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# *A Study on Personalized Intervention Strategies for Music Therapy in Children with Aphasia*

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***Abstract.*** This study aims to explore the impact of music therapy on children with aphasia. By clarifying the pathological mechanisms of childhood aphasia, applying clinical music therapy, and establishing personalized assessment systems and intervention strategies, 30 participants with consistent aphasia severity were divided into a control group and an experimental group. The control group received only conventional speech therapy alone, while the experimental group received adjunct music therapy. To evaluate the efficacy of music therapy for children with aphasia and its positive impact in daily life, the study used the CRRCAE rating scale was used to score both groups pre- and post-intervention. The results showed that the scores of the experimental group were significantly higher than those of the control group, confirming the objective and effective nature of music therapy for children with aphasia. Furthermore, music therapy is not limited to treating children with aphasia; it has been validated through extensive clinical research and experimental data in multiple areas, including neurorehabilitation support, mental health intervention, and pain management. Future research should focus on strengthening evidence-based medicine studies to promote the widespread practice and application of music therapy in public health systems

***Keywords:*** childhood aphasia, music therapy, experimental study, aphasia

## 1. Introduction

Research indicates that children around the age of 6 have largely matured language skills. Speech-language impairments emerging after this age—caused by brain injuries, central nervous system infections, or cerebrovascular malformations—are defined as childhood aphasia. Traditional speech therapy often overlooks the developmental need for multi-sensory training and psychological support during a child's development. Moreover, monotonous rehabilitation protocols frequently render it difficult for children to maintain focus during training. Therefore, integrating personalized assessment and intervention strategies with music therapy, using music that children enjoy for training and interaction, can effectively engage them and enhance their concentration. Music, as a universal language, can evoke emotional responses and resonance among people, bridging the gap between individuals. Additionally, this innovative approach can help patients with aphasia compensate for the functions of both hemispheres of the brain. By leveraging the artistic abilities of the right brain as a starting point for treating aphasia, it also exercises the language functions of the

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left brain, thereby promoting speech recovery. During music therapy, the relaxed atmosphere created by music helps to boost the child's enthusiasm, enhance their compliance, and improve their mood, confidence, and overall treatment outcomes.

## 2. Theories related to childhood aphasia and music therapy

### 2.1. Concept of childhood aphasia

Childhood aphasia is defined as an acquired language disorder caused by brain injuries (e.g., trauma, encephalitis, stroke), neurological developmental abnormalities, or cerebrovascular diseases [1]. The primary clinical manifestations include difficulties in language production, comprehension, and language organization. Childhood aphasia typically develops after the initial formation of language skills (around the age of two). Besides pathological aphasia, research indicates that psychological and environmental factors are also significant. Deprivation of a language-rich environment (such as a lack of communication opportunities), difficulty in adapting to environmental changes, or severe psychological trauma can exacerbate language disorders. Clinically, children with aphasia can be categorized into expressive aphasia and comprehensive aphasia. Expressive aphasia is characterized by verbal expression difficulties with preserved comprehension, whereas global aphasia involves comprehensive language dysfunction—encompassing severe deficits in expression, comprehension, reading, repetition, and writing [2]. This also imposes varying degrees of social and psychological pressure on the child. In recent years, with the increasing number of children affected by aphasia, research into its treatment has gained significant attention.

### 2.2. The mechanism of music therapy and its development process

As early as 4,000 years ago, ancient Egyptian records documented the use of music to treat ailments. Aristotle emphasized music's value in expressing emotions and for calming the mind and body, considering it a spiritual medicine. In the 'Xunzi: Music Theory' from the pre-Qin period in China, it is mentioned that ancient zither music has the effects of making the ears and eyes sharp and the blood and qi harmonious [3]. This shows that music can not only relax the body and mind and invigorate the spirit but also alleviate pain and promote the release of dopamine. Different pitches, rhythms, and frequencies influence the body through three mechanisms: neural resonance synchronization, cellular molecular resonance, and physiological rhythm regulation.

### 2.3. The influence and application of music therapy on children's aphasia

Brain imaging analysis shows that the left hemisphere is primarily responsible for language functions, while the right hemisphere is more involved in musical abilities. Consequently, many aphasic patients retain the ability to sing despite compromised linguistic communication. Research indicates that familiar music can be used to stimulate children's singing and humming, leveraging the shared neural network between language and singing to re-activate their language functions. This process facilitates left-hemispheric language restoration as a compensatory mechanism, rendering speech more coherent and fluent [4]. Music therapy seamlessly integrates these two aspects, helping patients return to normal levels. Additionally, since children with aphasia may have difficulty maintaining prolonged attention, the use of music's tempo and rhythm can effectively capture their attention. Compared to traditional treatments, music therapy, as a novel approach, is less monotonous and engaging. While treating aphasia, it also enhances patients' positive emotions,

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reduces fatigue, and refines their appreciation of music, which can improve their musical sensitivity and appreciation skills in the future.

## 3. Construction of personalized evaluation system

### 3.1. Evaluation indicators

Children with aphasia typically encounter four primary challenges: speaking, listening, reading, and writing. Therefore, the first step is to conduct a language function assessment, which involves evaluating their fluency in oral expression and their depth of understanding of spoken or written language. Aphasic children often exhibit characteristics such as soft speech, articulation difficulties, inadequate breath support, and reading-writing impairments [5]. Subsequently, assess the child's perception and response to music by evaluating their ability to judge volume or pitch, the accuracy of rhythm imitation, and the completeness of melody memory. Finally, observe changes in social engagement and emotional fluctuations. Music therapy can alleviate mood, reduce stress, and introduce positive affect into daily social interactions, thereby enhancing self-confidence. Additionally, note whether the child initiates conversations, responds to others, and regulates emotional exchanges during group activities.

### 3.2. Evaluation method

Based on the theories of behaviorism and cognitive neuroscience, an evaluation method using a stimulus-response model can effectively capture changes in the abilities of children with speech disorders. A two-dimensional assessment framework integrating language and music perception evaluations is recommended for aphasic children. For language assessment, therapists use tools like word cards and photos to guide children to describe content using questions such as “What is the tiger doing in the picture?” This process gradually enhances from basic noun recognition to more complex sentence expression, recording the child's current language ability stage and comparing it with the end of the treatment. Music perception assessment should be conducted in a well-lit and soundproof environment. Therapists first play different types of music, recording the child's emotional responses and subjective feelings. Subsequently, through activities such as drumming and piano playing, therapists guide the child to hum the melody rhythm, systematically assessing their ability to imitate music and connect it with language in the sequence of 'vowel-vowel plus consonant-simple word group/sentence.

### 3.3. Evaluation process

At the initial consultation, gather essential information about the child and their guardian, including the child's medical history (onset time, etiology, treatment history), family language environment, and educational background. Prepare relevant standardized tools (e.g., PLS, CRRCAE) and auxiliary tools (word cards, picture cards, recording devices, etc.). However, standardized tools have certain limitations and applicability. For example, PLS-5 (Preschool Language Scale-5) is suitable for assessing the language abilities of children aged 3-6, but it may have evaluation biases for children with severe aphasia. Finally, prepare auxiliary tools (word cards, picture cards, recording devices, etc.) and keep detailed records for future reference. Schedule assessments according to aphasia severity, with tasks escalating systematically in complexity. Post-treatment, assign practice exercises and adjust subsequent assessment difficulty based on task completion. Conduct a final summary assessment, comparing the child's initial aphasia severity with the quantified indicators at

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the end of the treatment period to analyze changes. Use the functional communication scale to evaluate the child's ability to apply communication skills in daily situations. It is recommended to maintain a long-term training plan with parental cooperation to prevent functional decline, such as organizing regular parent training sessions to teach home-based rehabilitation techniques, establishing a feedback mechanism for parents, encouraging them to record the child's performance in the home environment, and promptly communicating with therapists to adjust the training plan.

## 4. Personalized intervention strategies

### 4.1. Experimental preparation

This study enrolled 30 children with aphasia aged 3 to 10 years, with an average age of 6.28 ± 1.73 years. To ensure the accuracy and objectivity of the experiment, all participants underwent hospital-based diagnosis to confirm consistent aphasia severity levels. They were randomized into a control group of 15 and an experimental group of 15, with only the experimental group receiving music therapy. Both groups received routine nutritional supplements, physical therapy, and standard language therapy training. The standard language therapy training included auditory training, pronunciation training, reading training, and writing training. Pronunciation and phonetic discrimination training were conducted systematically [6]. During training, the children were guided to repeatedly practice lip movements in front of a mirror. Additionally, children were taught to differentiate between correct/incorrect syllables and master phoneme production to avoid confusion. Language function of the children in both groups was assessed using the CRRCAE (Chinese Standard Aphasia Examination) before and after the experiment. The examination included 30 test items, covering nine core areas such as oral expression, reading comprehension, oral repetition, and writing, using a six-level scoring system, with higher scores indicating better performance.

### 4.2. Experimental group

Prior to the experiment, children's music preferences were collected. During treatment, therapist quickly captured the children's attention by playing the piano and tapping the drum, creating a relaxed and pleasant atmosphere that gradually engaged the children with the lyrics and melodies. Starting with simple breathing exercises, activities like candle-blowing and paper-strip blowing helped children sense airflow production [7]. Therapists then incorporated breathing rhythm patterns, such as one long breath followed by one short, two long followed by three short, or continuous short breaths, while encouraging the children to practice abdominal breathing to master the technique. Next, phonetic training was conducted using interesting methods to encourage the children to speak, such as using animal sounds to guide them. For example, if asked 'How does a frog croak,' the child would respond with 'Quack quack quack,' accompanied by jumping actions to engage their physical functions. In the initial treatment stage, therapists began with familiar melody segments, such as 'Twinkle, Twinkle, Little Star' and 'Half a Moon Climbs Up,' and had the children point out cards featuring the moon or stars [8]. The therapist then hummed the melody without words, using consonants to replace the lyrics, guiding the children to pronounce the words while gradually increasing the volume. To ensure active participation from each child, the therapist organized activities in groups, using musical instruments to play nursery rhymes and leading the children in choral singing, incorporating stomping, clapping, and dancing for multi-sensory training [9]. This approach aimed to stimulate every cell in the children's bodies and unlock their potential. To make treatment more enjoyable and engaging, the focus is on enhancing the patient's

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concentration and overall abilities. In intensive training phases, children were expected to hum melodies, repeat lyrics, and express emotions. Training sessions are held five times a week, each session lasting 40 minutes, for a total of seven weeks. After the therapist assigns post-class exercises, the guardian records the patient's performance, and the therapist evaluates and adjusts the training intensity accordingly.

## 5. Results

The experimental results showed that in the first two weeks, there was no significant difference between the control group and the experimental group of children[10]. Both groups could only produce single syllables or phrases like 'eat,' 'drink,' and 'go.' Starting from the third week, the experimental group scored slightly higher than the control group. In articulation training, the experimental group maintained phonation for 7-10 seconds on average while the control group maintained it for about 5 seconds. By the fourth week, the scores were significantly higher than those of the control group. For familiar melodies, the experimental group could now perform simple word-filling and melody humming, with a noticeable increase in volume. In daily communication, experimental group children showed greater liveliness and positivity. By the seventh week, children who received a combination of conventional therapy and music therapy showed significant improvement in language recovery. Their speech fluency had largely returned to normal, and their abilities in listening, speaking, reading, and writing had significantly improved. They could also appropriately incorporate their own emotions into singing. In contrast, the control group, which only received conventional speech therapy, remained relatively rigid. Although daily communication skills recovered substantially, speech intonation remained mechanical and emotionless. Additionally, experimental group children exhibited more natural liveliness in daily life, with richer body language expressions [11] This experiment demonstrated that music therapy is an easily accepted and beloved treatment for children with aphasia. The same music can evoke different feelings in different individuals, and the personalized intervention strategy tailored to the preferences of the children made the treatment more relaxed and enjoyable. The addition of multi-sensory system training did not overlook the essential training for children during their growth stages, achieving a balance between diversification and the healthy development of both mind and body.

## 6. Conclusion

This study underscores that the allure of music extends beyond enhancing our aesthetic appreciation and enhancing life satisfaction. It also positively impacts physical and mental health. Music therapy is evolving from a supplementary treatment to a mainstream medical approach. Numerous clinical studies have shown that music therapy can effectively improve individuals' physical and psychological conditions. It has proven particularly effective in treating mental disorders such as depression, anxiety, and post-traumatic stress disorder (PTSD), neurological rehabilitation, and pain management. Diverse frequencies, volumes, and tones effectively alleviate symptoms across etiological contexts. Different frequencies, volumes, and tones can effectively alleviate symptoms caused by various factors. The effectiveness and functionality of music therapy have been validated through multiple dimensions, including psychology and neuroscience. Moving forward, it is crucial to strengthen evidence-based medical research, enhance interdisciplinary collaboration, and appropriately integrate AI to promote the development of music therapy across various fields. This will address the needs of diverse populations while reducing the social and medical burden.

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