The Impact of Early Music Education on Preschoolers' Executive Functioning

Coco Song

2023/12/16

Introduction

Early childhood is a critical and intensive period for cognitive development throughout the human lifespan (Carson et al., 2016; Gale, 2004). According to Jean Piaget's theory of cognitive development, young children start to develop symbolic thinking between 2 and 4 years old, and later immature logical thinking approximately from 4 to 7 years old. The development of executive functioning (EF) also begins in early childhood and continues rapidly during preschool and early school years (Degé & Frischen, 2022). Research has shown that EFs are reliable predictors of academic achievements throughout the school years (Ahmed et al., 2019; Willoughby et al., 2019). Therefore, it is crucial to strengthen these abilities in early childhood.

Music-making in early childhood is a highly engaging activity involving complex coordination of sensorimotor function (Bugos & DeMarie, 2017), which requires an integration of EFs, including attention, inhibitory control, and working memory. Given the importance of the development of EFs in early childhood, educators and caregivers are interested in knowing whether early music education during preschool years can boost young children's EF during preschool years. This paper will review the existing literature in the field to investigate the potential impact of early music education on preschoolers' executive functioning.

Purpose Statement

The purpose of this research project is to explore the impact of early music education on preschoolers' executive functioning. Specifically, the two research questions are: (1) How might

early music education affect preschool children's attention? And (2) How might early music education affect preschool children's inhibitory control?

Definition of Terms

In this research, executive function (EF) refers to a set of skills necessary for performing higher-order cognitive processes(Lagattuta et al., 2015). According to UCSF Weill Institute for Neurosciences (n.d.), executive functions can be divided into two categories: organizational and regulatory abilities. Organizational skills include attention, planning, working memory, abstract thinking, etc. Regulatory skills include initiation of action, inhibitory control, emotional regulation, decision-making, etc. Attention refers to the cognitive process that enables the selection of, focus on, and sustained processing of information (Cohen, 2011). Inhibitory control refers to the ability to suppress salient thought processes or behaviors that are not relevant to the ongoing goal or task (Carlson & Wang, 2007). For the purpose of this research paper, early music education includes both music programs involving group lessons and private lessons, and both vocal and instrumental training go under the definition of early music education.

Literature Review: Research Question #1

Attention is a fundamental skill that plays a pivotal role in cognitive, social, and communication development. Research has suggested that attention control in children is positively correlated with academic achievement (Kasuya-Ueba et al., 2020). Two empirical studies involve the use of the Suzuki method in their experiment design to examine the impact of music training on preschoolers' attention. Hallberg et al. (2017) assessed controlled attention among kindergarten children who received musical instruction using the Suzuki violin method

compared to students with no music instruction using random assignment design. The music group received 5 weeks of instruction. The Kiddie Connor's Continuous Performance Test Version 5 (K-CPT) was used to assess young children's selective and sustained attention. The research found a statistically significant difference in the pretest-posttest change in attentional control between treatment and control groups. In other words, children in the Suzuki training group improved their attention, while children in the control group did not. Scott (1992) investigated the effect of Suzuki violin instruction on preschool children's development of attention skills. The study recruited eighty 3- to 5-year-old children and divided them into 5 conditions based on their experiences with the Suzuki method and other activities. Fifteen minutes of each instruction session were videotaped. The researcher also videotaped participants completing the attention task. The results indicated that children who participated in both individual and group Suzuki lessons demonstrated more on-task behaviors during the instruction session than children in other conditions. They also had a better performance on the attention task.

Other experimental research using a designed music training program found similar results with improved attention. For example, in Moreno et al. (2011), children between 4 and 6 years old received either group music training or group visual art training for a total of 20 days. In the computerized program, children in the music group received training in rhythm, melody, and other basic elements of music; children in the visual art group learned visuospatial skills. Both training programs are conducted in groups led by teachers. The go/no-go task was administered before and after training to assess children's sustained attention. Results show that

children in the music training group improved significantly on the accuracy of the go/no-go task, displaying enhanced attention skills, compared to those in the visual art group.

Literature Review: Research Question #2

Similar to attention, research has revealed that inhibitory control can predict academic achievement over the early elementary years and through adolescence (Raver & Blair, 2016). Bolduc et al. (2020) assessed the effects of a music condition on the development of inhibition control in French Canadian kindergarteners and compared the effects to those of a motor condition and a no-intervention condition. 174 children were randomly assigned to one of the three conditions. The experiment lasted 19 weeks. In the music training program, children primarily learned about rhythm. The Developmental Neuropsychological Assessment, Second Edition (NEPSY-II) was used to assess inhibition control both pretest and posttest. The results revealed that at post-test, the music condition scored significantly higher than the control and motor conditions. Researchers also found an improvement in the NEPSY-II items from pretest to posttest in the music condition.

Degé et al. (2020) also investigated the impact of a music training program on children's inhibitory control. They used the same measure, NEPSY-II, to assess children's motoric inhibition. In the study, the researchers recruited 25 preschoolers from Germany and randomly assigned them to either the music group or the sports group. Both groups underwent 14 weeks of training. The music training program involved drumming, which is directly related to motoric inhibition. Like Bolduc et al. (2020), the researchers found a significant enhancement

from pre- to post-test in the musically trained group, whereas the sports group did not show any improvements.

A more complicated study also found similar results by comparing children who received music training and other interventions (Bowmer et al., 2018). This study investigated the effect of weekly musicianship training on the inhibitory control of 3-to-4-year-old children at a kindergarten in London, United Kingdom, using a two-phase experimental design. In Phase 1, one group of children participated in music classes, and the other two groups engaged in free play in the nursery. Results of Phase 1 showed that there is no improvement in inhibitory control. In Phase 2, children in Group A received music training, Group B children received visual art training, and Group C served as a control group. Results indicated that children's performance on the inhibitory control task improved significantly in Phase 2.

Discussion

All the studies reviewed above found a positive impact of music training on both children's attention and inhibitory control skills. The pre-test – experiment – post-test was a primary experimental design in most of the studies, which can examine the changes in participants' performance on the dependent variables before and after the treatment, i.e., executive functioning skills of preschool children. Moreover, most studies included at least one control group. In some studies, children in the control group did not receive special intervention (Hallberg et al., 2017). Other studies compared the effect of music training with other interventions, such as sports and visual arts (Moreno et al., 2011; Degé et al., 2020; Bowmer et al., 2018). Scott (1992) included five different conditions, comparing not only the Suzuki group

and non-Suzuki group but also private lessons and group lessons. All those methodologies increase the validity of the results, supporting the idea that music training during the preschool years has benefits on children's executive functioning.

There are several limitations in this field of study. First, the sample size of these studies is relatively small and lacks variety in the family background of the participants, which lowers the generalizability of the results to a larger population. Second, there might be some extraneous variables that could not be completely controlled because of the nature of the preschool setting. Third, the time span of the music training programs is too short. Among all the studies reviewed, the longest training program lasted only 19 weeks in total (Bolduc et al., 2020). Therefore, although these studies reported an improvement in children's executive functioning abilities after participating in music training programs, we cannot determine if the positive effect of music training is a short-term or long-term effect that would benefit the children through adulthood.

Implications for Music Engagement & Research

Given the importance of the development of EFs in early childhood and the potential positive impact of music training on children's EFs, more music-related activities should be encouraged in kindergartens. Actively engaging in music-making requires high levels of attention, inhibitory control, coordination, auditory feedback, etc (Bugos & DeMarie, 2017). Yet future research is necessary to investigate the following questions. First, longitudinal studies should be conducted to determine whether it has a long-term impact on children's EFs that last through their adolescence and adulthood. Second, since few studies have attempted to explain how the impact of music training can be transferred to children's general development, future

research is required to examine whether the improvement of EFs developed through music training can be transferred to academic performance and how it can be achieved. Third, music training programs in several studies involve parents' participation (e.g., Suzuki violin method), a future direction can explore if the parent is a factor that accounts for the positive impact of music training in early childhood.

Conclusions

This research paper explores the impact of early music education on preschoolers' executive functioning by reviewing existing literature. Taken together, most studies found a positive impact of early music education on preschoolers' EF. Though the results have high reliability and validity, questions remain that need future research. Ultimately, music training should be encouraged as an effective way to promote the development of young children's EFs.

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