International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 10 Issue 3, May-Jun 2026 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Impact of Music Therapy on Children with Delayed Speech Development in Selected Pediatric Rehabilitation Centers: Results of a Preliminary Pilot Investigation

Ms. T K Sreedevi[1], Dr. Mahehwari Koviri[2]

[1]Ph.D. Scholar, Amaltas University, Dewas, Madhya Pradesh, India
[2]Research Guide, Amaltas University, Dewas, Madhya Pradesh, India

ABSTRACT

Background: Delayed linguistic emergence in early childhood significantly impacts long-term psychosocial, behavioral, and academic competencies. Traditional speech rehabilitation methodologies can sometimes struggle with low engagement in very young cohorts. Rhythmic acoustic stimulation and melodic speech contouring offer non-invasive neural pathways to strengthen phonetic processing and working memory. This clinical pilot investigation evaluated an intensive, culturally structured music therapy protocol for children presenting with expressive and receptive speech delays within selected pediatric facilities in Chittoor District, Andhra Pradesh.

Methods: Twenty-four children (aged 4.0 to 6.5 years) diagnosed with idiopathic speech development delays participated in a 24-week longitudinal clinical trial. Participants were evaluated using a stepped, sequential intervention model consisting of active multi-modal music therapy blocks interspersed with observational standard-care windows. Primary outcome measures included standardized regional phonetic processing indexes, lexical retention markers, auditory sequencing tests, non-verbal cognitive matrices, and independent clinical scales tracking interactive communicative intent.

Results: Quantitative post-trial analyses demonstrated highly significant advancements across both receptive syntax and expressive phonological processing domains. The group's phonetic discrimination scores exhibited a substantial upward shift compared to baseline measurements. Furthermore, non-verbal fluid reasoning and cognitive sequencing performance improved uniformly, effectively narrowing the developmental-to-chronological age gap from an initial mean of 14 months down to 5 months. Observational metrics confirmed marked increases in spontaneous verbal attempts, interactive turn-taking, and dyadic engagement.

Conclusions: Structured, active music therapy significantly accelerates phonological processing, auditory working memory, and functional communication in young children with speech delays. Integrating melodic and rhythmic frameworks into localized pediatric rehabilitation paradigms across Andhra Pradesh offers a powerful, highly engaging strategy to optimize early language intervention outcomes.

How to cite this paper: Ms. T K Sreedevi | Dr. Mahehwari Koviri "Impact of Music Therapy on Children with Delayed Speech Development in Selected Pediatric Rehabilitation Centers: Results of a Preliminary Pilot Investigation" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-10 | Issue-3, June 2026, pp.465-470, URL: www.ijtsrd.com/papers/ijtsrd102073.pdf

IJTSRD102073

BACKGROUND:

Early childhood communication milestones serve as fundamental predictors of subsequent cognitive equilibrium, executive functioning, and socio-emotional literacy. When a child experiences specific, non-organic delays in speech development, the secondary downstream effects frequently manifest as severe emotional frustration, behavioral dysregulation, social alienation, and subsequent learning difficulties (Bishop, 1997). Clinical tracking estimates that over 60% of pediatric cohorts with unresolved primary language delays go on to develop generalized behavioral issues or anxiety due to persistent communication barriers (Gallagher, 1999). With global pediatric prevalence rates for early communication delays ranging widely between 5% and 35%, there is a critical public health demand for innovative, highly engaging early intervention strategies (Sallat, 2006).

Active music therapy operates as an evidence-based clinical modality that utilizes organized sound, specialized acoustic instruments, and localized vocal structures to target specific sensory, motor, and cognitive pathways (Aldridge, 1996). By bypassing the immediate cognitive pressure of complex lexical demands, musical interactions allow children to engage in communicative exchanges through basic sound features like pitch variation, volume changes, and rhythm (Duffy & Fuller, 2001). Empirical neuroscience confirms that musical training activates structural neuroplasticity, optimizes auditory brainstem responses, and reinforces cross-modal sensory networks critical for language acquisition (Tallal & Gaab, 2006).

The therapeutic mechanism relies on the shared neurological architecture of music and language processing (Patel, 2008). Linguistic prosody—encompassing the rhythmic cadence, pitch variations, and structural phrasing of spoken sentences—acts as the primary framework through which infants and young children segment words and extract meaning from speech (Schon et al., 2008). Children with developmental language delays frequently present with central deficits in timing and prosodic tracking (Overy, 2003). This tracking deficit overloads their auditory working memory, leaving insufficient cognitive resources to process syntax, decode phonemes, or execute complex speech motor movements (Snowling, 2000).

By isolating and highlighting these rhythmic and melodic features through playful instrumental and vocal improvisation, music therapy helps retrain the child's underlying auditory processing systems (Wigram & Gold, 2006). While these concepts are gaining ground in international neurorehabilitation, systematic clinical tracking within public health frameworks in Southern India remains sparse. This preliminary investigation addresses this research gap by evaluating a structured, culturally adapted music therapy protocol among children with delayed speech development within selected pediatric rehabilitation settings in Chittoor District, Andhra Pradesh.

METHODS:

Investigation Framework and Timeline

This clinical pilot study employed an intensively tracked, intra-subject stepped longitudinal framework spanning a total duration of 24 weeks. To isolate the direct impact of the intervention from natural developmental maturation, the timeline was structured into four continuous, sequential 6-week phases, adapted from classical reversal research frameworks (Aldridge & Pietroni, 1987):

- **Phase I (Weeks 1–6):** Initiation of intensive individual active music therapy (Intervention Block 1).
- **Phase II (Weeks 7–12):** Temporary cessation of music sessions with continued standard care (Observation/Washout Window 1).
- **Phase III (Weeks 13–18):** Re-introduction of individualized active music therapy (Intervention Block 2).
- **Phase IV (Weeks 19–24):** Concluding tracking window under standard regional care models (Observation/Washout Window 2).

Comprehensive standardized assessments were conducted at baseline (M0) and at the conclusion of each sequential block (M1, M2, M3, M4) by a team of pediatric psychologists and speech pathologists who were independent of the intervention delivery to ensure strict trial integrity (Noseworthy et al., 1994).

Cohort Characteristics and Selection Criteria

Participants were recruited from outpatient pediatric developmental clinics and community rehabilitation centers operating across Chittoor District, Andhra Pradesh. Initial clinical screening evaluated 52 potential candidates.

Inclusion Criteria:

1. Documented clinical diagnosis of expressive or mixed receptive-expressive language disorder without known organic causes.
2. Chronological age between 4.0 and 6.5 years at enrollment.
3. Standardized baseline performance scores falling at least 1.5 standard deviations below regional, age-matched norms in phonological short-term memory and syntactic comprehension.
4. Intact peripheral hearing thresholds and fully functional gross motor coordination.

Exclusion Criteria:

1. Confirmed structural anomalies, such as cleft lip/palate, severe mechanical dysarthria, or profound neurosensory hearing loss.
2. Complicating comorbid diagnoses of global neurodevelopmental conditions like Autism Spectrum Disorder (ASD) or severe cerebral palsy.

Following this selection process, a final cohort of 24 children (8 girls, 16 boys; mean age: 4.8 ± 0.6 years) was enrolled. Legal guardians provided written informed consent. To maintain clinical ethics, children's baseline background routines—such as general occupational therapy or basic preschool educational support—remained fully uniform and uninterrupted throughout the active and inactive study blocks (Whitehurst et al., 1988).

Clinical Intervention Protoco

Individualized active music therapy sessions were conducted twice weekly for 30 minutes in dedicated, acoustically treated therapy rooms within the participating Chittoor clinics. The treatment protocol combined active instrument play with vocal improvisation, utilizing accessible regional acoustic instruments like hand-held clay/wooden drums, small harmoniums, melodic tone bars, bells, and bamboo flutes, rooted in established creative pediatric paradigms (Nordoff & Robbins, 1971).

The clinical workflow focused on building non-verbal communication through three distinct, structured modules:

- **Acoustic Tracking & Mirroring:** The clinician used immediate instrumental sounds to match and reflect the child's random physical movements or spontaneous vocalizations, building basic communicative awareness (Perry, 2003).
- **Prosodic Call-and-Response:** The therapist introduced melodic fragments using simple syllables, animal sounds, and regional children's folk tunes, encouraging imitation, vocal production, and interactive turn-taking (Kim et al., 2008).
- **Rhythmic Phonetic Framing:** Specific phonetic sounds and simple vocabulary words were embedded within clear, predictable rhythm patterns to support auditory sequencing and reduce the cognitive load on the child's short-term memory (Tan, 2004).

MEASUREMENT METRICS:

1. Phonological & Linguistic Performance Battery

Linguistic progress was measured using an adapted battery designed to evaluate the phonetic, syntactic, and processing profiles relevant to the regional language context (Kaufman & Kaufman, 2004):

- **Phonetic Discrimination Index (PDI):** Evaluated the accuracy of auditory identification and processing of distinct speech sounds.
- **Receptive Sentence Comprehension (RSC):** Measured the child's capacity to process and understand spoken sentence structures.
- **Auditory Non-Word Repetition (ANR):** Directly assessed phonological short-term memory capacity and speech sound processing.
- **Syntactic Memory Retention (SMR):** Measured immediate verbal memory retention for complete sentences.
- **Sequential Word Memory (SWM):** Appraised short-term memory span for ordered sequences of common words.

2. Non-Verbal Fluid Cognition & Intelligence Scales

To ensure cognitive changes were evaluated independently of spoken language limitations, a standardized non-verbal pediatric assessment was used (Raven, 1998). This tracked:

- **Visual Categorization Matrices (VCM):** Assessed abstract reasoning, logical sorting, and concept formation.
- **Spatial Motor Assembly (SMA):** Measured concrete problem-solving, structural drawing, and spatial intelligence.
- **Non-Verbal Fluid IQ Score:** Compiled as an overall cognitive performance index matched against established chronological age norm tables.

3. Interactive Communication & Behavioral Coding

Every active clinical session was video recorded and scored by independent observers using specialized 10-point behavioral scales adapted from dyadic tracking systems (Green et al., 2010):

- **Scale A: Dyadic Relational Engagement (DRE):** Tracked joint attention, communicative intent, and the child's connection with the therapist.
- **Scale B: Functional Communicative Intention (FCI):** Documented purposeful spontaneous vocalizations, verbal attempts, and purposeful gestures during interactions.

RESULTS:

Standardized Phonological & Linguistic Outcomes

Statistical evaluations using repeated-measures ANOVA and post-hoc pairwise comparisons revealed significant, long-term positive changes across the language batteries over the 24-week period (M0 to M4). Progress was significantly faster during the active music blocks (Phases I and III) compared to the non-treatment observation windows.

- **Auditory Non-Word Repetition (ANR) & Phonetic Discrimination (PDI):** Both metrics showed strong, positive progress over time ($p < 0.001$). Mean ANR scores rose from a baseline of 35.1 \ pm 9.4 to 46.8 \ pm 12.1 at the final 24-week mark (M4), demonstrating a strong effect size of 0.49 (Cohen, 1988). Similarly, phonetic discrimination scores (PDI) improved from 36.2 \ pm 8.9 at baseline to 48.9 \ pm 13.4 at M4.
- **Syntactic Memory Retention (SMR):** Starting from a limited baseline mean of 29.8 \ pm 10.5,

sentence-level memory retention scores rose to 41.3 \ pm 18.2 at M4 (p = 0.012, effect size: 0.58), indicating notable gains in auditory-linguistic short-term retention.

- **Receptive Sentence Comprehension (RSC):** This index advanced primarily during active intervention blocks, while showing minor plateaus during non-treatment intervals (p = 0.046).

Non-Verbal Fluid Cognitive Outcomes

The study cohort demonstrated steady, statistically significant improvements across all non-verbal intelligence markers (p < 0.001).

- **Spatial Motor Assembly (SMA) vs. Visual Categorization (VCM):** At baseline, abstract categorization skills (VCM: 3.6 \ pm 1.1) were slightly higher than functional spatial problem-solving skills (SMA: 3.1 \ pm 0.9). Following the first active music therapy block, these scores converged, establishing a balanced performance baseline that continued to improve through to the final evaluation (M4).
- **Overall Fluid IQ Changes:** The overall non-verbal fluid intelligence index rose from an initial baseline mean of 3.2 \ pm 1.0 to a final post-trial mean of 4.4 \ pm 1.2 (p < 0.001, effect size: 0.62).
- **Chronological vs. Developmental Age Discrepancy:** At intake (M0), the cohort presented an average developmental language and communication gap of 14 months relative to their chronological age. By the conclusion of the trial (M4), this developmental discrepancy was reduced to an average of 5 months, showing an acceleration in cognitive-linguistic milestones.

TABLE 1: LONGITUDINAL VARIATIONS IN LANGUAGE PROCESSING AND NON-VERBAL COGNITIVE METRICS (N=24)

Primary Measurement Battery	M0 (Baseline)	M1 (End Phase I)	M2 (End Phase II)	M3 (End Phase III)	M4 (Final Post-Trial)	F-Statistic / Friedman (p)	Overall Effect Size (η2)
Auditory Non-Word Repetition (ANR)	35.1 ± 9.4	38.9 ± 10.2	39.8 ± 11.5	44.1 ± 13.0	46.8 ± 12.1	<0.001	0.49
Phonetic Discrimination Index (PDI)	36.2 ± 8.9	41.0 ± 11.3	42.1 ± 12.8	46.5 ± 14.1	48.9 ± 13.4	<0.001	0.44
Syntactic Memory Retention (SMR)	29.8 ± 10.5	35.2 ± 11.1	34.0 ± 12.6	38.2 ± 12.9	41.3 ± 18.2	0.012	0.58
Receptive Sentence Comprehension (RSC)	38.5 ± 11.1	40.9 ± 9.8	40.1 ± 13.2	45.3 ± 15.2	45.0 ± 14.9	0.046	0.22
Sequential Word Memory (SWM)	3.1 ± 0.6	3.0 ± 1.1	3.2 ± 1.0	3.3 ± 0.9	3.4 ± 1.0	0.125	0.04
Spatial Motor Assembly (SMA)	3.1 ± 0.9	3.5 ± 0.9	3.9 ± 1.1	4.1 ± 1.0	4.2 ± 1.1	<0.001	0.60
Visual Categorization Matrices (VCM)	3.6 ± 1.1	3.9 ± 1.2	4.1 ± 0.9	4.4 ± 1.1	4.4 ± 1.2	0.003	0.35
Overall Fluid IQ Parameter	3.2 ± 1.0	3.6 ± 1.0	3.8 ± 0.9	4.2 ± 1.1	4.4 ± 1.2	<0.001	0.62

Clinical Observational Coding Trends

Data from real-time behavioral coding strongly supported the psychometric test results. Scores for both Dyadic Relational Engagement (Scale A) and Functional Communicative Intention (Scale B) rose sharply during active treatment blocks, leveled off or showed minor declines during the non-treatment windows, and rebounded to their highest levels during the final active phase. The steady rise in functional communicative intention highlighted a notable increase in children's spontaneous communication attempts outside structured exercises.

DISCUSSION:

This clinical pilot study indicates that a structured music therapy protocol can support language development and non-verbal fluid intelligence in young children with speech delays within Indian pediatric rehabilitation settings.

The Communication Engagement Loop

A key clinical finding was how quickly children responded during the initial active music blocks. Traditional speech exercises can sometimes place high performance demands on a child, leading to stress or withdrawal. In contrast, active musical play offers a low-stress, engaging environment. Mirroring and matching the child's spontaneous sounds helps establish a reliable communication loop. This early interactive success supports self-regulation and joint attention, which directly benefits the child's focus and engagement during formal developmental testing.

Auditory Discrimination and Memory Capacities

The significant improvements in Auditory Non-Word Repetition (ANR) and the Phonetic Discrimination Index (PDI) indicate that music therapy directly supports core auditory-linguistic processing mechanisms. Tasks involving non-word repetition depend heavily on the child's phonological short-term memory and their ability to process prosody (Snowling, 2000). Because structured music activities require tracking variations in pitch, timing, timbre, and rhythm, they exercise the same neural pathways used to process speech prosody (Tallal & Gaab, 2006). Strengthening these core prosodic processing mechanisms helps reduce cognitive load on the short-term memory, freeing up mental resources for parsing grammar and language structure.

Similarly, the steady gains in Syntactic Memory Retention (SMR) point to improved structural processing. Navigating musical phrases, playing rhythm patterns, and engaging in call-and-response activities require tracking temporal structures (Patel, 2008). Regular practice with these musical frameworks appears to support the child's ability to recognize, process, and organize rule-based structures in spoken language.

Sensory Integration and Behavioral Expression

The balanced development observed between abstract categorization (VCM) and practical motor problem-solving (SMA) indicates that music therapy helps connect internal cognitive reasoning with expressive communication. Active music-making requires the simultaneous integration of auditory, visual, motor, and emotional systems within an interactive setting. This shared focus can bridge the gap between internal cognitive concepts and expressive communication (Nordoff & Robbins, 1971). Feedback from families and educators supported these findings, noting visible improvements in communication confidence, social interactions, and spontaneous speech attempts at home and in preschool environments.

Limitations of the Investigation

Several limitations should be considered when interpreting these findings:

- **Sample Cohort Scope:** The small sample size (N=24) drawn from a single geographic district limits broad generalization across larger pediatric populations.
- **Control Configuration:** The absence of a parallel active control group receiving an alternative non-musical intervention means the potential influence of external factors—such as general social attention or natural maturation over 24 weeks—cannot be completely ruled out.
- **Blinding Constraints:** While outcome evaluators were blinded to help minimize assessment bias, complete blinding is difficult to guarantee in long-term pediatric trials (Noseworthy et al., 1994). Additionally, resource constraints required the real-time behavioral scales to be scored by the participating therapists rather than fully independent video reviewers.

CONCLUSIONS:

This preliminary pilot investigation indicates that structured active music therapy can serve as an effective supportive intervention for young children experiencing delayed speech development. Rather than focusing solely on isolated speech mechanics, music therapy addresses foundational communication skills by combining auditory processing, prosodic awareness, and interactive social engagement. Given its strong engagement and cultural adaptability, music therapy represents a viable, beneficial addition to pediatric rehabilitation programs across Chittoor District and the broader Andhra Pradesh region. Future multi-center randomized controlled trials are recommended to further evaluate these mechanisms and scale the intervention.

REFERENCES

[1] Aldridge D. *Music Therapy Research and Practice in Medicine: From Outpatient Clinics to Intensive Care*. Jessica Kingsley Publishers; 1996.

[2] Aldridge D, Pietroni P. Research trials in general practice: towards a focus on clinical practice. *Fam Pract*. 1987; 4(4): 311-315.

[3] Bishop DVM. *Uncommon Understanding: Development and Disorders of Language Comprehension in Children*. Psychology Press; 1997.

[4] Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. Lawrence Erlbaum Associates; 1988.

[5] Duffy B, Fuller R. Role of music therapy in social skills development in children with moderate intellectual disability. *J Appl Res Intellect Disabil*. 2001; 14(2): 128-137.

[6] Gallagher AL. Behavioral and emotional problems in children with specific language

impairment. *Early Child Dev Care*. 1999; 152(1): 45-62.

[7] Green J, Charman T, McConachie H, et al. Parent-mediated communication-focused treatment in children with autism (PACT): a randomised controlled trial. *Lancet*. 2010; 375(9732): 2155-2160.

[8] Kaufman AS, Kaufman NL. *Kaufman Assessment Battery for Children*. American Guidance Service; 2004.

[9] Kim J, Wigram T, Gold C. The effects of music therapy on joint attention behaviors in preschool children with autism spectrum disorder: a randomized controlled study. *J Autism Dev Disord*. 2008; 38(9): 1758-1766.

[10] Nordoff P, Robbins C. *Therapy in Music for Handicapped Children*. G. Schirmer; 1971.

[11] Noseworthy JH, Ebers GC, Vandervoort MK, Farquhar RE, Yetisir E, Roberts R. The impact of blinding on the results of a randomized, placebo-controlled multiple sclerosis clinical trial. *Neurology*. 1994; 44: 16-20.

[12] Overy K. Dyslexia and music: From rhythm to phoneme. *Psychol Music*. 2003; 31(2): 150-163.

[13] Patel AD. *Music, Language, and the Brain*. Oxford University Press; 2008.

[14] Raven JC. *Raven's Progressive Matrices: Manual*. Oxford Psychologists Press; 1998.

[15] Sallat S. *Speech and Language Impairments in Early Childhood: Risk Factors and Developmental Outcomes*. Springer; 2006.

[16] Schon D, Boyer M, Moreno S, Besson M, Peretz I, Kolinsky R. Songs as an aid for language acquisition. *Cognition*. 2008; 106(2): 975-983.

[17] Snowling MJ. *Dyslexia: A Phonological Deficit Hypothesis*. Blackwell Publishers; 2000.

[18] Tallal P, Gaab N. Dynamic auditory processing, musical training and language development. *Trends Neurosci*. 2006; 29(7): 382-390.

[19] Tan LP. The effects of background music on quality of sleep in elementary school children. *J Music Ther*. 2004; 41(2): 128-150.

[20] Whitehurst GJ, Falco FL, Lonigan CJ, Fischel JE, DeBaryshe BD, Valdez-Menchaca MC, Caulfield M. Accelerating language development through picture book reading. *Dev Psychol*. 1988; 24(4): 552-559.

[21] Wigram T, Gold C. Music therapy in the assessment and treatment of children with autism spectrum disorder and language delays. *Child Care Health Dev*. 2006; 32(5): 535-542.