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Correlation Between Music and Preliteracy Skills in Preschool Age Children

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Is there a relationship between music and knowledge? If there is evidence that music is influential for processing complex cognitive information, it is reasonable to consider that if children are exposed to music early, it will help them develop literary skills. In the last decade, researchers have paid more attention to possible relationships between musical-rhythmical skills and reading acquisition. Our study chose to focus on the relationship between music and literacy development in preschool children. We hypothesized that since both music and reading involve the sequential processing of units of information, there must be a positive correlation between musical-rhythmical skills[1] and preliteracy skills.[2]

Literature Review

Previous research suggested that musical-rhythmical skills relate to important reading prerequisites, such as phonological awareness (PA).[3] For example, Bolduc and Montésinos-Gelet (2005) looked at the relationship between PA and pitch processing and/or rhythm perception. Through testing a group of thirteen preschool children with varying levels of formal musical training, they found that there was a significant link between pitch awareness[4] and PA, but they found no relation between rhythm perception and PA (Bolduc & Montésinos-Gelet, 2005).

Gordon, Shivers, Wieland, Kotz, Yoder, and McAuley (2015) studied the relationship between PA, grammar skills, and musical rhythm discrimination. The researchers tested 25 typically developing six-year-old children and found that those who scored higher on PA tasks were better able to discriminate complex rhythms than those with lower scores on PA tasks. However, these results changed when the researchers controlled for IQ, i.e., there was no longer a significant relationship between the two constructs (Gordon et al., 2015).

PA and reading were the focus of a report that sought to determine their possible relationship with musical metrical perception and auditory perception of amplitude envelope structure (Huss, Verney, Fosker, Mead, & Goswami 2011). This study was conducted with older children between the ages of eight and thirteen, some with dyslexia and some without. The results of the testing showed that musical metrical sensitivity accounted for 60% of the variance in the performance on PA and reading tasks, but children with dyslexia performed worse than children without (Huss et al., 2011).

Other studies looked not only at the relationship between PA and musical skills, but also at the possibility that PA can be improved by music training. Moritz, Yampolsky, Papadelis, Thompson, and Wolf (2013) conducted a two-part study that first determined whether a link existed between kindergarteners' musical-rhythmical skills and their PA. The researchers then examined whether kindergarten children who receive intensive musical training demonstrate better PA skills than those who receive less musical training. The researchers in this study found a relationship between musical skills and PA. Moreover, the group of children that received more training showed improvement in a wider range of PA skills (Moritz et al., 2013).

The question of whether music programs can help improve specific literacy skills was also studied by Bolduc (2009). This author chose specific music programs to determine whether they could improve PA in French-speaking, kindergarten-age children without learning disabilities.

1 Musical-rhythmical skills are skills needed for the interpretation of music and rhythm (i.e. the ability to identify the pitch of a note).

2 Reading prerequisites; skills that create the foundation for the ability to read (i.e. the ability to identify letters).

3 Phonological awareness is a skill that enables the identification and manipulation of sounds within a word.

4 The ability to identify and discriminate between different pitches (the degree of highness or lowness of a tone).

The results showed that one of the music programs tested indicated improvement in syllable, rhyme, and phoneme identification tasks (Bolduc, 2009).

Phonological awareness was not the only preliteracy skill that was of interest to researchers. For example, one study found that there was a significant positive correlation between pitch perception-production and phonemic awareness by testing children with and without musical training between the ages of seven and nine (Loui, Kroog, Zuk, Winner, & Schlaug, 2011).

Another correlation study by Corrigall and Trainor (2011) looked specifically at the influence of the length of music instruction with normal readers between the ages of six and nine on their word decoding and reading comprehension skills. The results of this study showed that music instruction length positively correlated with reading comprehension even when controlling for various factors such as IQ (Corrigall & Trainor, 2011). The study also hypothesized that the transfer between musical and reading abilities is more prevalent in early readers.

The effects of music training on preliteracy skills, aside from PA, were examined by Moreno, Friesen, and Bialystok (2011). In this study, children between the ages of four and six were evaluated using rhyming tests, visual-auditory learning tests, intelligence measures, and a background questionnaire. The results showed that there was a visible improvement in rhyming ability after the use of the music program (Moreno, Friesen, & Bialystok, 2011).

Although the majority of these studies evaluated preliteracy skills in children, other studies also examined the effect of musical training in an older population. One study looked at whether extensive musical training leads to enhancement in executive processing (Bialystok & DePape, 2009). A group of bilingual musicians from the ages of 18 to 35, alongside a control group, completed a questionnaire and participated in tasks to assess functions such as intelligence, memory, and auditory functioning. The results showed that extensive musical training does enhance nonverbal spatial tasks and control in specialized auditory tasks (Bialystok, & DePape, 2009).

Overall, the results from the existing literature do not consistently demonstrate a relationship between music and literacy skills. These results also do not differ among participants across age groups. Therefore, further investigation of the relationship between musical-rhythmical skills and early literacy must confirm previously established results. This project investigates the possible positive influence of various musical-rhythmical tasks on preliteracy skills and early literacy outcomes among children attending a childcare center that emphasizes daily musical lessons. We aim to examine how different measures of musical-rhythmical skills interact with preliteracy skills, such as PA. To do so, our study focuses on a younger age group than the previous studies have examined.

Research Question and Hypothesis

We posed the following research question: Does exposing children to musical training at an early age show a relationship between specific musical-rhythmical tasks and literacy precursors? We hypothesized that exposure to daily musical training will positively affect development of literacy precursors by showing correlations between musical-rhythmical tasks and measures of PA.

Method

Participants

Thirteen children (eight girls and five boys) between the ages of three and five years old (M = 3;9,[5] SD = 0.47),[6] currently enrolled in a childcare center in a middle class suburban area in Massachusetts, participated in the study. This center was chosen for its emphasis on music in their curriculum beginning with their youngest class. Children were tested over a period of one month. All children were tested individually on a range of musical-rhythmical tasks as well as measures of PA (rhyming, elision, and phonics). Individual tests were administered by the sponsoring professor or a trained student and were supervised by a licensed childcare professional. Children were removed from the classroom two to three times on average for approximately a half an hour at a time over the course of the project.

A demographic questionnaire was sent to the parents of children that participated in the research, but it will be used in future phases of the project, not the current analysis.

Assessment Battery

Early Literacy Assessment. Children were tested using the Assessment of Literacy and Language (ALL), the standardized measures of preliteracy and early literacy skills designed to test pre-kindergarteners through the end of the first grade. The test includes measures of Receptive Vocabulary, Letter Knowledge, Listening Comprehension, and Invented Spelling.

Reading Prerequisites (PA). ALL provides several measures that address PA. Specific reading prerequisites included: Rhyme Knowledge, comprised of Rhyme Iden-

5 Years;month (i.e., 3 years and 9 months old)

6 M is the mean of the sample (in this case the mean age); SD is standard deviation from the mean.

tification,[7] Rhyme Production,[8] or Nonsense Word Rhyme Production;[9] Elision;[10] Phonics Knowledge;[11] and Sound Categorization.[12] All children were also tested on nonverbal intelligence (Matrices, KBIT-2), as well as experimental measures of verbal working memory.

Musical-Rhythmical tasks. All children were tested on experimental musical-rhythmical tasks. The music tasks were created by the research team and consisted of: Copying Tasks where the child was asked to clap out the musical pattern played to them; Same-or-Different Tasks where the child had to identify whether two patterns they heard were identical; Pitch-Identification Tasks where the child had to identify where in the pattern the difference was (e.g., beginning or end); and Tapping Tasks where the child was asked to tap out the rhythm of "Happy Birthday" and "Jingle Bells" songs. These tasks were created to correspond to PA tasks as they required a child to process and manipulate the musical sequences similar to processing and manipulating sounds with words.

Scoring

Standardized measures were scored according to the manuals and consisted of assigning one point for correct answers and zero for incorrect answers. We maintained the same scoring system for the experimental measures and used raw scores (total number of correct responses for each measure) in our analysis. All tests were re-scored after an initial scoring by a different member of the team for rater reliability.

Results

To answer our research question, we used bivariate Pearson correlations[13] to identify possible interaction between musical-rhythmical tasks, tasks assessing PA, early literacy skills. Although correlations were run for all administered tests, our focus was on the correlation between musical-rhythmical tasks and literacy tasks only.

The results of the correlations showed strong significant correlations between Phonics knowledge (essential for reading acquisition, as it shows that a child identifies the sound that the letter makes) and three out of four musical-rhythmical tasks: Copying ($r = 0.581$, $p = 0.023$),[14] Same-or-Different ($r = 0.616$, $p = 0.014$), and Pitch Identification ($r = 0.790$, $p < 0.001$). We also ran correlations

7 Rhyme Identification is a task that assess the ability to say if two or more words rhyme.

8 Rhyme Production is a task that assesses the capability of providing a real word that rhymes with the target word.

9 Nonsense Word Rhyme Production is task that assesses the capability of providing a nonsense word that rhymes with the target word.

10 Elision is a task that assesses the ability to break apart words in a way where the child must identify what is left when part of the word is eliminated (e.g., "What is left when you have 'sailboat' and take away 'boat'?").

11 Phonics Knowledge is a task that tests the capability of producing the sounds that letters make.

12 Sound Categorization is a task that tests the ability to identify if two or more words begin with the same of different sound.

13 A bivariate Pearson correlation is a statistical test that analyzes the linear association between two variables.

14 r is the measure of the strength of the association between two variables (i.e. a higher r value means a stronger correlation). p is the probability that an observed difference could have occurred by chance (i.e. smaller p values indicate a smaller likelihood that the correlation occurred by chance

Table 1. Correlations between Musical-rhythmical tasks and Reading Precursor

	Literacy Precursors		
Musical-rhythmical tasks	**Rhyme Ident.**	**Elision**	**Phonics**
Copying Rhythm	.529*	.259	.581*
Same-Different	.414	.191	.616*
Pitch Identification	.433	.259	.790**
Tapping	.387	.531*	.400

Note: * considered significant at p = .05; ** considered significant at p = .01

between musical-rhythmical tasks and the individual components of Rhyme Knowledge, e.g., Rhyme Identification and Nonsense Word Rhyme Production. Rhyme Identification was found to have a strong positive correlation with the Copying music task ($r = 0.529$, $p = 0.029$). Correlations between the Elision task and musical-rhythmical tasks were also run, and it was found that Elision was significantly correlated with Tapping skills ($r = 0.531$, $p = 0.41$). The results of the correlations between reading precursors and musical-rhythmical skills are presented in Table 1.

Discussion

This study was initiated to investigate previously made claims that musical-rhythmical skills may positively influence the development of phonological awareness and therefore improve reading skills. Research in support of this claim suggests that even a short duration of musical training may enhance reading skills and greatly improve PA (an essential reading pre-requisite) of children in the early stages of literacy acquisition as well as in children with dyslexia (Moreno et al., 2011; Flaugnacco, Lopez, Terribili, Montico, Zoia, & Schön, 2015). Part of our aim was to see how early these interactions can be detected; our participants had a mean age of 3;9 years old, which is at the lowest end of children's age in previous studies.

Overall, our results supported our hypothesis that there is a correlation with at least one of the musical-rhythmical tasks and the preliteracy tests that we administered. These results are not surprising since the musical-rhythmical tasks were created to assess skills that may also be present and required for literacy, such as breaking sounds into individual parts. Additionally, the interaction between three out of four musical-rhythmical tasks and phonics knowledge supports previous research that musical skills play a role in literacy acquisition. Although phonics knowledge[15] and phonological awareness[16] are not exactly the same (Anthony & Lonigan, 2004; Morais, 1991a), they are inter-related because they suggest the same underlying processes[17] and provide a basis for the understanding of these processes as they relate to our findings.

The correlation between two of the musical-rhythmical tasks and rhyme identification was also expected. The Same-or-Different Task evaluates the ability of the child to identify the pattern of music that is heard and determine whether it sounds the same as the one played previously. The ability to identify rhymes also stems from hearing two words and being able to identify similar patterns within them. Therefore, it follows that these two tasks are related. The Copying Task also assesses the ability of the child to hear something and repeat it back to the tester. A greater ability to copy musical-rhythmical patterns would also correlate with Rhyme Identification since a child would need to be able to process the rhythmical pattern sequentially in order to copy it in the same way that they would process sequences of sounds to understand similarities between words in a sentence. Lastly, the Elision Task assesses the child's ability to deconstruct words; the Tapping Task also requires deconstruction, but it tests the child's ability to pull apart the rhythm of the song from its words and only tap back its rhythm. Therefore, this association makes sense because it requires the skill of separating individual parts from a whole.

Future Research

This paper addresses the first phase of this research project. Using the same measures, we are now collecting data from another branch of the same childcare center. This will not only increase the sample size to help add validity to the findings but also will add another possible variable of socioeconomic status (SES) since the second facility is in a neighborhood of slightly lower SES. In the future, we will collect data from a comparison or control group. This group will consist of children of the same age and roughly the same SES as our original school but the children will not have music incorporated into their curriculum. This will allow the research to determine first if there is a difference in the scores the children receive on preliteracy and music tasks, and then evaluate whether the musical training influences their preliteracy test scores.

Conclusion

This study was able to replicate some of the findings of previous studies such as the individual correlations of music tasks with Phonics Knowledge, Rhyme Identification, and Elision. In addition, this study was able to propose new findings that these relationships can be observed in children around the age of four. However, these results must be contextualized as a part of a larger, forthcoming project. The second and third phase of this project will lead to more concrete results and, possibly, additional and stronger correlations between musical tasks and preliteracy tasks.

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alone).

15 Reflects the knowledge of the sounds the letter makes and therefore become an integrated part of the word identification.

16 The ability to manipulate sounds within the words.

17 Auditory processes and cognitive functioning that allows for the discrimination between sounds.

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