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ENHANCING MEMORY PROCESSES IN EARLY CHILDHOOD THROUGH MUSICAL ACTIVITIES: A DESCRIPTIVE SURVEY OF PRESCHOOL TEACHERS' PERCEPTIONS

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Abstract:
This study investigates the role of musical activities in enhancing memory processes in early childhood education. More specifically, it examines preschool teachers' perceptions of how specific musical activity factors, such as rhythm, melody, repetition, imitation, synchronisation, verbal flow, emotional engagement, and multisensory experience, may contribute to the development of memory and broader cognitive functioning in preschool children. The study is grounded in theoretical perspectives on memory processes, including encoding, retrieval, and consolidation, as well as in interdisciplinary research on music, cognition, and early childhood learning. The research adopts an exploratory descriptive survey design in order to examine educators' views on the pedagogical value of music-based activities in preschool settings. Data were collected through a structured questionnaire administered to preschool teachers. The sample consisted of eleven educators of different age groups, levels of teaching experience, and professional backgrounds (N = 11). Data were analysed using descriptive statistical methods (frequencies and percentages). Findings indicate that music-based activities are widely perceived as valuable pedagogical tools for supporting children's memory processes. In particular, repetition, movement-based synchronisation, emotional engagement, and multisensory involvement were identified as important factors contributing to memory enhancement. Participants also reported that musical activities may support children's attention, participation, and broader cognitive development. Overall, the study suggests that musical activities can play a meaningful role in early childhood education by creating engaging and developmentally appropriate learning environments that support memory, attention, and cognitive growth. Findings also highlight the need for further research involving larger samples and direct observation of children's learning outcomes.

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Keywords: music education; memory processes; early childhood education; musical activities; cognitive development

1. Introduction

Memory is one of the core cognitive functions underpinning learning, knowledge acquisition, and the development of higher-order thinking. In early childhood education, memory processes are particularly important because they support the organisation, retention, and retrieval of new information during a period of rapid developmental change. Classical models in cognitive psychology describe memory as a complex and interactive system involving sensory memory, working memory, and long-term memory, all of which contribute to the encoding, storage, and retrieval of experience (Atkinson, Brelsford & Shiffrin, 1967; Atkinson & Shiffrin, 1968; Baddeley, 1992; Goldstein, 2018). These processes are central to children's cognitive development, as they enable the integration of new knowledge with prior experience and support the gradual formation of stable learning structures. The early years are also characterised by heightened neural and cognitive plasticity. Developmental research has shown that young children's learning is strongly shaped by the quality of their educational environment and by the richness of the sensory and social experiences available to them (Goswami, 2010; Kolb & Whishaw, 1998). For this reason, pedagogical approaches that incorporate multisensory, emotionally meaningful, and developmentally appropriate experiences are particularly valuable in early childhood settings. Such approaches can increase children's engagement and may strengthen attention, recall, and conceptual understanding. An important question, therefore, concerns which musical activity factors are perceived to contribute most effectively to memory processes.

Within this context, music constitutes a particularly powerful pedagogical medium. As a multimodal form of experience, music combines auditory perception, rhythmic organisation, movement, emotion, and social interaction. From both educational and neuroscientific perspectives, musical activities engage multiple systems associated with attention, perception, emotion, and memory (Peretz & Zatorre, 2003; Koelsch, 2011; Purves *et al.*, 2018). Research has also shown that music training is associated with improvements in executive functions and related cognitive skills in children. A recent meta-analysis of preschool children aged 3–6 found positive effects of music training on inhibitory control, working memory, and cognitive flexibility, while a 2024 meta-analysis reported moderate-to-large effects of music training on inhibition control in children (Shen, Lin, Liu, Fang, & Liu, 2019; Bayanova, Chichinina & Aslanova, 2024; Lu, Shi, & Musib, 2025).

In the field of music education, scholars have increasingly highlighted the contribution of music to language, attention, emotion, and memory. Earlier studies linked musical engagement with phonological awareness, early literacy, and verbal recall (Anvari *et al.*, 2002; Hallam, 2010; Knott & Thaut, 2018). More recent work has reinforced this view. Belfi and Jakubowski (2021) emphasised the strong relationship between music

and memory, while Benítez *et al*. (2024) found that preschool children who received music training demonstrated better mnemonic performance than a control group and recalled emotional material more effectively. Together, these findings suggest that music is not only an artistic practice but also a meaningful cognitive resource in the early years.

From a pedagogical perspective, preschool music activities frequently involve rhythm, melody, repetition, imitation, synchronisation, verbal flow, movement, emotional engagement, and multisensory participation. These elements are especially relevant because they create structured and affectively rich learning environments that may facilitate the encoding, retrieval, and consolidation of information. Repetition and rhythmic predictability may support memory through patterned exposure, while movement and synchronisation may strengthen recall through embodied participation. Emotional engagement may further enhance retention by making learning experiences more salient and memorable. Observations are consistent with both earlier theoretical work on music cognition and more recent studies emphasising the value of embodied and multisensory musical learning in early childhood. In addition, recent research on multisensory music education has shown that technology-supported and sensor-based musical environments can create engaging, developmentally appropriate experiences for young children, further underlining the educational importance of multimodal musical interaction (Del Barrio & Arús, 2024; Urbaitė, 2025; Stepaniuk, 2025).

Despite the growing body of research on music and cognition, an important question remains insufficiently explored in early childhood education: which musical activity factors are perceived to contribute most effectively to memory processes in preschool children? Although rhythm, melody, repetition, movement, emotional involvement, and multisensory stimulation have all been discussed in the literature, their relative pedagogical value within preschool music practice remains underexamined, particularly from the perspective of educators (Zhang, 2025; Zou, 2025; Wei, 2025).

The study addresses this issue by investigating the musical activity factors that may enhance memory processes in preschool education. Drawing on a descriptive survey approach and focusing on preschool teachers' perceptions, the study examines how specific musical elements may support the processes of encoding, retrieval, and consolidation in young learners. In doing so, it aims to contribute to a more nuanced understanding of the pedagogical value of music in early childhood education and to offer practical insights into how music-based activities may be integrated more effectively into teaching and learning.

2. Theoretical Framework: Memory Processes and Music in Early Childhood Education

Understanding the relationship between music and memory requires an interdisciplinary framework that draws on cognitive psychology, neuroscience, developmental psychology, and music education. Memory is widely understood as a complex cognitive system that enables individuals to encode, store, and retrieve information over time. Classical models describe memory as consisting of interconnected components (sensory

memory, working memory, and long-term memory) which together support the processing and consolidation of experience (Atkinson & Shiffrin, 1968; Baddeley, 1992; Goldstein, 2018). These processes are fundamental for learning because they allow new information to be integrated with existing knowledge structures and facilitate the development of cognitive schemas (Craik & Lockhart, 1972; Tulving, 1972).

Working memory, in particular, plays a central role in children's learning processes, as it enables the temporary maintenance and manipulation of information during cognitive tasks (Baddeley, 2000). Research has consistently shown that working memory capacity is closely associated with language development, problem-solving abilities and academic achievement in childhood (Gathercole & Pickering, 2000; Lightfoot, Cole, & Cole, 2015; Goswami, 2010). Within this framework, mnemonic strategies can significantly improve the efficiency of memory processes by organising information into meaningful patterns that facilitate both encoding and retrieval (Bellezza, 1981; Bower, 1970).

Music represents one of the most effective mnemonic tools because of its structured temporal organisation and emotional expressiveness. Musical structures, such as rhythm, melody, and repetition, provide patterns that help organise information and support memory formation. The hierarchical organisation of musical elements can facilitate segmentation and pattern recognition, thereby assisting encoding and retrieval processes (Lerdahl & Jackendoff, 1983; Brower, 1993). One of the most influential perspectives on memory enhancement involves the use of mnemonic strategies that organise information into meaningful and structured patterns. According to Bower (1970), mnemonic devices improve memory performance by structuring information hierarchically and associatively, thereby facilitating both encoding and retrieval processes. When information is organised into coherent patterns, learners are better able to integrate new material with existing cognitive schemas, resulting in stronger and more stable memory traces. Musical activities share many characteristics with mnemonic systems, as they rely on structured temporal patterns, repetition, rhythm, and melodic organisation. These elements allow information to be embedded within predictable and memorable frameworks. In early childhood education, songs, rhythmic games, and movement-based musical activities may therefore function as natural mnemonic tools, supporting children's ability to encode, retain, and retrieve information through patterned auditory and embodied experiences. At the same time, emotional engagement with music can enhance memory consolidation by activating neural mechanisms associated with long-term memory formation (Meyer, 1956; Jäncke, 2008). Recent research has further demonstrated that music can play a significant role in autobiographical memory and emotional recall, highlighting the strong link between music, emotion, and memory processes (Belfi & Jakubowski, 2021).

Advances in cognitive neuroscience have provided additional insights into the relationship between music and brain functioning. Musical engagement has been shown to activate distributed neural networks across auditory, motor, and emotional brain regions, including areas associated with attention, executive functions, and memory

processing (Peretz & Zatorre, 2003; Koelsch, 2011; Purves *et al.*, 2018). Musical training can also lead to structural and functional changes in the brain, supporting neural plasticity and strengthening cognitive skills such as auditory discrimination, motor coordination, and working memory (Hyde *et al.*, 2009; Schlaug *et al.*, 2005).

Recent research continues to confirm the positive relationship between musical engagement and cognitive development. Studies published in the last decade have shown that music training can contribute to improvements in executive functions, attention, and memory in young children (Habibi *et al.*, 2022). A growing body of evidence also suggests that musical experiences during early childhood may have long-term cognitive benefits by strengthening neural pathways involved in auditory processing and cognitive control (Patel, 2022). Similarly, Weiss *et al.* (2021) demonstrated that melodic structures can enhance memory recall in individuals with developmental differences, further highlighting the mnemonic potential of musical patterns.

From a developmental perspective, children acquire musical skills gradually through processes of enculturation and experiential learning. Early exposure to rhythmic and melodic structures contributes to the development of perceptual and cognitive abilities related to musical organisation (Hannon & Trainor, 2007). In addition, participation in music-based activities has been associated with improvements in phonological awareness, language development, and early literacy skills (Anvari *et al.*, 2002; Hallam, 2010). These findings illustrate the interdisciplinary connections between music education, language development, and cognitive psychology.

Another important aspect of music-based learning in early childhood is its multisensory and embodied nature. Musical activities often combine auditory, visual, motor, and emotional stimuli, creating rich learning environments that engage multiple sensory systems simultaneously. According to multisensory learning theories, information presented through multiple sensory modalities is more likely to be encoded effectively and retained over time (Shams & Seitz, 2008). In preschool education, musical experiences frequently involve movement, imitation, synchronisation, and repetition, which can facilitate memory processes through embodied interaction with the learning environment.

Within music pedagogy, these principles are reflected in educational approaches that emphasise experiential and participatory learning. Music education practices in early childhood often incorporate rhythmic movement, vocal expression, imitation, and collaborative musical interaction as key components of learning (Argyriou, 2025; Hargreaves, 1986). Such practices not only support children's musical development but also contribute to broader cognitive, emotional, and social growth.

Despite the substantial body of research highlighting the cognitive benefits of musical engagement, relatively little attention has been paid to the specific musical activity factors that may influence mnemonic processes in preschool education. Elements such as rhythm, melody, repetition, synchronisation, verbal flow, emotional engagement, and multisensory interaction may interact in complex ways to support children's memory development. Identifying and evaluating these musical activity factors may

therefore provide valuable insights into how music can function as an effective pedagogical tool for strengthening memory processes in early childhood learning environments.

For this reason, the present study focuses on the identification and evaluation of musical activity factors that may enhance mnemonic processes in preschool children. By examining preschool teachers' perceptions through a descriptive survey approach, the study seeks to explore how specific musical elements may support the processes of encoding, retrieval, and consolidation of information in early childhood education. In doing so, the research aims to contribute to a deeper understanding of the pedagogical potential of music as a tool for supporting cognitive development and meaningful learning in the early years.

3. Methodology

3.1 Research Design

The present study adopts an exploratory research design aimed at investigating preschool teachers' perceptions regarding the contribution of musical activities to the enhancement of mnemonic processes in early childhood education. The research is situated within the broader field of educational inquiry that seeks to connect theoretical perspectives with pedagogical practice. In this context, the study explores how educators conceptualise the role of specific musical parameters in supporting children's memory processes, including encoding, retrieval, and consolidation. The study follows a descriptive survey approach using a structured questionnaire as the primary data collection instrument. Survey research is widely used in educational studies to explore attitudes, perceptions, and professional experiences of educators within specific pedagogical contexts. This methodological approach allows researchers to collect systematic information from participants regarding their observations, beliefs, and practices in educational environments (Creswell & Creswell, 2018; Cohen, Manion, & Morrison, 2018). The choice of this research design was guided by the aim of examining teachers' perspectives on music-based pedagogical practices and their perceived effects on children's cognitive development. Since preschool educators are directly involved in the implementation of learning activities in early childhood settings, their insights provide valuable information regarding the pedagogical role of music in everyday classroom practice.

More specifically, the study focuses on identifying musical activity factors that may contribute to the strengthening of memory processes in preschool children. These factors include rhythm, melody, repetition, imitation, synchronisation with movement, verbal flow, emotional engagement, and multisensory experience. By analysing teachers' perceptions regarding these parameters, the study seeks to highlight how musical experiences may function as pedagogical tools that support cognitive engagement and learning in early childhood education. The survey method was selected because it enables the systematic recording of participants' responses and facilitates the quantitative

analysis of educators' perceptions. Furthermore, questionnaires provide participants with the opportunity to express their views in a structured and anonymous manner, which can increase the reliability of responses and reduce potential response bias (Bryman, 2016). Overall, the research design aims to provide an exploratory overview of how preschool teachers perceive music-based educational practices in relation to memory development. Findings are intended to contribute to a broader understanding of the pedagogical potential of music in early childhood education and to support further research on the relationship between musical engagement and cognitive processes in young learners. The study should therefore be interpreted as an exploratory investigation aimed at identifying pedagogical trends rather than producing generalisable conclusions.

3.2 Participants

The study involved a total of eleven preschool teachers working in early childhood education settings. The participants were selected through voluntary participation and represent educators with different levels of professional experience and backgrounds in preschool education. The demographic characteristics of the participating preschool teachers are summarised in Figure 1:

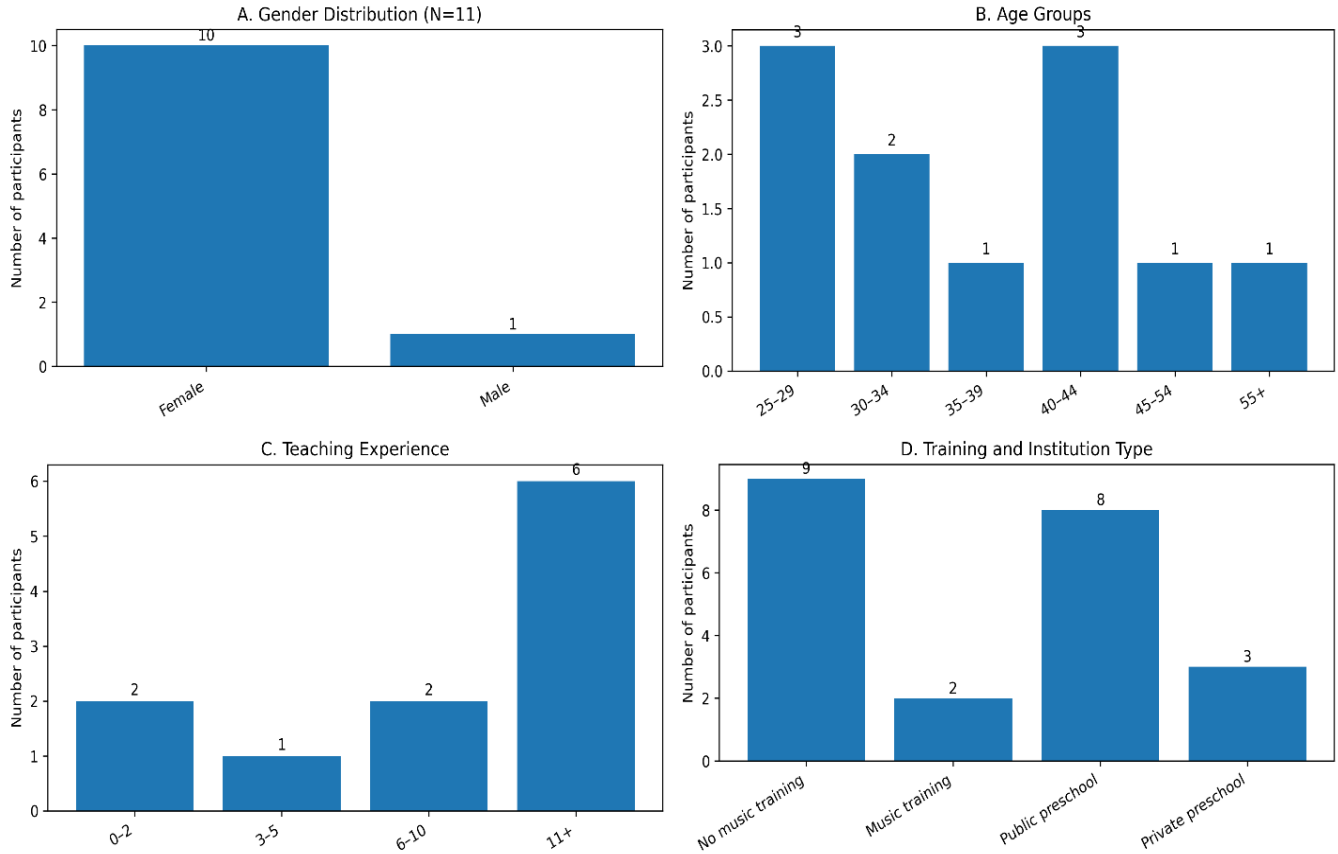


Figure 1: Demographic characteristics of the participants (N = 11): (A) gender distribution, (B) age groups, (C) teaching experience, and (D) specialised training in music education and type of preschool institution

With regard to gender distribution, the majority of participants were female (90.9%, n = 10), while one participant (9.1%, n = 1) was male. This distribution reflects the broader demographic characteristics of the early childhood education profession, where female educators constitute the majority of the workforce.

In terms of age, participants represented a range of age groups. Specifically, 27.3% of the participants belonged to the 25–29 age group, while another 27.3% were between 40 and 44 years old. A further 18.2% belonged to the 30–34 age group, 9.1% were aged between 35 and 39 years, 9.1% between 45 and 54 years, and the remaining 9.1% were over 55 years old. This age distribution indicates a heterogeneous sample that includes both early-career and experienced educators.

Regarding teaching experience, more than half of the participants (54.5%, n = 6) reported having more than eleven years of professional experience in preschool education. A smaller proportion reported fewer years of teaching experience, with 18.2% indicating 0–2 years of service, another 18.2% reporting 6–10 years of experience, and 9.1% reporting 3–5 years of professional experience.

Participants were also asked whether they had received specialised training or additional education in music education. The majority of respondents (81.8%) indicated that they had not received specialised training in music education, whereas only 18.2% reported having some form of additional training or specialisation in this field. This finding reflects the limited presence of formal music training among preschool teachers, which is often observed in early childhood educational settings.

Finally, participants were asked to indicate the type of preschool institution in which they worked. The majority of teachers (72.7%, n = 8) worked in public preschool institutions, while 27.3% (n = 3) were employed in private preschool settings.

Overall, the sample represents a group of educators with varied professional backgrounds and experiences, providing a useful perspective on how music-based pedagogical practices are perceived within preschool educational environments. However, given the relatively small number of participants, the findings should be interpreted as exploratory and indicative rather than representative of the broader population of preschool teachers.

3.3 Research Instrument

Data for the study were collected through a structured questionnaire designed specifically for the purposes of the research. The questionnaire aimed to explore preschool teachers' perceptions regarding the role of musical activities in supporting cognitive development and memory processes in young children. The development of the questionnaire was informed by the literature review conducted for the study, particularly research examining the relationship between music education, cognitive development, and memory processes in early childhood learning environments. The instrument was designed to capture educators' perceptions of specific musical parameters that may contribute to mnemonic functioning in preschool children.

The overall methodological model of the study, including the literature-informed questionnaire design, the four sections of the survey instrument, and the subsequent data analysis process, is presented in Figure 2, illustrating the relationship between the research aim, literature review, questionnaire design, the four sections of the survey instrument, the data analysis procedure, and the resulting findings.

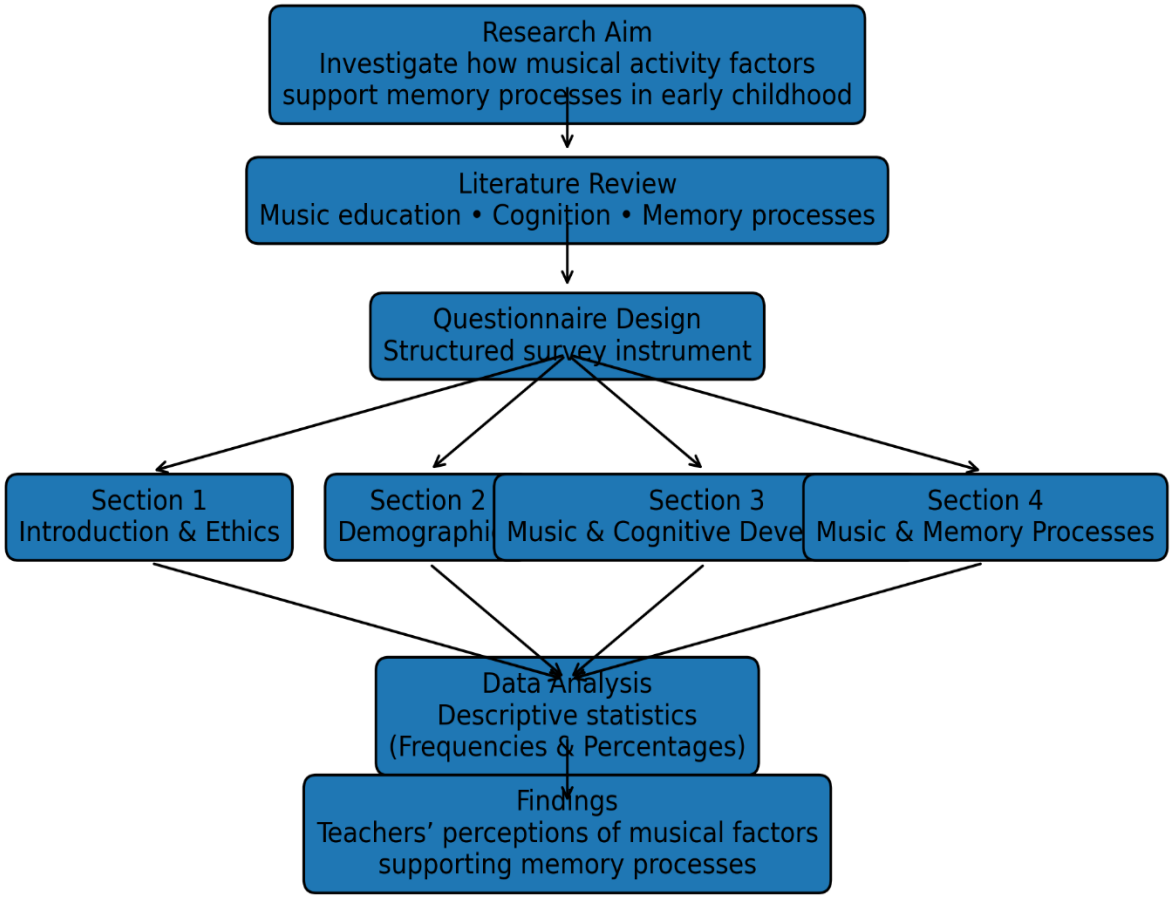


Figure 2: Methodological model of the study

The questionnaire consisted of four main parts. The first part included an introductory section that informed participants about the objectives of the research, the theoretical framework of the study, and the voluntary nature of participation. Participants were also informed that their responses would remain anonymous and would be used exclusively for research purposes. The second part of the questionnaire focused on participants' demographic characteristics and general professional information. This section included five questions examining variables such as gender, age group, years of professional experience in preschool education, the existence of specialised training in music education, and the type of preschool institution in which the participants were employed. The third part of the questionnaire explored teachers' perceptions regarding the role of music in the cognitive development of preschool children. This section included six questions examining the perceived contribution of music to various developmental domains, including language development, memory,

emotional and social development, motor skills, creativity, and participation in learning activities. Participants were asked to evaluate the importance of music education across these domains using Likert-scale responses. In addition, this section included questions examining educators' observations regarding children's concentration and attention during musical activities. Participants were also asked to compare children's engagement in music-based activities with participation in other classroom activities. The fourth and final part of the questionnaire focused specifically on the role of music in preschool children's mnemonic functioning. This section included eleven questions examining the perceived contribution of specific musical parameters to memory development. These parameters included rhythm, melody, repetition, imitation, verbal flow, synchronisation with movement, emotional engagement, and multisensory involvement.

Participants were asked to evaluate the extent to which each of these musical elements contributes to strengthening memory processes in preschool children. Responses were recorded using Likert scales ranging from 1 to 5 (1 = very low contribution, 5 = very high contribution), while some questions included multiple-choice options. In addition, participants were asked to indicate which memory processes—encoding, retrieval, or consolidation—are most strongly supported by musical activities. The use of structured questionnaires enabled the systematic collection of data and facilitated the quantitative analysis of teachers' perceptions regarding the pedagogical role of music in early childhood education.

3.4 Data Analysis

The data collected through the questionnaire were analysed using descriptive statistical methods. Descriptive statistics are commonly used in exploratory educational research in order to summarise participants' responses and identify patterns within the data. The analysis focused on the calculation of frequencies and percentages for each questionnaire item. These statistical measures allowed the researchers to examine the distribution of responses and to identify trends in teachers' perceptions regarding the role of music in cognitive development and memory processes. The results were organised according to the thematic sections of the questionnaire, allowing for a structured presentation of the findings. The analysis aimed to highlight the musical parameters that teachers considered most influential in supporting mnemonic functioning in preschool children, as well as their perceptions regarding the broader educational value of music-based activities. Although the study relies primarily on descriptive analysis, the findings provide useful insights into educators' perceptions of music as a pedagogical tool for supporting memory development in early childhood education.

3.5 Ethical Considerations

The study was conducted in accordance with the ethical principles governing educational research. Participation was voluntary, and all participants were informed about the purpose and scope of the study before completing the questionnaire. They were also informed that their responses would remain anonymous and would be used exclusively

for research purposes. No identifying personal data were collected, and confidentiality was maintained throughout the research process. Participants had the right to decline participation or to withdraw from the study at any stage without any consequences. The questionnaire was designed in a way that respected participants' professional integrity and avoided any form of sensitive or intrusive questioning. Particular care was taken to ensure that the study complied with the ethical standards of anonymity, informed consent, and responsible handling of research data in educational contexts.

3.6 Limitations of the Design

Although the present study offers useful insights into preschool teachers' perceptions of the role of musical activities in supporting memory processes, several limitations should be acknowledged. First, the study was based on a relatively small sample of eleven participants. Consequently, the findings should be interpreted as exploratory and cannot be generalised to the broader population of preschool teachers. Second, the research relied exclusively on self-reported data collected through a structured questionnaire. As a result, the findings reflect teachers' perceptions and professional interpretations rather than direct observation or empirical measurement of children's cognitive performance. Furthermore, the descriptive survey design enabled the identification of trends and perceived relationships but did not allow for causal conclusions regarding the effects of musical activities on children's memory processes. The results therefore provide an indicative representation of educators' views rather than experimental evidence of effectiveness. Despite these limitations, the research design was considered appropriate for the exploratory objectives of the study, as it allowed for the systematic investigation of teachers' perspectives and provided a useful foundation for future research employing larger samples, mixed-methods approaches, or classroom-based intervention studies.

4. Results

4.1 Music and Cognitive Development

The first part of the analysis examined teachers' perceptions regarding the contribution of music to preschool children's cognitive development. Participants were asked to rate the extent to which music supports cognitive development using a five-point scale ranging from 1 (very low contribution) to 5 (very high contribution). The results indicate that the majority of participants perceive music as an important factor supporting cognitive development in early childhood. Specifically, more than half of the participants (54.5%, n = 6) rated the contribution of music at the highest level ("5"), while 36.4% (n = 4) rated it as "4". Only one participant (9.1%) assigned a moderate evaluation ("3"). These findings suggest that preschool teachers generally recognise the educational value of music as a pedagogical tool that supports cognitive engagement and learning processes in early childhood settings. Teachers' evaluations of the contribution of music to cognitive development are presented in Figure 3:

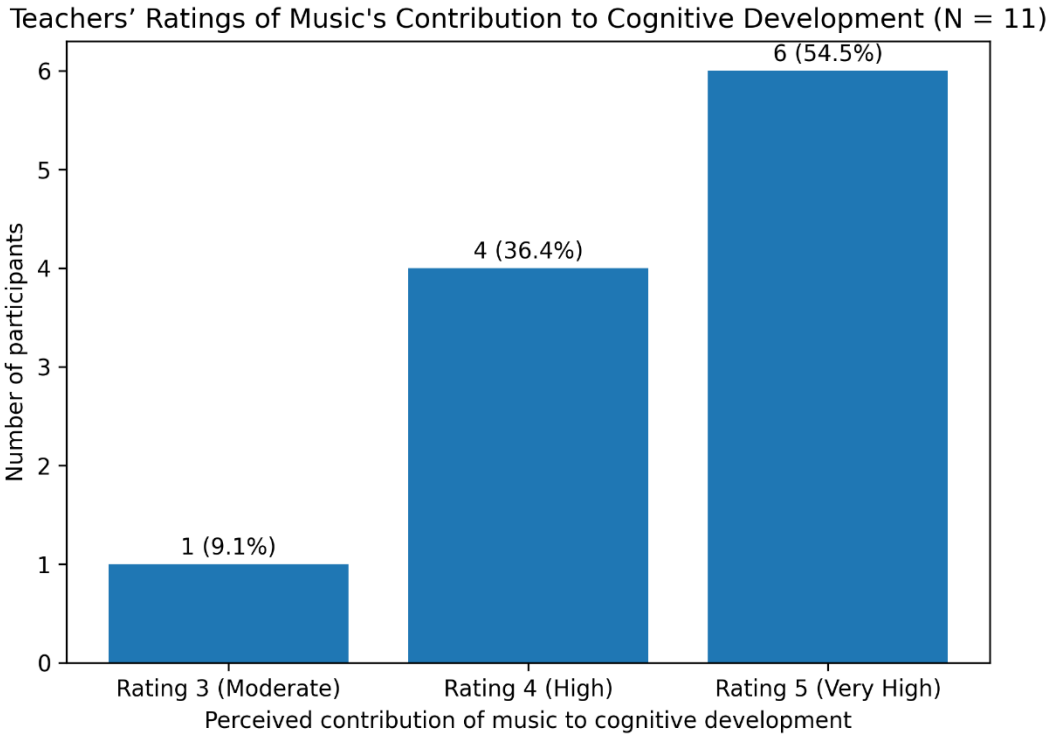


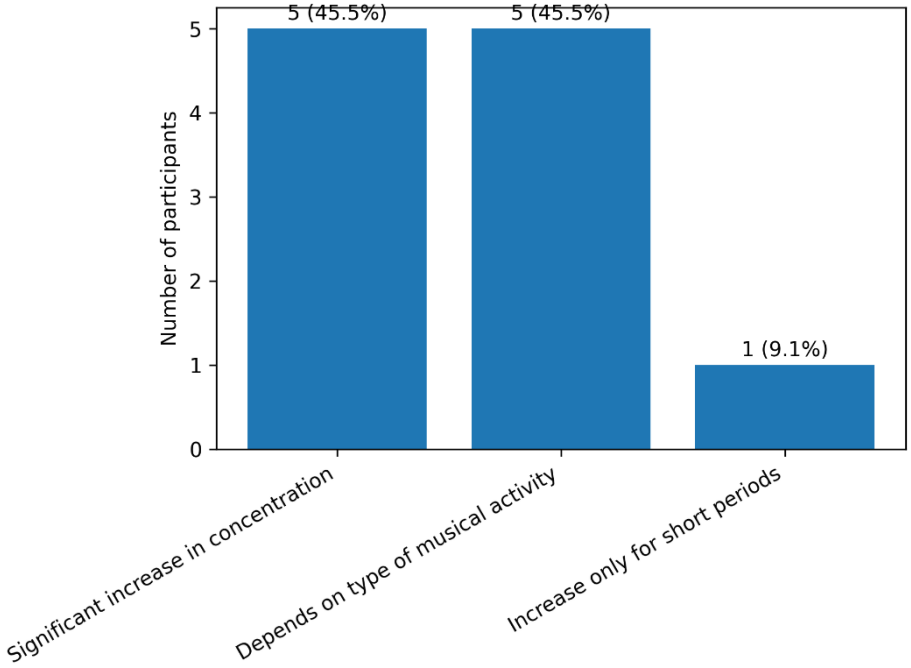
Figure 3: Preschool teachers' ratings of the contribution of music to cognitive development in early childhood (N = 11)

Participants were also asked to evaluate the contribution of music education to different developmental domains included in the Preschool Curriculum (2021). The domains examined included emotional and social development, motor development, creativity and artistic expression, environmental awareness, information and communication technologies (ICT), natural sciences and experimentation, and history and culture. The results show that teachers perceive music education as particularly important for emotional and social development as well as for motor development. A large proportion of participants assigned high ratings to these domains, reflecting the close relationship between musical activities, movement, and emotional expression in preschool learning environments. Music was also perceived as an important factor in fostering creativity and artistic expression, although responses showed slightly greater variability. By contrast, the perceived contribution of music to domains such as ICT and the natural sciences was more moderate, suggesting that educators primarily associate music with expressive, emotional, and motor aspects of development rather than with technological or scientific learning. Overall, the findings indicate that teachers view music education as a multidimensional pedagogical practice that contributes not only to artistic development but also to broader cognitive and developmental processes.

4.2 Music and Attention

The second part of the analysis examined teachers' observations regarding preschool children's attention, concentration, and participation during musical activities. Participants were asked whether they had observed differences in children's concentration when participating in music-based activities. The responses indicate that musical activities are generally associated with increased engagement and attention among preschool children. More specifically, 45.5% of participants reported that children's concentration increases significantly during musical activities. Another 45.5% indicated that the level of attention depends on the type of musical activity involved, such as singing, dancing, or playing musical instruments. Only one participant (9.1%) suggested that musical activities increase attention only for short periods of time. Teachers' observations regarding children's attention during musical activities are presented in Figure 4:

Figure 4: Teachers' observations regarding preschool children's attention and concentration during musical activities (N = 11)



These findings suggest that music may function as a stimulating learning medium that enhances children's engagement and concentration in educational contexts. However, the effectiveness of musical activities appears to depend on the characteristics of the activity itself, particularly the degree of interaction, movement, and active participation involved. Participants were also asked to compare children's participation in musical activities with participation in other classroom activities, such as drawing or free play. The results show that more than half of the participants (54.5%) believe that participation in musical activities depends on the specific type of activity implemented. At the same time, 36.4% reported that participation in music-based activities is generally

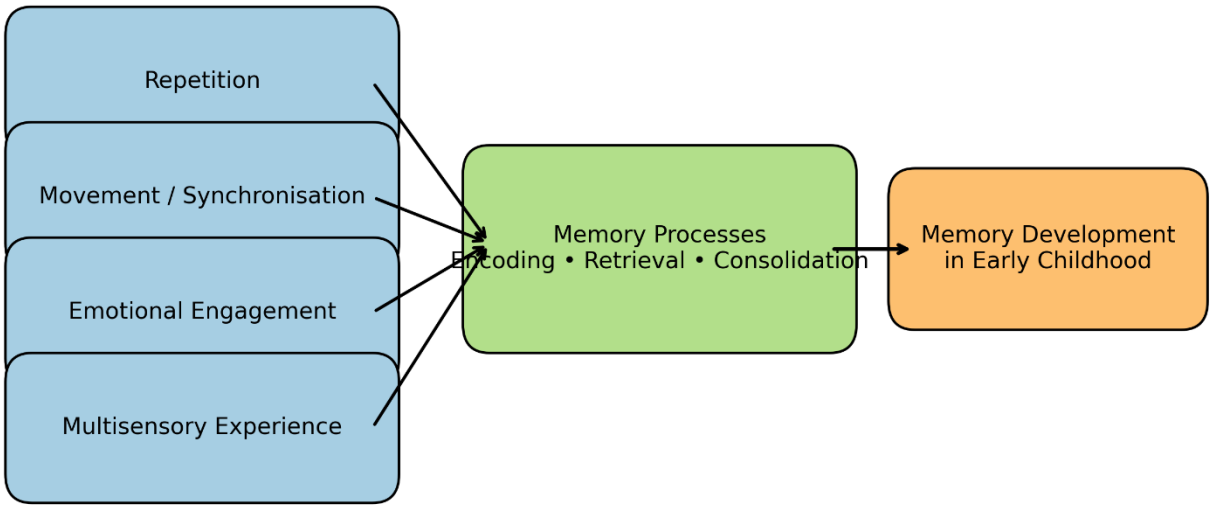
higher than in other classroom activities, while only one participant (9.1%) indicated that participation levels are similar across different activities.

Taken together, these findings indicate that musical activities have the potential to promote high levels of engagement in preschool classrooms, particularly when they involve interactive and movement-based experiences.

4.3 Musical Parameters and Memory

A central objective of the study was to examine teachers' perceptions regarding the musical parameters that contribute most effectively to strengthening preschool children's memory. Participants evaluated the contribution of eight musical parameters to mnemonic functioning: rhythm, melody, repetition, imitation, verbal flow, synchronisation with movement, emotional engagement, and multisensory experience. Among these parameters, repetition emerged as the most significant factor supporting memory processes. Based on the teachers' responses, a conceptual relationship between musical activity factors and memory processes is illustrated in Figure 5:

Figure 5: The relationship between musical activity factors, memory processes, and memory development in early childhood learning



A large majority of participants (72.7%, n = 8) rated repetition at the highest level of contribution, highlighting its role in reinforcing the encoding and retention of information. Synchronisation with movement was also identified as an important factor supporting memory development. Teachers indicated that the integration of rhythmic patterns with physical movement may facilitate learning by linking cognitive processing with motor activity. Emotional engagement and multisensory involvement were also perceived as important contributors to mnemonic functioning. Participants emphasised that musical activities that incorporate emotional expression and multiple sensory modalities—such as sound, movement, and visual stimuli—appear to support children's ability to remember information more effectively. Rhythm and melody were recognised as important musical parameters as well, although participants generally considered

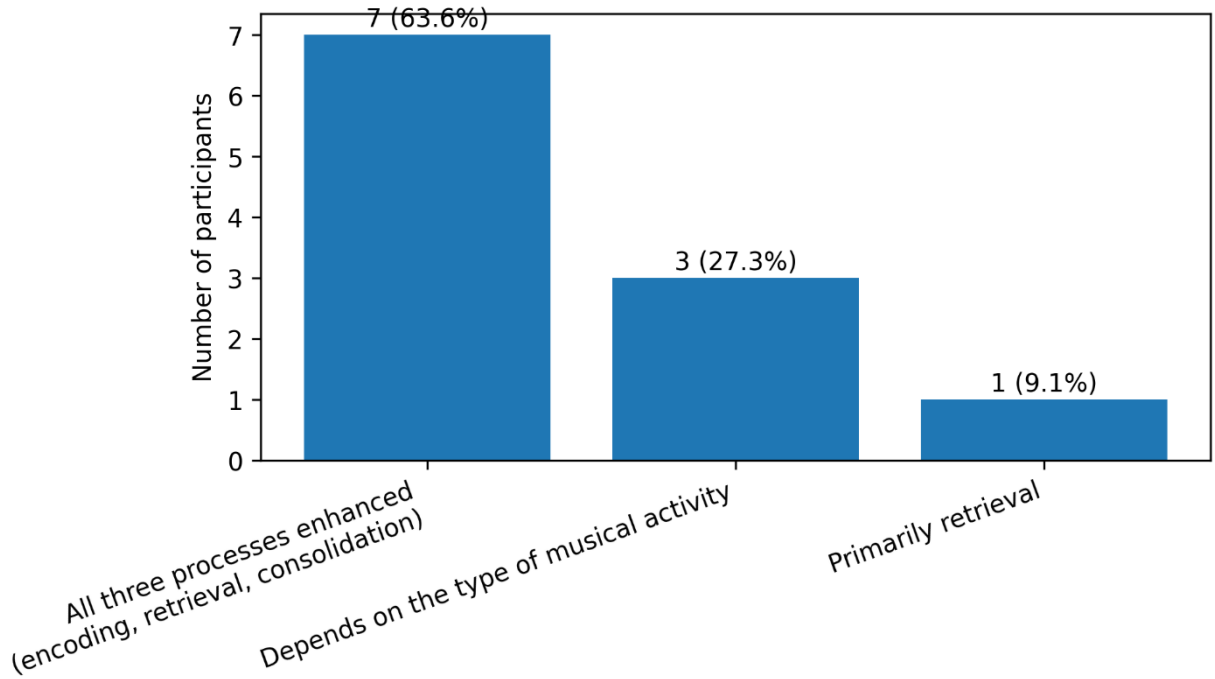
them most effective when combined with other factors such as repetition and movement. Imitation and verbal flow were also perceived as useful elements of musical activities, although they were not evaluated as the most influential factors in supporting memory processes.

Overall, the results suggest that musical parameters function most effectively when combined within integrated musical experiences. Activities that incorporate repetition, movement, emotional engagement, and multisensory stimulation appear to provide particularly supportive learning environments for the development of memory processes in early childhood education.

4.4 Memory Processes (Encoding, Retrieval, Consolidation)

The final part of the analysis examined teachers' perceptions regarding the influence of music on the three main stages of memory processing: encoding, retrieval, and consolidation. When asked which memory processes are strengthened through musical activities, the majority of participants (63.6%, n = 7) indicated that all three processes are enhanced simultaneously. This finding suggests that teachers perceive music as a holistic learning medium capable of supporting multiple stages of mnemonic functioning. A further 27.3% of participants stated that the specific memory process strengthened by music depends on the type of musical activity used, while 9.1% believed that musical activities primarily enhance retrieval by helping children recall previously learned information. Teachers' perceptions regarding the influence of musical activities on the main stages of memory processing are presented in Figure 6:

Figure 6: Teachers' perceptions regarding the influence of musical activities on memory processes in preschool children (N = 11)



Participants also suggested that different musical practices may support different stages of the memory process. For example, repetition of songs and rhythmic patterns was associated with improved encoding and consolidation of information, while movement-based musical activities were perceived as particularly helpful for strengthening retrieval. In addition, teachers highlighted the importance of emotionally engaging musical experiences, such as musical storytelling and expressive singing, which may facilitate the creation of associative memory links. Such experiences allow children to connect new information with meaningful contexts, thereby enhancing recall and retention. Overall, the findings highlight the potential of music-based pedagogical practices to support multiple dimensions of memory functioning in preschool education. By integrating repetition, movement, emotional engagement, and multisensory participation, musical activities may create learning environments that facilitate children's ability to encode, retain, and retrieve information effectively.

5. Discussion

The present study investigated preschool teachers' perceptions of the role of musical activities in supporting memory processes in early childhood education. The findings suggest that music-based activities are widely perceived as effective pedagogical tools that support multiple dimensions of cognitive development, particularly memory, attention, and emotional engagement. These results reinforce existing research highlighting the cognitive and educational value of musical engagement during the early years. One of the most significant findings of the study concerns the perceived role of repetition in strengthening memory processes. The majority of participants identified repetition as the most influential musical parameter supporting mnemonic functioning. This finding is consistent with cognitive theories of memory, which emphasise that repeated exposure to information enhances encoding and consolidation processes by reinforcing neural connections (Baddeley, 2000). In musical contexts, repetition is often embedded within rhythmic and melodic patterns, allowing children to internalise information through structured and predictable sequences. Another important finding relates to the role of movement and synchronisation in musical learning. Teachers emphasised the importance of motor participation in strengthening memory, suggesting that the combination of rhythm and bodily movement facilitates the memorisation and recall of information. This observation aligns with theories of embodied cognition, which propose that cognitive processes are closely linked to bodily experiences and sensorimotor interaction with the environment (Shapiro, 2019). In music education, activities such as clapping, dancing, and rhythmic movement may therefore contribute to memory development by connecting physical action with cognitive processing.

The findings also highlight the importance of emotional engagement in the learning process. Participants recognised that musical experiences often evoke emotional responses that enhance children's attention, motivation, and memory. Research in cognitive neuroscience supports this observation, demonstrating that emotional arousal

activates brain structures such as the amygdala and hippocampus, which play key roles in memory formation and consolidation (Immordino-Yang & Damasio, 2007; McGaugh, 2015). Consequently, emotionally meaningful musical experiences may facilitate stronger memory traces and more effective recall.

In addition to emotional involvement, multisensory engagement emerged as an important factor supporting mnemonic processes. Musical activities in preschool education often combine sound, movement, visual stimuli, and social interaction, creating complex learning environments that stimulate multiple sensory channels. According to multisensory learning theories, information processed through multiple modalities is more likely to be encoded and retained in memory (Shams & Seitz, 2008). This suggests that music-based learning may provide particularly favourable conditions for cognitive development during the early years.

The study also explored teachers' perceptions of the relationship between music and the three principal memory processes: encoding, retrieval, and consolidation. The majority of participants reported that musical activities contribute to all three processes simultaneously. This finding suggests that music functions as a holistic learning medium that supports different stages of memory processing. For example, repetition and melodic structure may facilitate encoding, while movement-based activities and rhythmic cues may assist retrieval. Similarly, emotionally engaging musical experiences may contribute to long-term consolidation of information.

These findings reinforce previous studies demonstrating the effectiveness of musical mnemonics and structured musical activities in educational settings (Thaut, 2005; Knott & Thaut, 2018). Music provides a structured framework that organises information into meaningful patterns, making it easier for learners to remember and retrieve content. In early childhood education, songs and rhythmic activities are frequently used to support the learning of numbers, language patterns, and daily routines, illustrating the practical application of music as a mnemonic device.

Despite these promising findings, it is important to acknowledge certain limitations of the present study. The sample consisted of a relatively small group of preschool teachers, which limits the generalisability of the results. In addition, the study focused on teachers' perceptions rather than direct observation of children's learning outcomes. Future research could therefore expand the scope of investigation by incorporating larger samples, experimental designs, or classroom observations in order to examine the direct effects of music-based interventions on children's cognitive development. Nevertheless, the study contributes to the growing body of research emphasising the pedagogical value of music in early childhood education. By identifying key musical parameters—such as repetition, rhythm, movement, emotional engagement, and multisensory stimulation—that support mnemonic processes, the findings provide useful insights for educators seeking to integrate music more effectively into teaching practices.

In conclusion, the results suggest that music-based activities can play a significant role in strengthening memory processes and supporting meaningful learning experiences

in early childhood education. The integration of structured musical activities into preschool curricula may therefore contribute not only to artistic development but also to broader cognitive and educational outcomes.

6. Conclusions and Educational Implications

The present study explored the role of musical activities in enhancing mnemonic processes in early childhood education, focusing on the perceptions of preschool teachers regarding the musical parameters that contribute to memory development. The findings indicate that music-based activities are widely recognised by educators as effective pedagogical tools that support cognitive development, attention, and memory processes in preschool children.

One of the central conclusions of the study is that music provides a structured and engaging learning environment that can strengthen multiple stages of memory functioning. Musical elements such as rhythm, melody, repetition, movement, and emotional expression appear to facilitate the processes of encoding, retrieval, and consolidation of information. Teachers participating in the study consistently emphasised the importance of repetition and movement-based activities, highlighting the role of embodied musical experiences in supporting children's learning.

The findings also demonstrate that music contributes to broader developmental domains within preschool education. Participants identified strong connections between music activities and emotional and social development, motor coordination, and creative expression. These results reinforce the view that music functions not only as an artistic discipline but also as an interdisciplinary pedagogical tool that supports holistic child development.

In addition, the study highlights the importance of multisensory learning environments in early childhood education. Musical activities often combine auditory stimuli with movement, visual elements, and social interaction, creating complex learning contexts that stimulate children's cognitive engagement. Such environments are particularly beneficial during the early years, when children's learning is strongly influenced by experiential and sensory-based interactions.

From an educational perspective, the results suggest that integrating music systematically into preschool curricula may contribute to more effective learning processes. Teachers can use musical activities strategically to support memory development by incorporating repetition, rhythmic patterns, imitation, and movement into daily classroom practices. Songs, rhythmic games, and movement-based activities may therefore function as practical mnemonic strategies that facilitate children's understanding and retention of information. At the same time, the study highlights the need for further research on the pedagogical applications of music in early childhood education. Future studies could examine the impact of specific music-based interventions on children's cognitive development through experimental or longitudinal research designs. Additionally, research involving larger samples and direct observation of

children's learning processes would provide deeper insights into the relationship between music, memory, and early learning.

Despite its limitations, the present study contributes to the growing body of literature emphasising the educational value of music in early childhood settings. By identifying key musical parameters that support mnemonic processes, the findings provide useful guidance for educators seeking to design more effective and engaging learning experiences for young children. Ultimately, the integration of music into early childhood education should be understood not only as a means of artistic expression but also as a powerful pedagogical approach that supports cognitive development, emotional engagement, and meaningful learning.

Conflict of Interest Statement
The authors declare no conflicts of interest.

About the Authors
Marianna Theodoropoulou is a preschool teacher. Her academic and professional interests focus on preschool pedagogy, particularly on the relationship between early learning environments, brain development, and young children's cognitive processes. She is especially interested in how educational practices, such as music and multisensory activities, can support memory, attention, and overall cognitive development during the early years.
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