for the intervention group. It was also hypothesized that the developmental pathway for both rhythm and PA would be reflected in the results. For example, when examining PA scores in both the comparison and control groups, it was expected that rhyme/syllables will be higher or more developed than scores for onset/rime. Last, it was also hypothesized that over-all literacy scores would improve due to the nature of the IRL intervention. However, it was not clear if the over-all literacy scores would improve significantly based upon the literature reviewed.

Research Design

The purpose of this study was to examine the impact of an IRL intervention on the development of PA and rhythm skills of preschool children. To answer the research questions, the study employed an experimental pretest and posttest research design. At the start of the study, participants were randomly assigned to one of two groups using an online random assignment tool. The first group or group #1 was the comparison group (n = 20). This group participated in their regular classroom activities. The second group or group #2 was the intervention group (n = 23). This group took part in the IRL intervention for 15 minutes, two times per week for 8 weeks (see Table 4).

Table 4

Study Groups

Group 1: Comparison	Participated in regular classroom activities
Group 2: Treatment Integrated Rhythm and Literacy (IRL)	Participated in the IRL intervention 2x per week for 15 minutes, 8 weeks

At the start of the study, general demographic data and pretest data pertaining to rhythm and literacy skills was gathered for the two groups. The IRL intervention was then implemented for the intervention group. To assist with management, the IRL intervention curriculum was delivered to small groups of approximately 4-5 participants, two times per week for 8 weeks. Instruction consisted of integrated rhythm-literacy activities including integrated rhythmic text events, integrated call and response events, and integrated rhythmic movement events to age appropriate songs. The researcher provided the intervention curriculum with the help of an assistant. At the conclusion of the study, posttest data pertaining to rhythm and literacy skills was gathered for the two groups.

It is important to note that the study took place within a larger study titled *The Relationship Between Rhythm, Language & Literacy in Preschool Children: Assessment, Development and Intervention*. The larger study examined the role rhythm may play in the development of a variety of literacy skills, not just PA. An example would be concept of word in text. These additional skills were measured by the PALS-PK assessment. However, for this study only assessment data pertaining to PA and rhythm was analyzed to determine the impact of the IRL intervention and answer the research questions.

Population and Sample

The context of this study is a preschool in a Midwestern state. The preschool offers child care for children ages 19 months through 12 years. This study focused on a subset of the children attending the preschool, children ages 4-5.5 years old. Therefore, only a portion of the preschool was invited to participate. After agreeing to participate, classroom teachers sent home permission letters approved by the Internal Review Board (see Appendix A & B). These letters overviewed the study and contained a place for permission to be granted by a parent or guardian. A total of forty-three families returned the form and gave permission for their children to be included in the study.

Data Collection Instruments

An overview of the data collection instruments used for the study follows. To begin, the literacy assessments used for the study are described. Next, details on the rhythm assessment are provided. The section concludes with a presentation of additional data collection instruments. These instruments include a demographic data collection sheet, a fidelity of implementation checklist, researcher observation notebook and a musical history questionnaire.

Literacy Assessments

To determine participant's level of literacy development the following literacy assessments were administered. Those assessments include the Phonological Awareness Literacy Screening-Prekindergarten (PALS-PreK) test that was developed through a partnership between the University of Virginia and the Virginia State Department of Education (Invernizzi, Sullivan, Meier & Swank, 2004), the Phonological Awareness Test (Robertson & Salter, 1997) and an extended COW-T assessment created by the research team.

PALS-PK assessment. PALS-PreK was designed to be a comprehensive tool that could be used to identify students who are at-risk of reading difficulties and delays based on several foundational literacy tasks. A substantial body of research indicates that the literacy tasks included in the PALS-PreK are robust predictors of later literacy achievement (Bloodgood, 1999; Morris, 1981; Snow, Burns & Griffin; Whitehurst & Lonigan, 2001). These tasks are related to alphabet knowledge, beginning sound awareness, print and word awareness, rhyme awareness and nursery rhyme awareness (Table 2). Tasks are scored and a Summed Score is calculated for each student (ranging from a low of 0 to a high of 125) and then compared with the Summed Score benchmark for the testing period. The test is designed to provide educators with a general sense of where four-year-old children might be if they are on a typical path of literacy development associated with successful later reading. The authors caution that students scoring below the developmental range on one or more PALS-PreK tasks should not necessarily be assumed “at risk” or otherwise in danger of failing to learn to read. Instead, the purpose of the assessment is to help teachers target and plan future literacy instruction.

Table 5

PALS-PreK Tasks

PALS-PK Subtest	Rhyme	Beginning Sound	Upper-Case Alphabet	Lower-Case Alphabet	Letter Sounds	Print & Word Awareness	Nursery Rhyme Awareness	Name Writing
# Tasks	10	10	26	26	26	10	10	7

The reliability for PALS-PreK tasks was assessed by examining the internal consistency and inter-rate reliability. This was done by using Cronbach’s alpha level which is an index of internal consistency based on the average correlation of tasks within a screening instrument

(Mehrens & Lehmann, 1987). A Cronbach's alpha level of 1.00 is an indication of perfect internal consistency. The reliability for the PALS-PreK measures was high, with Cronbach's alpha scores ranging from .77 to .93 demonstrating the adequacy of their internal consistency. Inter-rater reliability of .99 for all tasks indicate that the PALS-PreK tasks can be scored consistently by individuals (Invernizzi, Sullivan, Meier & Swank, 2004). In the sections following, the individual subtests on the PALS-PreK are described.

Name writing. In a one-on-one setting, children are asked to draw a picture of themselves and write their name. For this assessment, only the name is scored. The minimum score for the item is 0, while the maximum is 7. The item is scored 0 if the child's name and picture are represented by one scribble. The item is scored 7 if the name is separate from the picture and does not include backwards letters or mirror image writing.

Alphabet knowledge. In a one-on-one setting, children are asked to identify upper and lower-case letters and letter sounds. This assessment examines children's knowledge of the alphabetic code at various levels and is divided into three sub-assessments. For each sub-assessment, items are scored as incorrect (0) or correct (1) with a total of 26 points possible. Upper-case alphabet recognition is assessed first. If a child reaches a certain threshold of upper-case recognition the lower-case alphabetic recognition assessment is administered. Similarly, letter sounds are only assessed if a certain threshold of lower-case recognition is demonstrated.

Beginning sound awareness. In a one-on-one setting, children are asked to demonstrate their knowledge of phonological awareness by producing the beginning sound of a word supplied by the administrator. Items are scored as incorrect (0) or correct (1) with a total of 10 points possible.

Print and word awareness. In a one-on-one setting, children are asked to demonstrate their knowledge of the form and function of books (title and print conventions) as well as their ability to point accurately to words in a familiar nursery rhyme (concept of word). Items are scored as incorrect (0) or correct (1) with a total of 10 points possible.

Rhyme awareness. In a one-on-one setting, children are asked to demonstrate their knowledge of phonological awareness by identifying a picture that rhymes with the target word. Items are scored as incorrect (0) or correct (1) with a total of 10 points possible.

Nursery rhyme awareness. In a one-on-one setting, children are asked to demonstrate their knowledge of phonological awareness by listening to a nursery rhyme and filling in a missing word when cued by the administrator. Items are scored as incorrect (0) or correct (1) with a total of 10 points possible.

Extended COW-T assessment. In addition to the PALS-PreK literacy assessments, one additional literacy assessment was administered for the larger study. The assessment was the Extended Concept of Word in Text assessment. The extended COW-T Assessment is a researcher developed assessment. This assessment asks children to use the text Hey Diddle to demonstrate COW-T skills such as pointing with one-on-one correspondence to text while reading. The assessment asks a total of seven questions that focus on the concept of COW-T. Items were scored as incorrect (0) or correct (1) with a total of 7 points possible.

Rhythm Assessment

One rhythm assessment was administered before and after the intervention. The assessment was videotaped for analysis. This allowed researchers to focus on administering the test and dealing with any questions the children had about the assessment.

Beat competence assessment. Assessments pertaining to rhythm skills were also administered to each child. The Beat Competence Assessment (BCA) developed by Weikart (2013) was used to assess rhythm skills. The BCA is designed to assess an individual's ability to perform movement to the underlying steady beat of recorded music. The test has been shown to be positively and significantly correlated with California Achievement Test total scores at the end of 1st and 2nd grade ($r = .30$ and $.24$, $p < .05$) in a study conducted by Weikart, Schweinhard & Lerner (1987).

The BCA consist of four steps that progress a child through tasks using nonlocomotor movement and locomotor foot movements in personal space. A single musical selection is used for the assessments. For step 1, the child is asked to pat his or her knees with both hands at the same time to the beat of the music. Step 2 asks the child to pat his or her knees to the beat using alternate hands for each beat. Step 3 uses the same music but asks the child to stand and "step" or "march" in time to the beat while remaining in place. Step 4 asks the child to do a "touch, step" sequence with one foot and then the other in time to the beat.

Each step of the assessment is scored on a 3-point scale. A total of 32 beats are analyzed. For each step, 0 indicates that the child is not able to accurately feel and demonstrate the beat for fewer than 14 beats. A score of 1 indicates that the child accurately demonstrates the beat for a short time but is not able to keep the beat throughout (15-29 beats). A score of 2 indicates that the child can accurately match movement to the underlying steady beat for 30 or more beats of the 32.

Additional Data Collection Instruments

Demographic data collection sheet. This data was supplied by the preschool after permission from parents/guardians was granted. Data on date of birth, gender, and classroom placement was collected.

Fidelity of implementation checklist. A fidelity of implementation checklist was also used 2 times by the researcher during the intervention sessions. This checklist examined the percentage of intervention curriculum and that was implemented during an intervention session.

Musical experience questionnaire. A questionnaire about musical experience was also given to participant's parents/guardians to complete. It was sent home at the conclusion of the study. The questionnaire seeks information on the number of preschool music classes participants may have taken and any music activities that may occur in the home. A copy of the questionnaire can be found in the Appendix B.

Data Collection Procedures

The following data collection procedures were implemented after permission was granted from both the families and the preschool. Data for the study was collected before, during and after the intervention.

Instrumentation and Materials Procedures

After obtaining IRB approval (see Appendix A), the research team met prior to the start of the study to discuss study procedures and participate in assessment training. Assessment training was conducted to assist in creating a consistent administration protocol and reduce the possibility of testing variability. It was determined that four researchers would administer the pretests so they could be completed in a timely manner for the forty-three participants. After random placement with the researchers, the approved literacy and rhythm assessments were

administered. Each researcher was assigned between ten to eleven children. To assist in reducing possible testing fatigue, the assessments were divided into three assessment sessions approximately ten to fifteen minutes long. One session was administered per day. To aid in creating a fun and engaging environment a game board with stickers for assessment completion was used during each session.

The first assessment session administered the following assessments: PALS-PK Name Writing, PALS-PK Upper-case Alphabet Recognition, PALS-PK Lower-case Letter Recognition, PALS-PK Letter Sounds and PALS-PK Beginning Sound Awareness. The second assessment session administered the following: PALS-PK Rhyme Awareness, PALS-PK Nursery Rhyme Awareness, PALS-PK Print Awareness and the Extended COW-T assessment. The final or third day consisted of the PAT2 Segmentation assessment and the Weikart Beat Competency rhythm assessment. The assessment administration guide can be found in Table 6.

After administration of pretests, participants were randomly assigned to the control or intervention group. Children in the control group participated in their normal classroom activities. The preschool was implementing The Creative Curriculum (Dodge, Colker & Heroman, 2013). This standards based curriculum is designed to help educators at all levels of experience plan and implement a developmentally appropriate, content-rich program for children with diverse backgrounds and skill levels. A typical daily schedule for the preschool started with large group time, moved to centers or individual play time, then recess and lunch, followed by nap time and then centers or individual play time again. The large group activities at the start of the day included a variety of literacy practices such as shared writing, read alouds and group discussions. Each week also typically had a theme such as “In the Kitchen” that was threaded

Table 6

Assessment Administration Guide

Day 1

Materials: PALS-PK testing kit, PALS Fall/Spring Child Summary Sheet (data), pencils, game board/pieces

- _____ Name Writing
- _____ Upper Case Alphabet Recognition*
Only proceed if child gets 16 or more correct
- _____ Lower-Case Alphabet Recognition*
Only proceed if child gets 9 or more correct
- _____ Letter Sounds*
- _____ Beginning Sound Awareness

Day 2

Materials: PALS-PK testing kit, PALS Fall/Spring Child Summary Sheet (data), COW-T extended data sheet, pencils, game board/pieces

- _____ Rhyme Awareness
- _____ Nursery Rhyme Awareness
- _____ Print Awareness and COW-T Extended Assessment

Day 3

Materials: Rhythm assessment instructions and scoring sheet, PAT2 Syllables scoring sheet, music, music player, recording device, game board/pieces

- _____ PAT2 Syllables
 - _____ Weikart Beat Competency Test (video record)
-

throughout the daily activities. The intervention group was typically pulled for 15 minutes from the center or individual play time in the morning at the request of the teachers.

The intervention group was split into 4 smaller groups to assist with management. Children were grouped by class whenever possible to reduce disruptions for the teacher. Participants were seen for 16 sessions of approximately 15 minutes in length delivered over a period of approximately 2 months. All intervention sessions were implemented by the same two members of the research team and are described in the following paragraphs.

IRL intervention. The IRL intervention consisted of numerous developmentally appropriate tasks designed to target the development of both rhythm and literacy skills. Each intervention session followed a similar three part format. Those three sections are listed below:

1. Integrated rhythm-literacy text interactions: Children took part in reading events focused on rhythmic texts. An example might include having students repeat a nursery rhyme in time to a clapped beat.
2. Integrated rhythm-literacy call and response: Children mimicked a rhythmic sentence with embedded literacy components using the body or small instruments. An example might include presenting a letter sound (such as the letter b) in a specific pattern (3 quarter notes followed by 2 eighth notes) and asking students to repeat that pattern and sound.
3. Integrated rhythm-literacy movement: Children took in part in rhythmic movement events with embedded literacy components. An example might include creating a list of animals and then moving like those animals in time to the specific song.

The opening IRL intervention session curriculum can be found in Appendix C. It highlights how these integrated events were implemented on the first day of the intervention. In addition, a

photo of the opening IRL intervention session materials and a cumulative list of songs/texts used in the IRL intervention can also be found in Appendix C. Over the course of the intervention sessions, data collected also included fidelity of implementation checklists, demographic data and a musical history questionnaire.

Posttests. Following completion of the IRL intervention, posttests were administered to both groups. The pretest administration guide was also used for the posttests. Each child participated in 3 assessment sessions that lasted approximately 10-15 minutes and were spread out over the course of 3 days. All data was then scored by the research team. Periodically during the scoring period, researchers compared results to ensure that the team was following the same scoring protocol. Data was then entered into an excel file for analysis using SPSS.

Data Analysis Procedures

Data analysis was performed with the statistical software SPSS (SPSS, 2011). SPSS is the acronym of Statistical Package for the Social Science. SPSS is a widely used statistical package which can perform highly complex data manipulation and analysis. The data collected for the groups was analyzed in two primary ways. The first was a comparison of the group's pretest mean scores and posttest mean scores. T-tests were used in the analysis to determine if the means of two groups were statistically different from each other. The second analysis used analysis of variance (ANOVA). An ANOVA is a statistical technique used for determining the statistical significance of differences among means. For this analysis, the growth over the course of the intervention was examined by calculating the mean change score.

Summary

This chapter presents the research methodology used for testing the research questions. These questions sought to determine the impact an IRL intervention had on the development of rhythm and PA in preschools. The research questions and study design were presented. The intervention, data set and data analysis plan were also discussed.

CHAPTER 4. RESULTS

Introduction

The purpose of this study was to examine the impact of an IRL intervention on the development of phonological awareness and rhythm skills of preschool children. This chapter presents the results of the previously described investigation and presents data from multiple analyses conducted to determine the effectiveness of the IRL intervention. The chapter first presents the research questions. General descriptive data for the intervention and comparison groups follows. Then, initial group differences between the intervention and comparison groups are presented through the comparison of pretest scores. Next, group differences at the conclusion of the study are presented through the comparison of posttest scores. Additionally, results from the musical history questionnaire and fidelity implementation checklist are presented. Last, data from analysis of the mean change score or the differences between pretest and posttest scores for both groups is shared.

Research Questions

The following research questions helped to guide the study. These questions focused on the effectiveness of the IRL intervention and its impact on the development of phonological awareness and rhythm skills in preschoolers.

1. Is there a significant difference in phonological awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?
 - a. Is there a significant difference in PALS-PK Rhyme Awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?

- b. Is there a significant difference in PALS-PK Beginning Sound Awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?
 - c. Is there a significant difference in PALS-PK Nursery Rhyme Awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?
 - d. Is there a significant difference in the PAT2 Syllables scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?
2. Is there a significant difference in rhythm scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?

General Group Data

Forty-five preschool families gave permission to participate in the study. These children were then randomly assigned to either the intervention or comparison group using an online randomization program. Therefore, two groups of children are represented in this study: intervention (IRL intervention group) or comparison group. As a point of clarification, two children were not included in the final study analysis. This is due to one child moving out of the area and one child self-requesting to not participate in specific assessments. This brings the total number of children participating in the study to forty-three. The number of participants by condition can be found in Table 7.

Table 7

Participants by Condition

Group	Program	N
1	Treatment	23
2	Control	20

General Group Statistics

The following section offers details on the composition of each group. In total, two categories are examined. Those categories include age and gender.

Age. The average age of the intervention group was 4.7 years while the average age of the comparison was 5.1 years at the conclusion of the study. The averages of the two groups can be seen in Table 8.

Table 8

Average Age by Group

Group	Program	Average Age
1	Intervention	4.7 years
2	Comparison	5.1 years

Gender. The gender balance between the groups is noted in Table 9.

Table 9

Gender by Group

Gender by Group	Group		Total
	Intervention	Comparison	
Female	13	6	19
Male	12	12	24
Total	25	18	43

Initial Group Differences

Initial group differences compared the starting points for PA and rhythm skills between all children in the IRL intervention group and all children in the comparison group. For the larger study, each group of children was assessed using the PALS-PK literacy assessments, the Extended COW-T assessment, the PAT2 Syllable Segmentation test and the Weikart Beat Competency Test. For purposes of this study, only assessments that focus on PA and rhythm skills were included. Those assessments include elements of the PALS-PK, the PAT2 Syllable Segmentation test and the Weikart Beat Competency Test. The PALS-PK assessments that focus on PA include: (1) Rhyme Awareness, (2) Beginning Sound Awareness and (3) Nursery Rhyme Awareness. In addition, the composite PALS-PK literacy score was included to provide context for the subtests.

Pretest Data

An analysis of the pretest data was conducted to examine the initial differences between the two groups.

Weikart beat competency pretest. There are 4 assessments or steps in the Weikart Beat Competency Test. Each step of the assessment is scored on a 3-point scale. For each step, 0 indicates that the child is not able to accurately feel and demonstrate the beat for fewer than 14 beats. A score of 1 indicates that the child accurately demonstrates the beat for a 15-29 beats but is not able to keep the beat throughout. A score of 2 indicates that the child can accurately match movement to the underlying steady beat for 30 or more beats of the 32. Therefore, the lowest composite score a child can receive is 0 while the highest is 8.

Table 10 highlights the results of the independent samples t-test for the Weikart Beat Competency pretest scores. Scores for the rhythm test can range from a low of 0 to a high of 10. Results indicate there was not a significant difference in Weikart Beat Competency pretest scores between the intervention ($M = 1.09$, $SD = 1.41$, $N = 23$) and comparison ($M = 1.80$, $SD = 1.78$, $N = 20$) groups, $t(36) = -1.457$, $p = .161$. Figure 5 illustrates the range and frequency of rhythm scores between the two groups. The scores for the Beat Competency pretest ranged from a low of 0 to a high of 5 out of 8.

Table 10

Independent Samples t-test Weikart Beat Competency (WCA) Pretest

Assessment	N	Intervention		Comparison		<i>t</i>	<i>p</i>
		M	SD	M	SD		
WBC	43	1.087	1.4114	1.800	1.7947	-1.457	.161

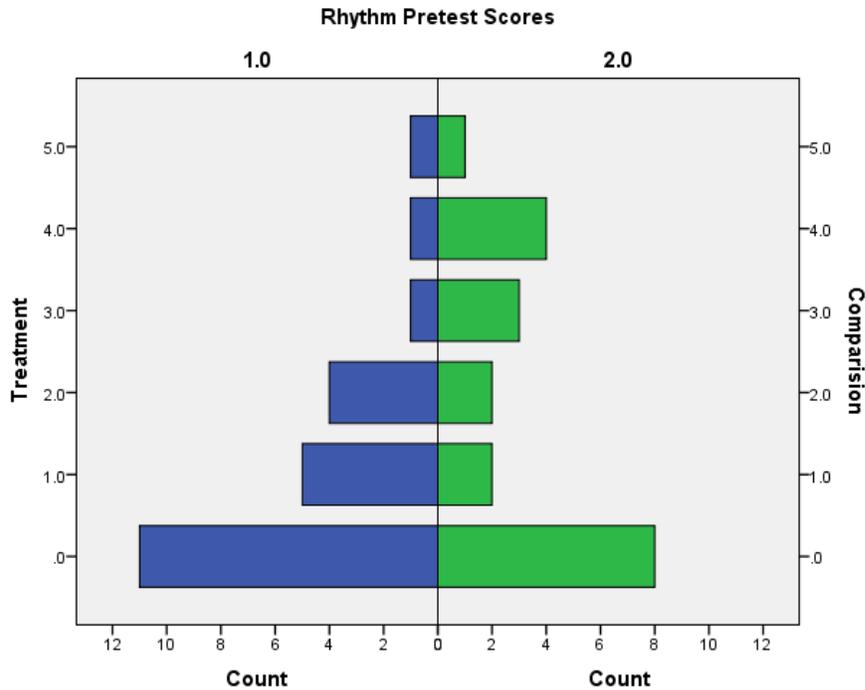


Figure 5. Frequency of Rhythm Pretest Scores

PALS-PK composite literacy pretest. To lend context to the individual literacy assessments, the PALS-PK composite scores for both groups were examined. This score is a combination of all PALS-PK literacy tests. The composite score includes name writing ability, upper-case and lower-case alphabet recognition, letter sound and beginning sound production, print and word awareness, rhyme awareness and nursery rhyme awareness assessment scores.

Table 11 highlights the results of the independent samples t-test for the PALS-PK Composite pretest scores. Scores for the PALS-PK Composite test can range from a low of 0 to a high of 125. Results indicate there was a significant difference in PALS-PK Composite pretest scores between the intervention ($M = 56.00$, $SD = 35.81$, $N = 23$) and comparison ($M = 80.15$, $SD = 29.70$, $N = 20$) groups, $t(40) = -2.416$, $p = .020$. Figure 6 visually illustrates the range and

frequency of PALS-PK Composite pretest scores between the two groups. The scores for the PALS-PK Composite ranged from a low of 8 to a high of 118 out of 125.

Table 11

Independent Samples t-test PALS-PK Composite (COM) Pretest

Assessment	N	Intervention		Comparison		<i>t</i>	<i>p</i>
		M	SD	M	SD		
PALS-PK COM	43	56.000	35.8139	80.150	29.7043	-2.416	.020

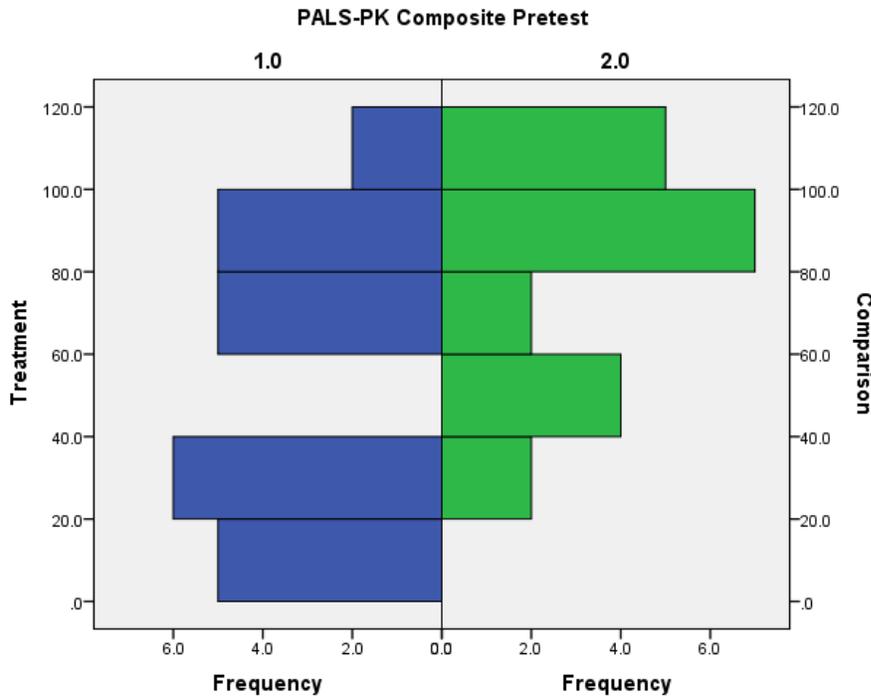


Figure 6. Frequency of PALS-PK Composite Literacy Pretest Scores

Pretest data specifically related to the development of PA was then analyzed through the use of independent samples t-tests. Tests included in the analysis were the PAT2 Syllable

assessment and three PALS-PK assessments. The PALS-PK assessments included were Nursery Rhyme Awareness, Rhyme Awareness and Beginning Sound Awareness. Results of the analyses are presented below.

PALS–PK nursery rhyme awareness pretest. Table 12 highlights the results of the independent samples t-test for the PALS-PK Nursery Rhyme Awareness pretest scores. Scores for the test can range from a low of 0 to a high of 10. Results indicate there was not a significant difference in PALS-PK Nursery Rhyme Awareness pretest scores between the intervention ($M = 6.04$, $SD = 2.38$, $N = 23$) and comparison ($M = 7.15$, $SD = 2.25$, $N = 20$) groups, $t(41) = -1.563$, $p = .126$. Figure 7 visually illustrates the range and frequency of nursery rhyme awareness pretest scores between the two groups. The scores for the PALS-PK Nursery Rhyme Awareness pretest ranged from a low of 1 to a high of 10 out of 10.

Table 12

Independent Samples t-test PALS-PK Nursery Rhyme Awareness (NRA) Pretest

Assessment	N	Intervention		Comparison		<i>t</i>	<i>p</i>
		M	SD	M	SD		
PALS-PK NRA	43	6.043	2.3832	7.150	2.2542	-1.563	.126

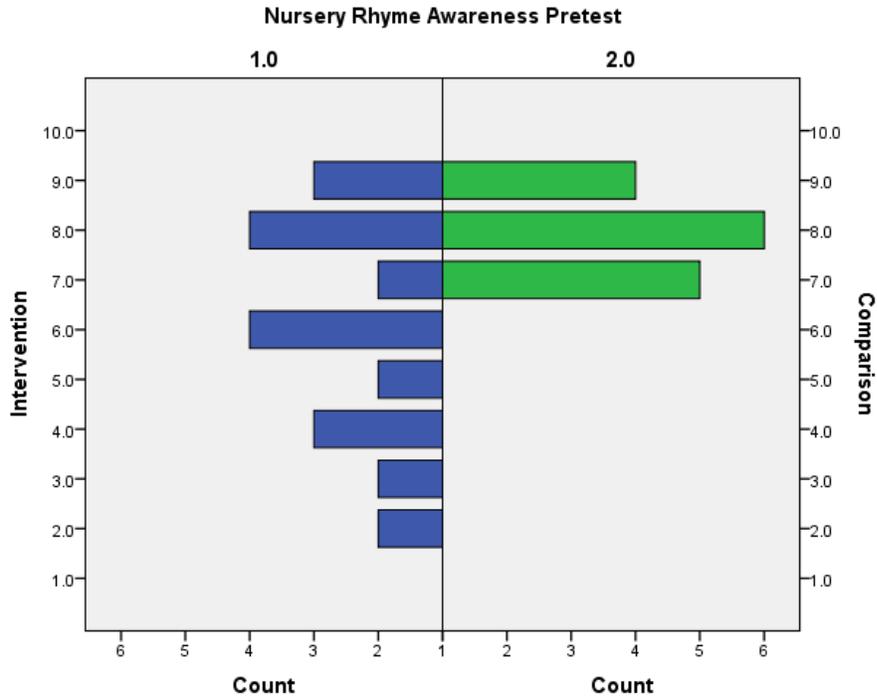


Figure 7. Frequency of PALS-PK Nursery Rhyme Awareness Pretest Scores

PALS-PK rhyme awareness pretest. Table 13 highlights the results of the independent samples t-test for the PALS-PK Rhyme Awareness pretest scores. Scores for the test can range from a low of 0 to a high of 10. Results indicate there was not a significant difference in PALS-PK Rhyme Awareness pretest scores between the intervention ($M = 5.96$, $SD = 3.62$, $N = 23$) and comparison ($M = 7.45$, $SD = 2.76$, $N = 20$) groups, $t(41) = -1.530$, $p = .141$. Figure 8 visually illustrates the range and frequency of rhyme awareness pretest scores between the two groups. The scores for the PALS-PK Rhyme Awareness pretest ranged from a low of 1 to a high of 10 out of 10.

Table 13

Independent Samples t-test PALS-PK Rhyme Awareness (RA) Pretest

Assessment	N	Intervention		Comparison		<i>t</i>	<i>p</i>
		M	SD	M	SD		
PALS-PK RA	43	5.957	3.6241	7.450	2.7621	-1.530	.141

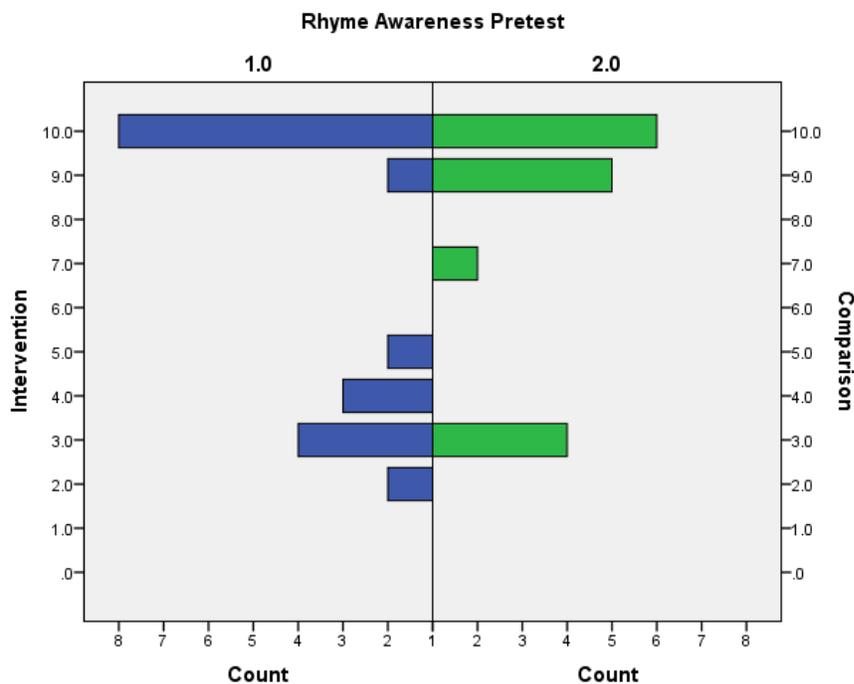


Figure 8. Frequency of PALS-PK Rhyme Awareness Pretest Scores

PALS-PK beginning sound awareness pretest. Table 14 highlights the results of the independent samples t-test for the PALS-PK Beginning Sound Awareness pretest scores. Scores for the test can range from a low of 0 to a high of 10. Results indicate there was a significant difference in PALS-PK Beginning Sound Awareness pretest scores between the intervention ($M = 4.78$, $SD = 3.87$, $N = 23$) and comparison ($M = 7.35$, $SD = 3.41$, $N = 20$) groups, $t(41) = -2.567$, $p = .026$. Figure 9 visually illustrates the range and frequency of

Beginning Sound Awareness pretest scores between the two groups. The scores for the PALS-PK Beginning Sound Awareness pretest ranged from a low of 1 to a high of 10 out of 10.

Table 14

Independent Samples t-test of PALS-PK Beginning Sound Awareness (BSA) Pretest

Assessment	N	Intervention		Comparison		<i>t</i>	<i>p</i>
		M	SD	M	SD		
PALS-PK BSA	43	4.783	3.8725	7.350	3.4070	-2.5674	.026

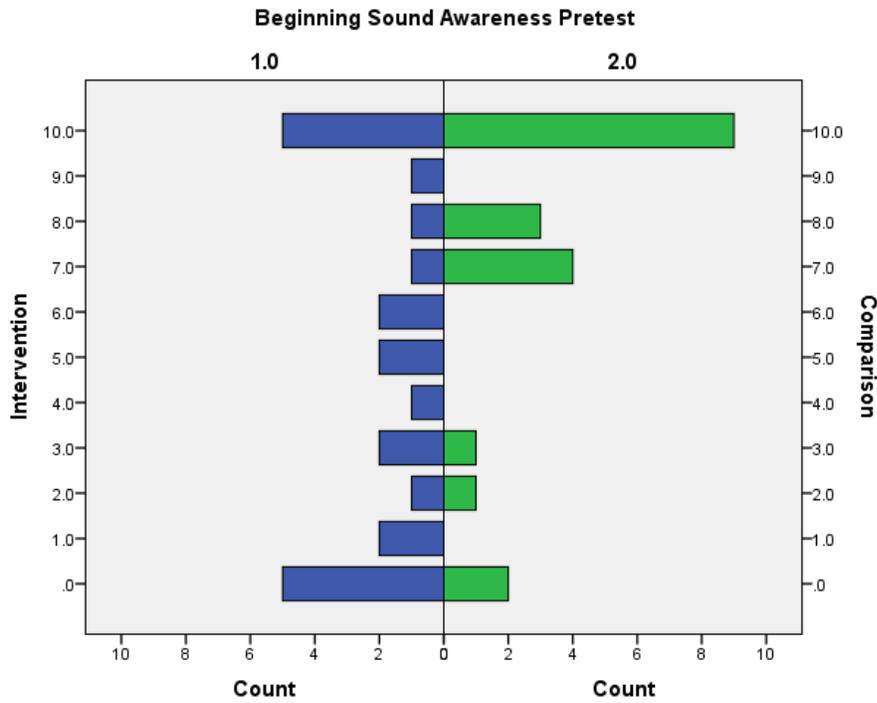


Figure 9. Frequency of PALS-PK Beginning Sound Awareness Pretest

PAT2 byllables. Table 15 highlights the results of the independent samples t-test for the PAT2 Syllables pretest scores. Scores for the PAT2 Syllables test can range from a low of 0 to a high of 10. Results indicate there was not a significant difference in PAT2 Syllables pretest scores between the intervention ($M = 5.26$, $SD = 2.77$, $N = 23$) and comparison ($M = 5.90$, $SD = 3.06$, $N = 20$) groups, $t(39) = -.714$, $p = .479$. Figure 10 visually illustrates the range and frequency of rhyme awareness pretest scores between the two groups. The scores for the PAT2 Syllables pretest ranged from a low of 0 to a high of 10 out of 10.

Table 15

Independent Samples t-test PAT2 Syllables Pretest Scores

Assessment	N	Intervention		Comparison		<i>t</i>	<i>p</i>
		M	SD	M	SD		
PAT2 Syllables	43	5.261	2.7670	5.900	3.0591	-.714	.479

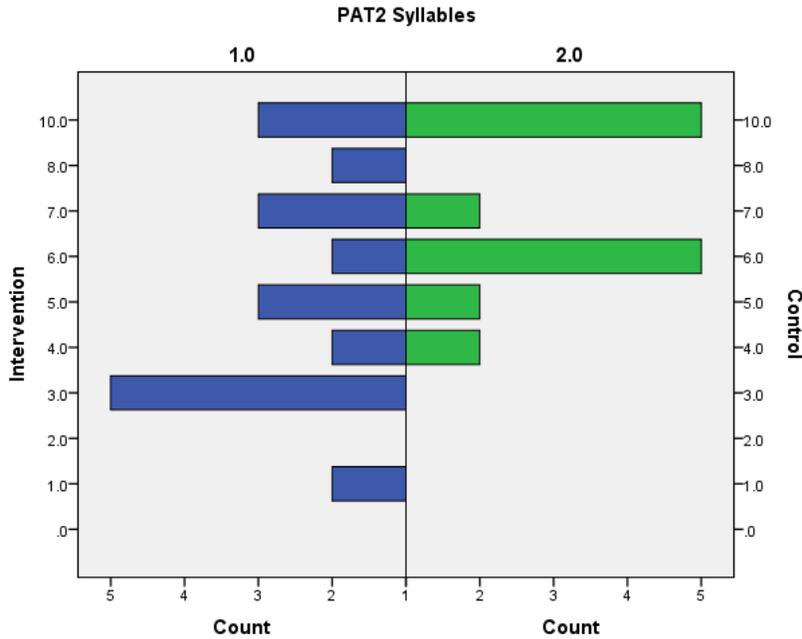


Figure 10. Frequency of PAT2 Syllable Pretest Scores

Concluding Group Differences

Concluding group differences compared the posttest assessments of all children in the IRL treatment group and all children in the control group. Each group of children was assessed using the PALS-PK literacy assessments, the extended COW-T assessment, the PAT2 syllable segmentation test and the Weikart Beat Competency Test. For purposes of this study, only assessments that focus on PA and rhythm skills were included. Those assessments include elements of the PALS-PK, the PAT2 Syllable Segmentation test and the Weikart Beat Competency Test. The PALS-PK assessments that focus on PA include: (1) Rhyme Awareness, (2) Beginning Sound Awareness and (3) Nursery Rhyme Awareness. In addition, the PALS-PK Composite score was included to provide context for the subtests.

Posttest Data

An analysis of the posttest data was conducted to examine the concluding differences between the two groups

Weikart beat competency posttest. Table 16 highlights the results of the independent samples t-test for Weikart Beat Competency pretest scores. Scores for the test can range from a low of 0 to a high of 8. Results indicate there was not a significant difference in Weikart Beat Competency pretest scores between the intervention ($M = 2.97$, $SD = 1.74$, $N = 23$) and comparison ($M = 2.20$, $SD = 2.19$, $N = 23$) groups, $t(36) = 1.098$, $p = .279$. Figure 11 illustrates the range and frequency of rhythm scores between the two groups. The scores for the Weikart Beat Competency posttest ranged from a low of 0 to a high of 7 out of 8.

Table 16

Independent Samples t-test Weikart Beat Competency (WBC) Posttest

Assessment	N	Intervention		Comparison		<i>t</i>	<i>p</i>
		M	SD	M	SD		
WBC	43	2.970	1.7400	2.200	2.1909	1.098	.279

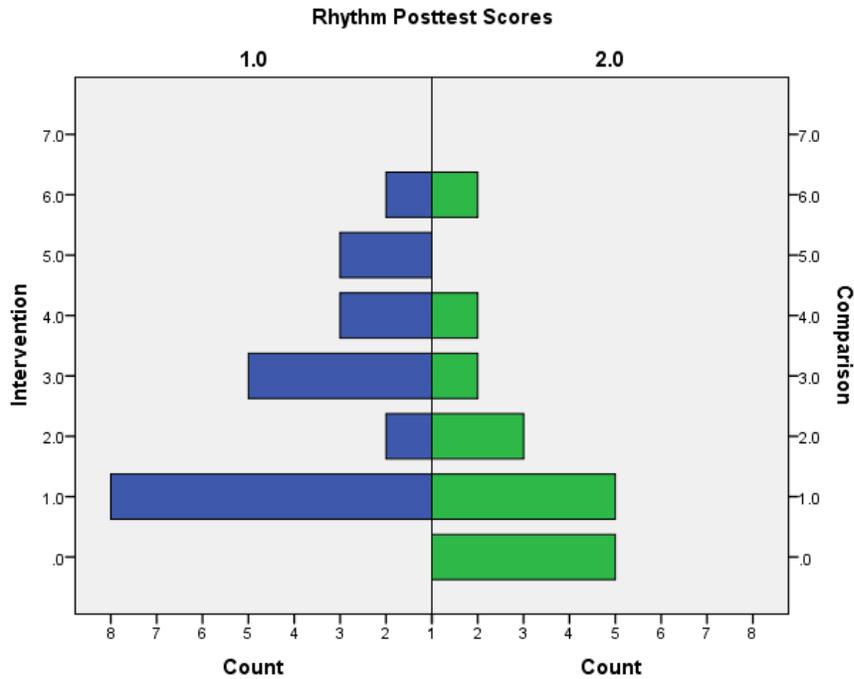


Figure 11. Frequency of Rhythm Posttest Scores

Composite PALS-PK literacy posttest. To lend context to the individual literacy assessments, the PALS-PK Composite scores for both groups were examined. This score is a combination of all PALS-PK literacy tests. The composite score includes name writing ability, upper-case and lower-case alphabet recognition, letter sound and beginning sound production, print and word awareness, rhyme awareness and nursery rhyme awareness assessment scores.

Table 17 highlights the results of the independent samples t-test for the PALS-PK Composite pretest scores. Scores for the PALS-PK Composite test can range from a low of 0 to a high of 125. Results indicate there was a significant difference in PALS-PK Composite pretest scores between the intervention ($M = 69.57$, $SD = 36.62$, $N = 23$) and comparison ($M = 88.65$, $SD = 25.77$, $N = 20$) groups, $t(39) = -1.995$, $p = .053$. Figure 12 visually illustrates the range and frequency of rhythm posttest scores between the two groups. The scores for the PALS-PK Composite posttest ranged from a low of 18 to a high of 119 out of 125.

Table 17

Independent Samples t-test PALS-PK Composite Posttest Scores

Assessment	N	Intervention		Comparison		<i>t</i>	<i>p</i>
		M	SD	M	SD		
WBC	43	69.565	36.6157	88.650	25.7708	-1.995	.053

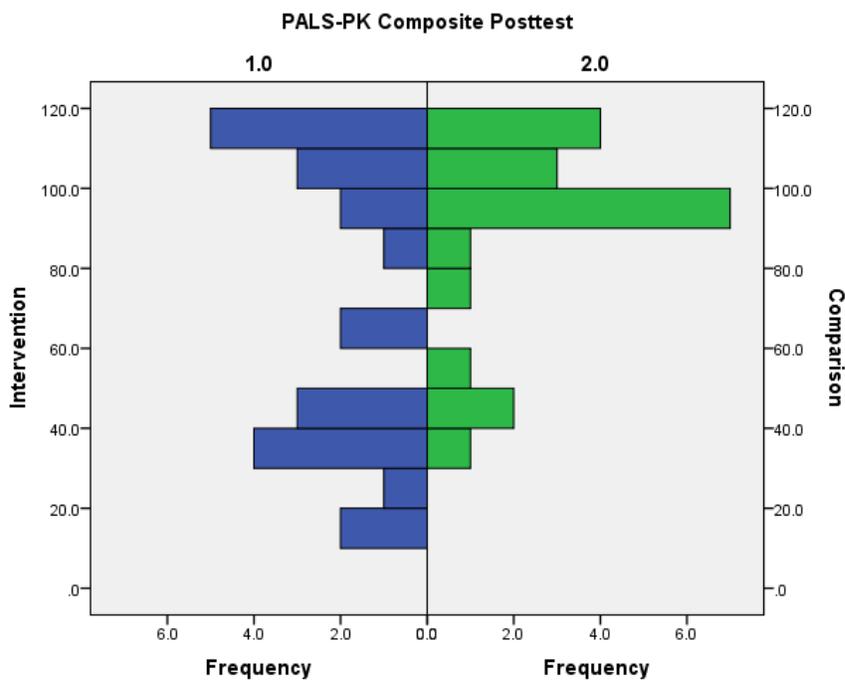


Figure 12. Frequency of PALS-PK Composite Posttest Scores

PALS–PK nursery rhyme awareness posttest. Table 18 highlights the results of the independent samples t-test for the PALS-PK Nursery Rhyme Awareness posttest scores. Scores for the test can range from a low of 0 to a high of 10. Results indicate there was not a significant difference in PALS-PK Nursery Rhyme Awareness posttest scores between the intervention

($M = 6.52, SD = 2.39, N = 23$) and comparison ($M = 7.40, SD = 1.82, N = 20$) groups, $t(40) = -1.365, p = .180$. Figure 13 visually illustrates the range and frequency of nursery rhyme awareness posttest scores between the two groups. The scores for the PALS-PK Nursery Rhyme Awareness posttest ranged from a low of 2 to a high of 10 out of 10.

Table 18

Independent Samples t-test PALS-PK Nursery Rhyme Awareness (NRA) Posttest Scores

Assessment	N	Intervention		Comparison		<i>t</i>	<i>p</i>
		M	SD	M	SD		
PALS-PK NRA	43	6.522	2.3907	7.400	1.8180	-1.365	.180

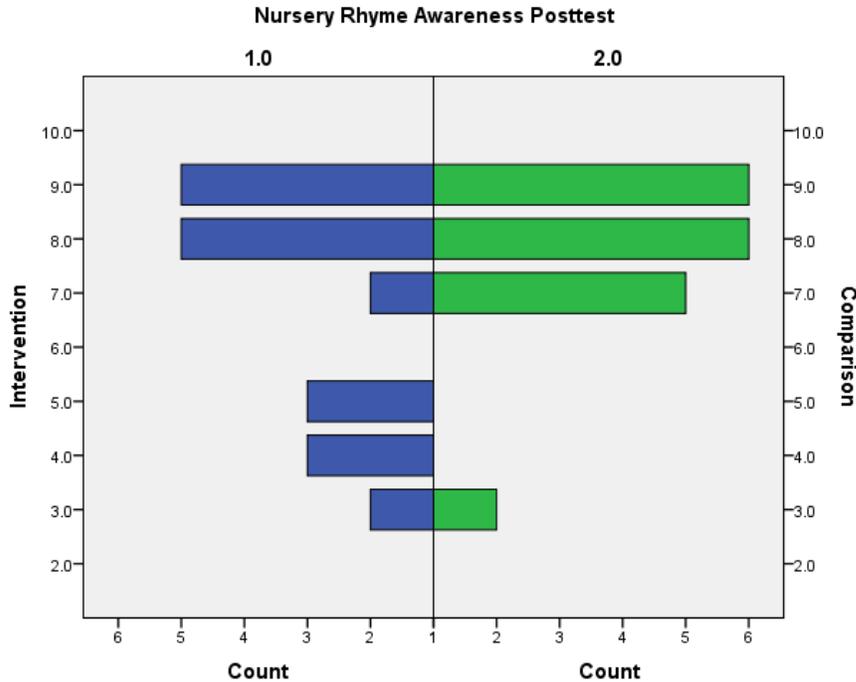


Figure 13. Frequency of PALS-PK Nursery Rhyme Awareness Posttests

PALS-PK rhyme awareness posttest. Table 19 highlights the results of the independent samples t-test for the PALS-PK Rhyme Awareness posttest scores. Scores for the test can range from a low of 0 to a high of 10. Results indicate there was not a significant difference in PALS-PK Rhyme Awareness posttest scores between the intervention ($M = 7.87, SD = 2.55, N = 23$) and comparison ($M = 7.90, SD = 3.14, N = 20$) groups, $t(37) = -.035, p = .973$. Figure 14 visually illustrates the range and frequency of rhyme awareness posttest scores between the two groups. The scores for the PALS-PK Rhyme Awareness posttest ranged from a low of 0 to a high of 10 out of 10.

Table 19

Independent Samples t-test PALS-PK Rhyme Awareness Posttest Scores

Assessment	N	Intervention		Comparison		<i>t</i>	<i>p</i>
		M	SD	M	SD		
PALS-PK RA	43	7.870	2.5460	7.900	3.1439	-.035	.973

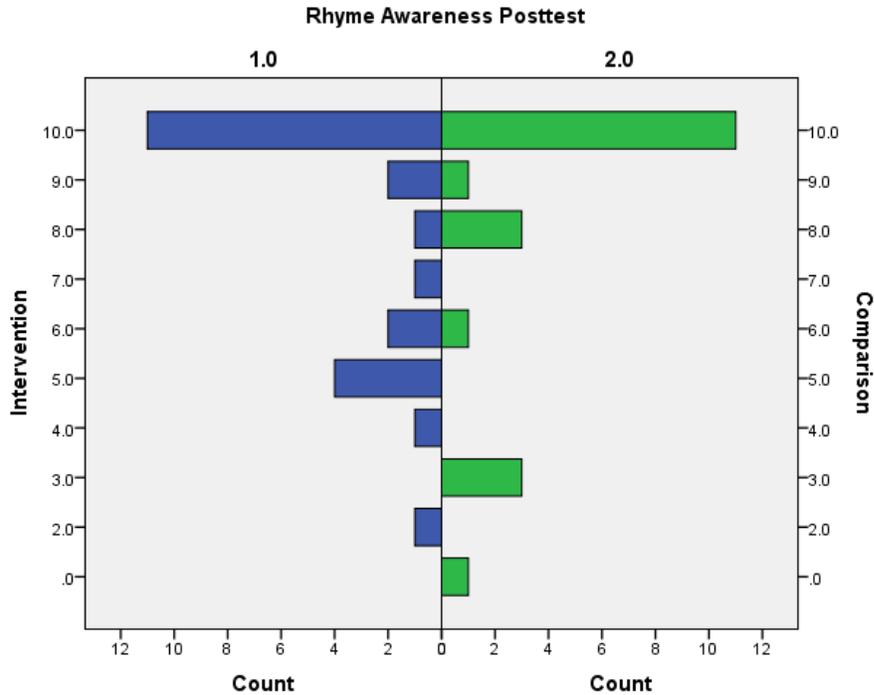


Figure 14. Frequency of PALS-PK Rhyme Awareness Posttest Scores

PALS-PK beginning sound awareness posttest. Table 20 highlights the results of the independent samples t-test for the PALS-PK Beginning Sound Awareness posttest scores. Scores for the test can range from a low of 0 to a high of 10. Results indicate there was not a significant difference in PALS-PK Beginning Sound Awareness scores between the intervention ($M = 6.75, SD = 3.58, N = 23$) and comparison ($M = 8.00, SD = 3.31, N = 20$) groups, $t(40) = -1.199, p = .237$. Figure 15 visually illustrates the range and frequency of beginning sound awareness posttest scores between the two groups. The scores for the PALS-PK Beginning Sound Awareness posttest ranged from a low of 0 to a high of 10 out of 10.

Table 20

Independent Samples t-test PALS-PK Beginning Sound Awareness (BSA) Posttests

Assessment	N	Intervention		Comparison		<i>t</i>	<i>p</i>
		M	SD	M	SD		
PALS-PK BSA	43	6.739	3.583	8.000	3.309	-1.199	.237

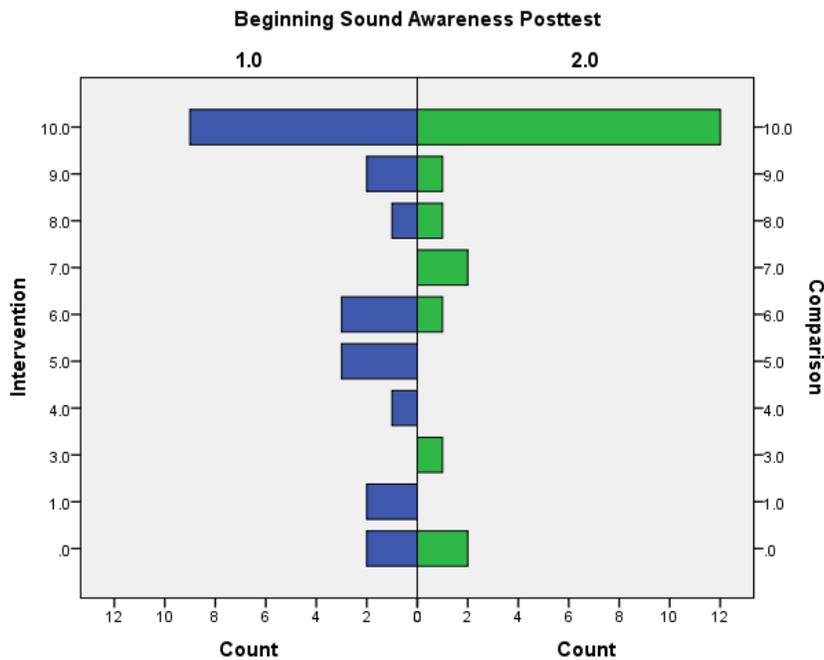


Figure 15. Frequency of PALS-PK Beginning Sound Awareness Posttests

PAT2 syllables. Table 21 highlights the results of the independent samples t-test for the PAT2 Syllable posttest scores. Scores for the test can range from a low of 0 to a high of 10. Results indicate there was not a significant difference in PAT2 Syllable scores between the intervention ($M = 5.26$, $SD = 2.76$, $N = 23$) and comparison ($M = 5.90$, $SD = 3.06$, $N = 20$) groups, $t(35) = -5.16$, $p = .609$. Figure 16 visually illustrates the range and frequency of PAT2

Syllables posttest scores between the two groups. The scores for the PAT2 Syllables posttest ranged from a low of 2 to a high of 10 out of 10.

Table 21

Independent Samples t-test PAT2 Syllables Posttest Scores

Assessment	N	Intervention		Comparison		<i>t</i>	<i>p</i>
		M	SD	M	SD		
PAT2	43	5.261	2.767	5.900	3.059	-.516	.609

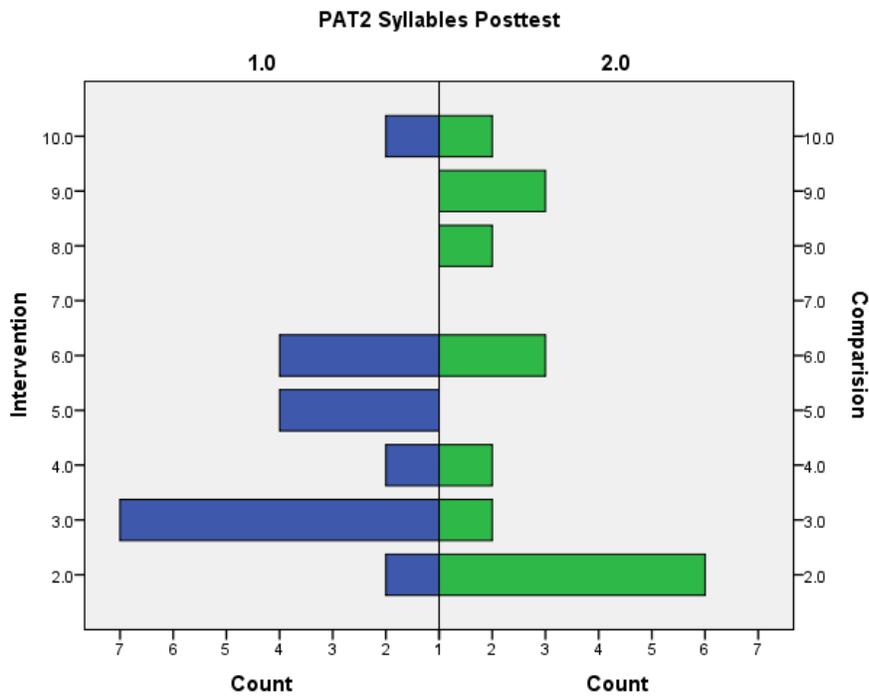


Figure 15. Frequency of PAT2 Syllable Posttest Scores

Supplemental Study Data Analysis

In addition to the pre and posttest data, the study also collected data from a musical history questionnaire and fidelity of implementation checklist. Further information on this data is provided in the following sections.

Musical history questionnaire. Results from the musical history questionnaire are presented below. Question 1 on the questionnaire asked parents/guardians to share if their child had previously taken a preschool music class (Table 22). Results highlight that a total of 6 (4: intervention, 2: comparison) of the 43 of the participants had taken a formal preschool music class prior to the start of the study. All respondents stated that the classes were Kindermusik classes. Kindermusik International is an established community of music educators. The group began in 1978 and utilizes a music-and-movement curricula. Question 2 on the questionnaire asked parents/guardians to share if their child was currently taking a music class. Results show that at the time of the study no participants were participating in a formal music class. Question 3 on the questionnaire asked parents/guardians to share if their child participated in musical activities such as singing or dancing to music in the home (Table 23). Results show that a large percentage of both groups participate in musical activities at home.

Table 22

Question 1: Has your child taken a preschool music class?

Taken Music Class	Yes	No
Intervention	4	19
Comparison	2	20

Table 23

Question 3: Does your child take part in musical activities in your home?

Home Musical Activities	Yes	No
Intervention	18	5
Comparison	16	4

Fidelity of implementation checklist. A fidelity of implementation checklist was utilized twice during the intervention. This checklist sought to ensure that the intervention curriculum was fully implemented for all intervention groups. Another researcher completed that checklist during two intervention sessions. The first checklist was completed during session 9 of the intervention. The second was completed during session 13 of the intervention. The checklist for session 9 indicates 100% implementation of all intervention elements for groups 1, 3, 4. For group 2, the fidelity implementation checklist noted that 4 of 5 elements were fully implemented and one 1 of 5 was partially implemented. The checklist for session 13 indicates 100% implementation of all components for each of the four groups.

Study Results

To determine the effectiveness of the IRL intervention, an analysis of variance (ANOVA) was used to examine the group mean change differences between the pretest scores and posttest scores for rhythm and PA associated tests. The group mean change differences between the pretest scores and the posttest scores for intervention and comparison groups are presented in Table 24.

Table 24

Differences in Group Assessment Mean Change

Assessment	Intervention Group Mean Change	Comparison Group Mean Change
PALS-PK Composite	13.565	8.500
PALS-PK Rhyme Awareness	1.913	.450
PALS-PK Nursery Rhyme Awareness	.478	.250
PALS-PK Beginning Sound Awareness	1.957	.650
PAT2 Syllables	-.348	-.550
Weikart Beat Competency	1.783	.400

There were some concerns with normality of the data. Therefore, the Wilcoxon Rank Sum Test was conducted. This test makes no assumptions for normal distribution. The results agreed with the one-way ANOVAs that were initially conducted and data analysis using ANOVAs continued. In addition, random effects for both the intervention groups and classroom placement were taken into consideration. The estimated variances of both random effects were negligible when compared to the error variance due to the students. Therefore, the analyses of random effects were not included. The statistical software SPSS was used for analysis and significance was set at $< .05$. The following paragraphs present the research questions and the results of the one-way ANOVAs.

Question 1: Is there a significant difference in phonological awareness scores between the integrated rhythm-literacy intervention group and the control group after treatment?

In order to answer research question one, an Analysis of Variance was conducted to determine the impact of the IRL intervention. A one-way ANOVA was utilized to assess if the mean differences between the groups was significant. The mean differences were calculated using the differences between pretest and posttest scores for each group on the following measures: PALS-PK Composite, PALS-PK Rhyme Awareness, PALS-PK Nursery Rhyme Awareness, and PALS-PK Beginning Sound Awareness. Significance was set at $p < 0.05$. This ensures a 95% certainty that the differences did not occur by chance. The following paragraphs present the results of this analysis for each assessment.

PALS-PK composite ANOVA. The difference between the group posttest mean and the group pretest mean for both groups was calculated. This data was then analyzed using a one-way ANOVA. Results indicate that there were not significant differences ($p = .260$) between the PALS-PK Composite group means. Results of the one-way ANOVA are presented in Table 25.

Table 25

PALS-PK Composite ANOVA

PALS-PK Composite	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	274.464	1	272.464	1.305	.260
Within Groups	8624.652	41	210.357		
Total	8899.116	42			

PALS-PK rhyme awareness ANOVA. The difference between the group posttest mean and the group pretest mean for both groups was calculated. This data was then analyzed using a one-way ANOVA. Results indicate that there were significant differences ($p = .023$) between the rhyme awareness group means. Results of the one-way ANOVA are presented in Table 26.

Table 26

PALS-PK Rhyme Awareness ANOVA

PALS-PK Rhyme Awareness	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	23.756	1	23.756	5.618	.023
Within Groups	173.360	41	4.228		
Total	197.116	42			

PALS-PK nursery rhyme awareness ANOVA. The difference between the group posttest mean and the group pretest mean for both groups was calculated. This data was then analyzed using a one-way ANOVA. Results indicate that there were not significant differences ($p = .812$) in the nursery rhyme awareness means. Results of the one-way ANOVA are presented in Table 27.

Table 27

PALS-PK Nursery Rhyme Awareness ANOVA

PALS-PK Nursery Rhyme Awareness	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.162	1	.162	.057	.812
Within Groups	115.884	41	2.826		
Total	116.047	42			

PALS-PK beginning sound awareness ANOVA. The difference between the group posttest mean and the group pretest mean for both groups was calculated. This data was then analyzed using a one-way ANOVA. Results indicate that there were not significant differences ($p = .388$) between the beginning sound awareness means. Results of the one-way ANOVA are presented in Table 28.

Table 28

PALS-PK Beginning Sound Awareness ANOVA

PALS-PK Beginning Sound Awareness	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.662	1	5.662	.763	.388
Within Groups	304.384	41	7.424		
Total	310.047	42			

PAT2 syllables ANOVA. The difference between the group posttest mean and the group pretest mean for both groups was calculated. This data was then analyzed using a one-way

ANOVA. Results indicate that there were not significant differences ($p = .830$) between the PAT2 Syllables mean group scores. Results of the one-way ANOVA are presented in Table 29.

Table 29

PAT2 Syllables ANOVA

PAT2 Syllables	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.437	1	.437	.047	.830
Within Groups	384.167	41	9.370		
Total	384.605	42			

Question #2: Is there a significant difference in rhythm scores between the integrated rhythm-literacy intervention group and the control?

The difference between the group posttest mean and the group pretest mean for both groups was calculated. Results show a significant difference ($p = .013$) between the rhythm group mean scores. Results of the one-way ANOVA are presented in Table 30.

Table 30

Rhythm Test ANOVA

Rhythm Scores	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	10.888	1	10.888	6.689	.013
Within Groups	66.740	41	1.628		
Total	77.628	42			

Age Analysis

It was noted that the intervention group (4.7 years) had a lower average age than the comparison group (5.1 years). To determine if age interacted with the results additional univariate ANOVAs were conducted for all assessments. Two independent variables were examined. Those variables were group (intervention versus comparison) and age (< 4.9 years, > 5 years). Only two assessments showed significant results and are presented below.

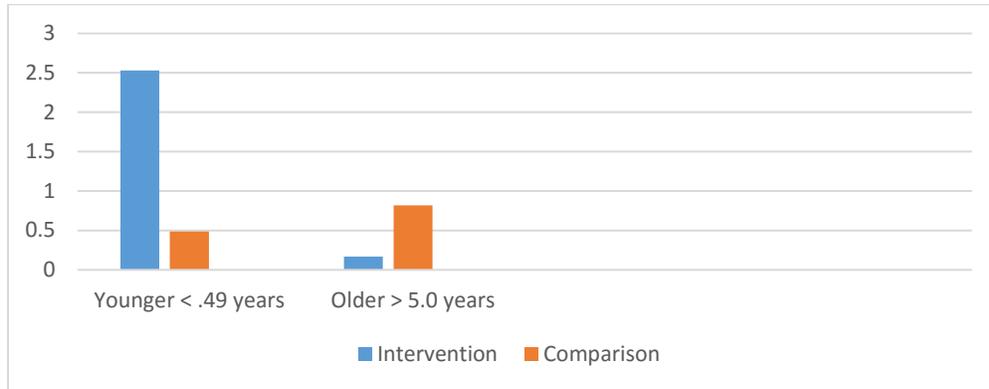
Rhyme awareness. When examining the mean score differences for rhyme awareness, the change was much greater for the younger group versus the older group in the intervention (Table 31). Overall, regardless of age the intervention group performed significantly better than the comparison group.

Table 31

Rhyme Awareness Univariate ANOVA

Group	Mean	SD	F	Sig.	Eta Squared
Intervention	1.91	2.56	4.48	.04	.10
Comparison	.45	1.43			

Figure 17

Rhyme Awareness Univariate ANOVA

Rhythm. To determine if age interacted with the results an additional univariate ANOVA was conducted. Two independent variables were examined. Those variables were group (intervention versus comparison) and age (< 4.9 years, < 5 years). When examining the mean score differences for rhythm, regardless of age the intervention group performed significantly better than the comparison group.

Table 31

Rhythm Univariate ANOVA

Group	Mean	SE	F	Sig.	Eta Squared
Intervention	1.853	.300	12.48	.001	.24
Comparison	.394	.394			

Summary

This chapter presented the results of the data analysis. To begin, the research questions were presented. Next, general descriptive data for the intervention and comparison groups was provided. Then, initial group differences between the intervention and comparison groups was presented through the comparison of pretest scores. Next, group differences at the conclusion of the study were presented through the comparison of posttest scores. Additionally, results from the musical history questionnaire and fidelity implementation checklist were shared. Last, an analysis on the effectiveness of the IRL intervention was conducted through the examination of the differences between pretest and posttest scores for both groups. The next chapter will examine and interpret the results, as well as discuss future research and implications for the early childhood classroom.

CHAPTER 5. DISCUSSION

Introduction

The purpose of this study was to examine the impact of an IRL intervention on the development of PA and rhythm skills of preschool children. Participants of the study were either children who received the intervention (intervention group), or those who did not (comparison). The IRL intervention is comprised of three main instructional components. These components include: (1) integrated text interactions, (2) integrated call and response, and (3) integrated rhythm-focused movement. The IRL intervention study extends the work of previous research studies (Bhide, Power & Goswami, 2013; Dege and Schwarzer, 2011; David, Wade-Woolley, Kirby & Smithrim, 2007; Linardakis, Trouli & Chlapana, 2014) that highlight a connection between rhythm and PA development.

In the sections that follow, a discussion of the study results is presented. The chapter begins by discussing the limitations of the study. The limitations discussed include study size, study length, external influences and assessment constraints. Following the limitations, an analysis of study results and discussion on how these results may reflect PA and rhythm development is presented. For this section, the research questions and data pertaining to them will be examined in detail. Next, a discussion on the possible implications for teaching and future research is presented. The chapter ends with concluding statements about the study.

Limitations

There are several limitations to consider when interpreting the results of the study. To begin, the sample size of the study was small ($n = 43$). The study was larger than many previous research studies pertaining to the use of rhythm and its impact on the development of PA in the early childhood classroom. Nevertheless, a larger sample may produce different results than the

ones found in this study. Due to the limited size, educators and researchers should be cautious in generalizing the study findings to different populations and geographic areas. Future research should attempt to replicate the findings with a larger sample. However, the findings described earlier are consistent with the results obtained in similar studies (Dege and Schwarzer, 2011; David, Wade-Woolley, Kirby & Smithrim, 2007; Linardakis, Trouli & Chlapana, 2014).

Second, the length of the intervention needs to be taken into consideration when interpreting the results. The IRL intervention was conducted two times per week for eight weeks. This time frame was comparable to previous research studies pertaining to the topic (Dege and Schwarzer, 2011; Linardakis, Trouli & Chlapana, 2014). However, a longer intervention may allow for improvement in additional PA and rhythm skills farther up the developmental pathway for both groups. It is suggested that future research include a longer intervention schedule of 6-12 months.

Third, study results may have been influenced by the home environment of the participants. It was noted in researcher assessment notes that 2 children in the comparison group indicated that their parents were practicing literacy skills with them at home. The children shared that the practicing was to help get them ready for kindergarten in the fall. As literacy researchers, we were pleased to note that parents were working on literacy activities with their children at home. Nevertheless, this was not explicitly addressed in the study design.

Fourth, it is unclear if the assessment constraints of specific PALS-PK tests impacted the study results. The range of data that can be gathered by specific PALS-PK assessments may be constrained by inherent limits in the instrument's design creating a possible ceiling effect. Therefore, it may be possible that the results obtained are impacted by this effect. This limitation

is discussed in greater detail later in the chapter and should be taken into consideration when interpreting specific PALS-PK results.

Discussion of the Results

The following section will discuss and interpret the study results. The section begins with a review of the mean pretest and posttest scores for the intervention group and comparison group. This is followed by an analysis of the mean differences between the pretest and posttest scores for both groups. The section concludes with a broad discussion of the study findings.

Analysis of Pretest and Posttest Scores

A comparison of the initial group differences for PA and rhythm was conducted. The analysis sought to determine if the two groups were similar in their initial PA and rhythm skills. The pretest mean group scores highlighted in Table 31 show that the comparison group scored higher than the intervention group on all of the administered assessments. In particular, the comparison group scored higher on the PALS-PK Composite and the PALS-PK Beginning Sound Awareness pretest scores.

The PALS-PK Composite score is the sum of all PALS-PK assessments. It should be noted that some of the composite mean score difference may be due to the assessment administration protocol. The protocol calls for 3 of the assessments (upper-case, lower-case and letter sounds) to be given in order and as a set. For example, a child would need to score 16 out of 26 on the upper-case assessment in order to be administered the lower-case assessment. That same child would then need to score 16 out of 26 on the lower-case assessment in order to be administered the letter sound assessment. Therefore, if a child is unable to meet the 16 out of 26 threshold on the first or second assessments, the composite score is greatly impacted. The PALS-PK Beginning Sound Awareness scores may reflect the age differences and

developmental levels of the two groups. The intervention group began the study with an average age of 4.7 years while the comparison group had an average age of 5.1 years. The age difference may provide some context for the differences in the PALS-PK Beginning Sound Awareness mean scores. Beginning sound awareness (onset) is farther along the developmental pathway for PA. Therefore, it may be reasonable to assume that an older group would be more developed in this and the other assessed PA skills.

Table 32

Pretest and Posttest Mean Scores by Group

Assessment	Pretest Intervention Group	Pretest Comparison Group	Posttest Intervention Group	Posttest Comparison Group
PALS-PK Composite	56.000	80.150	69.565	88.650
PALS-PK Rhyme Awareness	5.957	7.450	7.870	7.900
PALS-PK Nursery Rhyme Awareness	6.043	7.150	6.522	7.400
PALS-PK Beginning Sound Awareness	4.783	7.350	6.739	8.000
PAT2 Syllables	5.261	5.900	4.913	5.350
Weikart Beat Competency	1.087	1.800	2.970	2.200

The posttest mean scores (Table 32) again show that for most assessments the comparison group scored higher than the intervention group. The only assessment that saw a change was the rhythm assessment. For this assessment, the intervention group had a higher mean score than the comparison group. This result was to be expected based upon previous research studies highlighted.

A comparison of the pretest scores and the posttest scores (Table 32) also shows that the group mean scores were closer or comparable at the end of the intervention. This narrowing of the gap is evident for all of the PALS-PK literacy assessments and highlights the possibility that the IRL intervention may assist in helping children “catch-up” to higher achieving peers. This possible application of the IRL intervention needs further research. Nevertheless, it was interesting to note that the gap between the two groups narrowed for the PALS-PK assessments over the course of the 8 weeks.

Analysis of Group Mean Differences

An analysis of the group mean differences was conducted to examine growth over the course of the study and the possible impact of the IRL intervention. Pretest mean scores were subtracted from the posttest mean scores to determine the group mean change scores and are presented in the next section. As noted in Table 33, the intervention group had higher mean change scores than the comparison on all assessments excluding the PAT2 Syllables test. The higher group mean change scores indicate greater growth for the intervention group and a narrowing of the gap between the comparison and intervention group mean scores.

Table 33

Mean Change Scores

Assessment	Intervention Group Mean Change	Comparison Group Mean Change
PALS-PK Composite	13.565	8.500
PALS-PK Rhyme Awareness	1.913	.450
PALS-PK Nursery Rhyme Awareness	.478	.250
PALS-PK Beginning Sound Awareness	1.957	.650
PAT2 Syllables	-.348	-.550
Weikart Beat Competency	1.783	.400

The PAT2 Syllables assessment mean change score showed negative growth for both groups. The negative growth may be due to the assessment being designed for children ages 5-9. However, it is unclear as to why both groups scored lower on the PAT2 Syllables posttest given the higher average age of the comparison group. It may be reasonable to assume that a portion of the children were experiencing some amount of testing fatigue on the 3rd and final day of the posttest assessment period.

The Weikart Beat Competency assessment scores (mean change, pretest and posttest) highlight a unique study result. This data showcases the only assessment in which the intervention group not only showed a higher mean change score but also a higher posttest mean score (Table 32) than the comparison group. These results may indicate that the IRL intervention may be particularly effective at assisting children in the development of rhythm skills in the early childhood classroom.

Due to the higher PALS-PK pretest mean scores for the comparison group, the possibility of a ceiling effect was considered when examining the mean score changes. A ceiling effect occurs when the scale range is smaller for children at the higher ends of possible scores and suggests that children with higher scores would make smaller gains (Keeley, English, Iron & Henslee, 2013). A majority of the PALS-PK assessments have scores that range from 0 to 10. An analysis of the pretest scores highlights that a portion of children from both groups scored 10 out of 10 on the pretest assessments. Therefore, the range of data that can be gathered by the PALS-PK individual assessments may be constrained by inherent limits in the instrument's design. In such a case, the ceiling effect keeps the instrument from noting a measurement or estimate higher than some limit not related to the phenomenon being observed, but rather related to the design of the instrument.

A deeper analysis showed that three assessments had children that scored the maximum or 10 on the pretest. Those assessments were PALS-PK Rhyme Awareness, PALS-PK Beginning Sound Awareness and the PAT2 Syllables. The possibility of a ceiling effect was factored into data analysis for those three tests and noted in upcoming discussion. It is recommended that any additional studies using the PALS-PK assessments be conducted with children approximately 4 years old in the fall or at the start of their preschool year. The publisher of PALS-PK does recommend conducting the first assessment in the fall. However, due to unexpected start date issues the study began later than anticipated in the winter. A change in initial assessment administration may produce lower initial scores for all children, thereby, leaving room to document student growth and negating any possibility of a ceiling effect. To further examine the group mean change scores, each assessment and its corresponding research question are examined in more detail in the following sections.

Phonological awareness. The first research question asked: *Is there a significant difference in phonological awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?* The following subtests measured PA: PALS-PK Rhyme Awareness, PALS-PK Nursery Rhyme Awareness, PALS-PK Beginning Sound Awareness and PAT2 Syllables. A One-way ANOVA indicated a significant difference in rhyme awareness but not beginning sound awareness, nursery rhyme awareness and syllables between the two groups.

Rhyme awareness. A sub question of research question 1 asked: *Is there a significant difference in rhyme awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?* For this assessment, the intervention group mean change score showed significant improvement when compared to the comparison group mean change score ($p = .023$). This is notable due to the fact that this is one test that was flagged in the ceiling effect discussion. However, a review of the PALS-PK Rhyme Awareness assessment data shows that the intervention group had 8 children that obtained the maximum score while the comparison had 6 children. Therefore, a ceiling effect should have impacted the scores of the intervention group more than the comparison.

When the data is viewed with a developmental lens for PA the significant improvement of rhyme awareness before other PA skills fits the model. Rhyme awareness is typically one of the first PA skills to develop in young children (Anthony & Francis, 2005). The developmental model of PA moves from large chunks of sound to smaller chunks of sound and supports children becoming increasingly sensitive to smaller parts of words as they develop. Therefore, an awareness of whole words that sound alike would be one of the first PA skills to develop during

the IRL intervention. The data appears to reflect the developmental model of PA in young children.

Further analysis indicated that the score change was much greater for the younger children (< 5.0 years) versus the older children (> 5.0 years) in the intervention group. This may indicate that the intervention is particularly effective for children ages 4.0-4.9 years old. This aspect of the results needs further research. However, the role age may play in the intervention should be examined in more detail in subsequent studies using the IRL intervention.

Nursery rhyme awareness. A sub question of research question 1 asked: *Is there a significant difference in nursery rhyme awareness scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?* For this assessment, the intervention group mean change score did not show significant improvement when compared to the comparison group mean change score ($p = .812$). The nursery rhyme awareness task depended heavily on a child already knowing the nursery rhyme. For this assessment, the administrator leaves out a word at the end of a sentence of the nursery rhyme. For example, the administrator says the nursery rhyme, “Jack and Jill went up the _____.” The child is asked to supply the missing word which in this case is “hill”. When a child did not know the rhyme, he or she would often substitute a rhyming word but not the correct one during testing. The task did measure a child’s awareness of nursery rhymes. However, so as not to influence the assessment scores any nursery rhymes used in the assessment were not used in the IRL intervention. Assessment notes indicate that many children knew the structure of nursery rhymes and did supply a rhyming word (even though incorrect) for the missing word.

Beginning sound awareness. A sub question of research question 1 asked: *Is there a significant difference in beginning sound awareness scores between the integrated rhythm-*

literacy intervention group and the comparison group after treatment? For this assessment, the intervention group mean change score did not show significant improvement when compared to the comparison group mean change score ($p = .388$). This ability to listen for and separate out the beginning consonant of a word did improve for both groups. However, the mean change score for the intervention group was 1.957, while the mean change score for the comparison group was .650 (Table 32, p.79). This data highlights that the intervention group more than doubled their beginning sound awareness scores over the course of the study. Unfortunately, this is one test flagged for a possible ceiling effect. For this assessment, 5 students from the intervention group and 9 students from the comparison group scored a perfect 10 on the pretest. Therefore, a ceiling effect should have impacted the scores of the comparison group more than the intervention. If this test is also viewed through a developmental lens the larger amount of growth, but not significant growth, is appropriate. An awareness onset or the beginning element of a spoken syllable is the second component in the developmental sequence of PA.

PAT2 syllable segmentation. A sub question of research question 1 asked: *Is there a significant difference in syllable segmentation scores between the integrated rhythm-literacy intervention group and the comparison group after treatment?* For this assessment, the intervention group mean change score did not show significant improvement when compared to the comparison group mean change score ($p = .830$). The ability to separate words into syllables did show improvement for the intervention group. However, the intervention group did not show significant improvement over the control. The IRL intervention did focus on syllables through the use of various activities such as clapping the number of syllables in the children's names. Nevertheless, several students in both groups posted lower scores in the posttest to the surprise of the researchers. This negative over-all change in scores for both groups could be due to multiple

factors. Those factors might include test age range, interaction of the IRL activities with a child's response and testing fatigue. After analysis, it was proposed that the negative change in scores for both groups could be due to testing fatigue and the age range of the test. The test was conducted on day 3 or the final day of assessments. Assessment notes do indicate that 2 children asked if the test would be done soon. Lower scores could also be contributed to the assessment selected by the research team. Prior to the study, it was noted that the PAT2 segmentation test states an age range of 5-9 years. This range fits a portion but not all of the children involved in the study. At the time of the study design, the test was deemed to be the best standardized assessment fit for the study. However, after reflection it was noted that another assessment may be a better suited to assess syllable knowledge. An observation checklist completed during the study is proposed as one possible way to assess syllables in any future research done with the IRL intervention. This checklist could be completed by one of the researchers when children demonstrated their understandings of syllables in the intervention or regular classroom setting.

If the results are viewed through a developmental lens this assessment should have been the next to show improvement after rhyme. As children become increasing aware of words and their sounds, they begin to become sensitive to smaller and smaller part of words. Typically, children can detect or manipulate rhyme/syllables, then onsets and rimes, followed by the individual phoneme. It is unclear what impact the IRL may have had on the development of syllable awareness.

Rhythm. The second research question asked: *Is there a significant difference in scores between the integrated rhythm-literacy intervention group and the comparison after treatment?* For this assessment, the intervention group mean change score showed significant improvement when compared to the comparison group mean change score ($p = .013$). This question sought to

determine the impact of the IRL intervention on the development of rhythm skills in preschool children. The data highlights a significant difference in the group mean change scores. This indicates that the intervention group made significant growth when compared to the comparison group on the Weikart Beat Competency assessment. Data analysis also highlighted that regardless of age the intervention group did significantly better than the comparison. In addition, at the start of the study, the intervention pretest group mean score for rhythm was lower than the comparison. This is in direct contrast to the conclusion of the study which showcases a reversal of scores. At the conclusion of the study, the intervention group scored higher than the comparison on the posttest group mean score for the rhythm assessment.

A study by Tsang & Conrad (2011) discusses the use of rhythm discrimination assessments versus rhythm production assessments. A rhythm discrimination assessment typically asks a child to listen to two rhythmic phrases and share if they are alike or different. While a rhythmic production assessment such as the Weikart Beat Competency Test, asks a child to produce a consistent rhythmic phrase. This study uses a rhythm production assessment for multiple reasons. To begin, rhythm production requires the child to first differentiate or discriminate the sounds in a musical piece. The child is required to listen to the music, use rhythmic discrimination skills to determine the beat and then produce a movement that matches the beat. A rhythm production assessment offers a child the chance to integrate both rhythmic discrimination and production elements. Second, the ability to produce a rhythm insures that researchers have substantial evidence of a child's rhythmic skills. It reduces the chance of assessment error by eliminating an element of chance should a child correctly "guess" if two rhythmic patterns are alike or different. Previous studies that have examined the impact of rhythm (music) on PA development have not always conducted a rhythm assessment (Dege &

Schwarzer, 2011; Linardakis, Trouli & Chlapana, 2014). However, this assessment data is essential in determining the role an IRL intervention may play in the development of PA and rhythm skills.

A musical history questionnaire was given to families in an effort to determine the role that formal and informal music experience might play in the development of rhythm. The questionnaire reflects work by Tsang & Conrad (2011) that suggests a correlation between formal music training and reading skills. In the study, Tsang & Conrad examined whether musical processing skills differentially predicted reading performance in a broad range of 69 children with and without formal music training. Their study indicates that the correlation between music skills and reading skills was impacted by the presence of formal music training. Therefore, a questionnaire was sent home to determine musical history. The musical history questionnaire noted a total of 6 children (4 intervention; 2 comparison) took part in formal music class prior to the start of the study.

It is unclear what role prior formal music classes may have played in the development of rhythm skills for the study participants due to the low number of positive respondents. The questionnaire responses also note that a majority of the families participated in a variety of home music activities or informal music education. These activities included singing, dancing and playing a variety of instruments. All activities shared by the families could assist in the development of rhythm and are similar to many of the activities done in formal early childhood music classes. Therefore, it may be that a distinction between formal and informal music activities should not be drawn in this study or other early childhood studies examining the impact of an IRL intervention on the development of PA. Instead, it may be beneficial to examine the amount of time spent on music activities in both formal and informal music settings.

To summarize, data from the rhythm production assessment indicates a significant increase in rhythm scores for the intervention group when compared to the control. This suggests that the IRL framework can assist in the development of rhythm skills which in turn may impact in the development of PA.

Comprehensive study findings. The hypothesized model forwarded the notion that an IRL intervention would impact the development of rhythm and PA. It drew upon work indicating a strong correlation between the ability to hear and distinguish notes and the ability and to hear and distinguish the sounds of language. A literature review highlighted that empirical evidence supports the idea that music and language have a common basis in the early years of a child's development (McMullen & Saffran, 2004). PA requires the listener to be able to segment speech into its component sounds and recognize those sound categories across variations in pitch, tempo, speaker and context. Rhythm perception also requires the listener to be able to segment sounds and recognize variations in tempo, length and duration. Degé & Schwarzer (2011) state that consequently, a relationship between language sound categories such as phoneme awareness and musical sound categories such as notes should be evident. Additionally, the developmental pathways of both rhythm and PA are similar in that they both move from large to smaller units of sound. The study findings suggest that an IRL intervention can significantly improve children's rhythm and rhyme (PA) skills. The findings also appear to reflect the developmental progression of rhythm and PA. This progression can be noted in the movement from large units of sound to smaller units of sound.

Implications for Teaching

The study presents several possible implications for teaching. First, an overview of implications in formal educational settings is provided. Next, an overview of implications for the home educational settings is presented.

Formal educational settings. Formal educational settings such as preschools and elementary schools may benefit from the examination of the IRL intervention components and the research behind the study. A lack of development in PA has been shown to negatively impact the foundational reading skills of children. This requires that institutions of formal education look for new and innovative ways to address any gaps, in particular for groups of children that may experience persistent achievement gaps in reading. The IRL intervention may be one tool that can be used to assist in the development of foundational reading skills such as PA. The study design took into consideration that other educators may want to replicate the lessons. Therefore, the IRL intervention three-part framework was described in detail and sample IRL intervention curriculum has been provided in the appendix. It should also be noted that many existing activities used by early childhood educators could be modified and used in the framework. Also, the study focused on the use of materials that were low cost and typically found in early childhood classroom (see Appendix C: Intervention Curriculum and Materials). It is recommended that any changes to teaching methods or curriculum be a part of a broader professional development plan or learning community. This way teachers can work through any issues that arise together and better respond to the needs of their specific group of children.

Informal educational settings. Family plays a critical role in the education of children (National Early Literacy Panel, 2008). This research offers possible activities for families to incorporate at home if they seek to improve their child's rhythm and literacy skills. Many of the

activities used in the IRL intervention could be implemented at home allowing for the research to have a broader impact. Further, the positive results from this study, while significant from a statistical point of view, often have minor importance from a policy point of view. Many studies include only children whose parents send them to pre-K, excluding the vast majority of children under age five, who are at home or in child care. The prospect of an intervention that could be implemented at home offers families the opportunity to participate in positive interactions that may contribute to the development of children's rhythm and PA skills. As previously stated, support while implementing the IRL framework is critical. It is recommended that any use of the IRL intervention framework in informal settings be supported by training, peer mentor groups and early childhood educators.

Implications for Future Research

Based on the findings from this study, future research should be conducted to further refine understandings on the role an IRL intervention may play in the development of rhythm and PA skills. To begin, it is suggested that the study be conducted with a larger sample size. A large sample size may assist in providing a data set that will allow researchers to further refine their understandings of the role rhythm may play in the development of PA. A larger sample size may also indicate outcomes that were not seen in the sample size used for this study. Second, it is recommended that the length of the IRL intervention be extended longer than eight weeks. A longer time frame may allow for researchers to note the IRL intervention's impact on the long-term development of rhythm and PA skills in preschoolers. This notion of development could also be explored through the use of an additional testing phase conducted six months to a year after the completion of the intervention. This additional testing phase may allow for researchers to note if the closing of any achievement gaps in literacy and rhythm skills can be

maintained over time. Last, if the same assessments are used in further studies it is recommended that the intervention begin in the fall with children approximately 4-4.5 years old. This change in study design would allow for a more precise fit with the assessments. It may also allow for more direct comparisons between the groups during data analysis.

Conclusion

“I loved the everything!” 4-year-old participant

The above quote from a participant highlights aspects of the study that are not always easy to quantify. Those aspects are motivation and joy. The researchers and classroom teachers noted that the IRL intervention engaged and motivated the children. Researchers noted children eager to attend the intervention sessions and singing and dancing in the hall on the way back to their regular classes. These are also important aspects of early childhood education and research that should not be overlooked.

The persistent gap in literacy achievement calls for continued work in the field of literacy education. In particular, the advancement of foundational literacy skills such as PA so that all children can achieve to their highest potential. The study detailed in this paper highlights how an integrated rhythm and literacy intervention has the potential to significantly impact the development of both PA and rhythm skills. Therefore, the IRL intervention framework may be another tool in the teaching of PA and rhythm skills.

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APPENDIX A. IRB APPROVAL FORM

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2307
515-294-4366
FAX 515-294-4267

Date: 1/22/2016

To: Dr. Donald Bear
N156 Lagomarcino Hall

From: Office for Responsible Research

Title: The Relationship Between Rhythm and Literacy Among Preschool Children: Assessment, Development and Intervention

IRB ID: 15-427

Approval Date: 1/22/2016 **Date for Continuing Review:** 8/30/2017

Submission Type: Modification **Review Type:** Expedited

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University according to the dates shown above. Please refer to the IRB ID number shown above in all correspondence regarding this study.

To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- **Use only the approved study materials** in your research, including the recruitment materials and informed consent documents that have the IRB approval stamp.
- **Retain signed informed consent documents for 3 years after the close of the study**, when documented consent is required.
- **Obtain IRB approval prior to implementing any changes** to the study by submitting a Modification Form for Non-Exempt Research or Amendment for Personnel Changes form, as necessary.
- **Immediately inform the IRB of (1) all serious and/or unexpected adverse experiences** involving risks to subjects or others; and (2) **any other unanticipated problems involving risks** to subjects or others.
- **Stop all research activity if IRB approval lapses**, unless continuation is necessary to prevent harm to research participants. Research activity can resume once IRB approval is reestablished.
- **Complete a new continuing review form** at least three to four weeks prior to the **date for continuing review** as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

Please be aware that IRB approval means that you have met the requirements of federal regulations and ISU policies governing human subjects research. **Approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **IRB approval in no way implies or guarantees that permission from these other entities will be granted.**

Upon completion of the project, please submit a Project Closure Form to the Office for Responsible Research, 1138 Pearson Hall, to officially close the project.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

APPENDIX B. INTERVENTION DOCUMENTS**Parent/Guardian Letter**

Date

Dear Parent/Guardian,

My name is _____, and I am a professor in the School of Education at _____. My research team and I are interested in learning more about how children begin to develop literacy skills, such as alphabetic knowledge and concept of a word (being able to accurately point to words while reading a text). Additionally, we are interested in children's rhythmic knowledge, because it is related to literacy development.

We are recruiting children who are between the ages of 4-5.5 to participate in this project. We will be assessing children's ability to perceive and produce rhythms and melodies. We will also be assessing children's oral language and literacy development.

Our hope is to create an assessment of rhythmic knowledge and use that assessment for early identification of language and reading difficulties. Additionally, we hope to further look at how lessons that focus on rhythm impact literacy skills. There is no benefit to participation but the information we collect regarding your child's literacy skills will be shared with you and the classroom teacher.

All assessment sessions will take place at your child's preschool. Your child will be introduced to tasks in a game format and will have ample opportunity to take breaks and request to be finished with assessments, as boredom and/or fatigue can result from such tasks.

We hope you consider participating in our study. If you consent, please sign the consent form and return to your child's preschool teacher. If you have any questions, do not hesitate to contact me.

Sincerely,

Primary Investigator

Assessment Checklist

Participant #: _____

Day 1

Materials: PALS testing kit, PALS Fall/Spring Child Summary Sheet (data), pencils, game board/pieces

_____ Name Writing

_____ Upper Case Alphabet Recognition*

Only proceed if child gets 16 or more correct

_____ Lower-Case Alphabet Recognition*

Only proceed if child gets 9 or more correct

_____ Letter Sounds*

_____ Beginning Sound Awareness

Day 2

Materials: PALS testing kit, PALS Fall/Spring Child Summary Sheet (data), COW extended data sheet, pencils, game board/pieces

_____ Rhyme Awareness

_____ Nursery Rhyme Awareness

_____ Print Awareness and COW Extended Assessment

Day 3

Materials: PAT2 segmentation instructions and data sheet, pencils, rhythm assessment instruction, music, music player, recording device, game board/pieces

_____ PAT2 Segmentation test

_____ Rhythm Tasks (**record**)

Extended COW-T Assessment Scoring Sheet

Name/Participant #:

Date:

Scoring for Supplemental COW-T Assessment

Page	Score	Total Score
Page 1	Pointed correctly to 1 2 3 words	/3
Page 3	Pointed correctly to jumped	/1
Page 3	Pointed correctly to moon	/1
Page 5	Pointed correctly to ran	/1
Page 5	Pointed correctly to spoon	/1
		/7

PARENT/GUARDIAN DATA FORM

Date

Dear Parent/Guardian,

Thank you for your participation in the study: The Relationship Between Rhythm, Language & Literacy in Preschool Children: Assessment, Development and Intervention. Please take a moment to answer the following questions and return the form to your child's teacher.

Child's Name:

Parent Name:

1. Has your child taken a preschool music class? YES NO

If so, which class or classes has he/she taken?

If so, how many classes total has he/she taken?

2. Is your child currently taking a music class? YES NO

If so, which class is he/she taking?

3. Does your child take part in musical activities in your home? YES NO

If so, what type of activities? (examples might include: singing, dancing to music)

4. Do you or any other family members in your household regularly play a musical instrument or sing? YES NO

5. Would you like to provide any other information about your child's musical background? If so, please write the information below.

Rhythm Assessment Scoring Sheet

Participant #:

Name:

Date:

Song #1: O'Keefe Slide

Song #2: Urgos

Reminder: Video Assessment

Step	Task	Overall Score	Phrase 1	Phrase 2	Phrase 3	Phrase 4
1	Pat beat, both hands					
2	Pat beat, alternating hands					
3	"March" in place (standing)					
4	Touch, step sequence (floor marker, alternating feet)					
Step	Task	Overall Score	Phrase 1	Phrase 2	Phrase 3	Phrase 4
1	Pat beat, both hands					
2	Pat beat, alternating hands					
3	"March" in place (standing)					
4	Touch, step sequence (floor marker, alternating feet)					

Overall Score key: Put a 2, 1, or 0 in Overall Score column

Score of 2: Student moves to the beat for 30 or more beats

Score of 1: Student moves to the beat for 15-29 beats

Score of 0: Student moves to the beat for 14 or fewer beats

Break-out Scores key: Put a 2, 1, or 0 in Phrase 1-4 columns

Score of 2: Student maintains the beat for all 8 beats of an 8-beat phrase

Score of 1: Student maintains the beat for 4-7 beats of the 8-beat phrase

Score of 0: Student maintains the beat for fewer than 4 beats of the 8-beat phrase

APPENDIX C. INTERVENTION CURRICULUM AND MATERIALS**Intervention Curriculum Sample**Intervention Session 1*1. Welcome and Introduction. Integrated Text Interaction*

a. Have the children sit in a circle. Researcher will introduce his/herself to the group.

Then through a game format students will share their names.

b. Children's names will be written on a piece of tagboard. Researcher will hold up card with a child's name on it. If the child recognizes his/her name they can raise their hand and come get their name card. If not, the researcher can read the name and give to the child.

c. Placing the card in front of them, the children will clap a steady beat along with the teacher. They can join in the chant when they are ready. Go around the circle clapping each child's name with each syllable. Let's clap Annie. Ann-ie! Now let's clap Tristan. Tris-tan!

d. Gather the cards.

2. Integrated Text Interaction

a. Introduce the song Hickory Dickory Dock.

b. Chart paper with the song title will be posted. Researcher will point to the words as the children recite the title. Focus on the letter d and the sound that it makes or the onset of the word.

c. Researchers model poem first, then ask children to recite the poem together.

d. Introduce song, have children clap while you sing the first time, then join in. Create some actions to the song and sing again.

Music by: Eric Franzen (Piano)

3. *Integrated Call and Response*

- a. The researcher and any assistants will model how to do a clapping call and response for the group.
- b. The researcher will model first pattern: whole, whole, half-half, whole.
- c. Children will join in as the researcher repeats the pattern.
- d. Steps b and c will be repeated with the following patterns: 1) Half-half, whole, half-half, whole, 2) Whole, half-half, whole, whole.
- d. Introduce the egg shakers. Model how to safely use them. Do the same patterns again only this time with the shakers.

4. *Integrated Rhythm-Focused Movement*

- a. To begin, practice marching to the song Hickory Dickory Dock. When the music stops children return to their spots.
- b. Create a list of ways that we can march around the room. Ex: softly, etc...
Children will march around the room to the song Yankee Doodle. Point to each action word before asking the children to make that movement.
- c. If time permits play a game of Freeze. While playing the game a small drum or other instrument will be used to keep a steady beat. Talking by the researcher will be done in time to the beat. Children can only move when the drum is playing. They music freeze when the beat stops.

5. *Closing.* Say goodbye and let children know when you will meet next.

Intervention Materials Photos

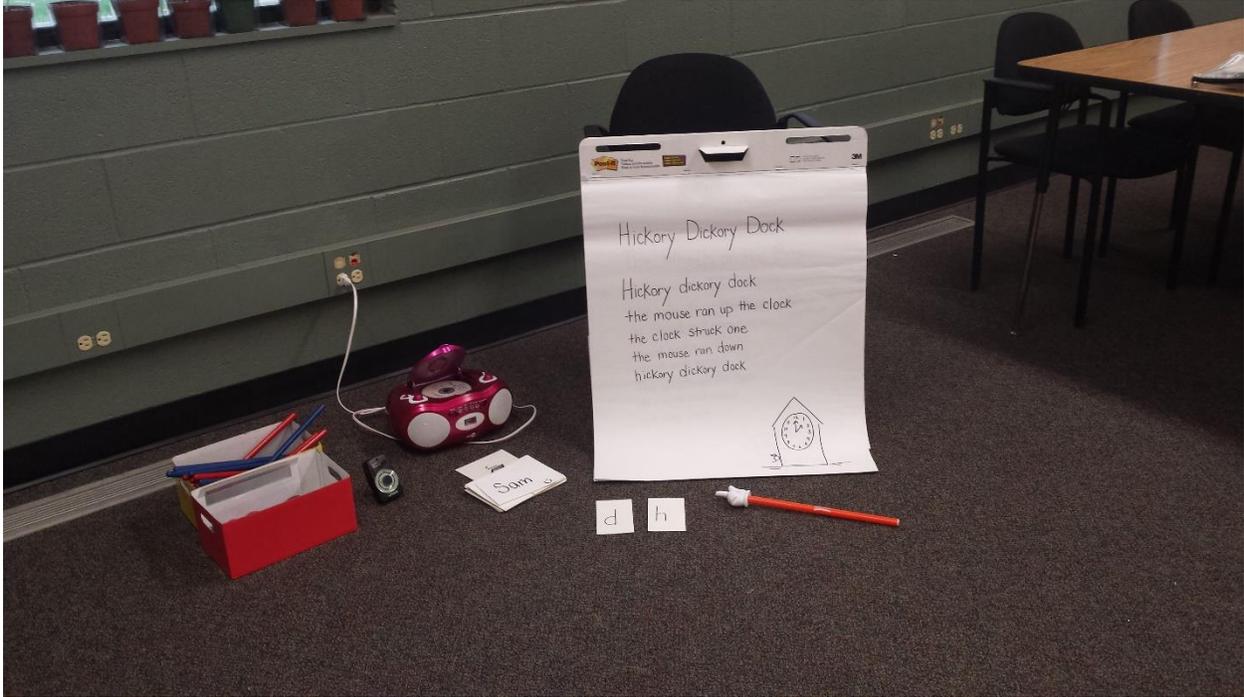


Figure 18. Intervention Session 1 Materials

IRL Intervention Song and Text List

Music arranged by Eric Franzen:

1. Hickory Dickory Dock*
2. You're a Grand Old Flag*
3. The Wheels on the Bus*
4. Old McDonald
5. BINGO

*Lyrics also used as text

Music arranged and/or written by Raffi:

1. Willoughby Wallaby Woo
2. Down by the Bay
3. Apples and Bananas*

*Lyrics also used as text

Children's Books:

1. Archambault, J., & Plummer, D. (2000). *Chicka chicka boom boom*. New York: Simon & Schuster.
2. Rosen, M., & Oxenbury, H. (1989). *We're going on a bear hunt*. New York: Little Simon.
3. Martin, B., & Carle, E. (1984). *Brown bear, brown bear*. New York: Henry Holt & Company.

Nursery Rhymes/Rhymes:

1. Humpty Dumpty
2. Hickory Dickory Dock
3. Who Stole the Cookie from the Cookie Jar?