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Indian Classical Music Therapy for Pervasive Developmental Disorder: A Case Study

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Abstract: Music therapy is transitioning from a social science model that focuses on overall health and well-being to a neuroscientific research field that focuses on addressing motor, cognitive, language, emotional and social deficits in people with neurological disorders. As music therapy in India is nascent and still evolving, there is a need at this stage to make use of the rich musical resources to develop culturally sensitive approaches, techniques, or methods adaptable to clinical applications. The current case report of Rahul, 29 years, diagnosed with Pervasive Developmental Disorder, delineates the benefits of structured Indian classical music intervention towards various cognitive goals, sensory goals, communication goals, improved physical and emotional response, behavior improvement, social cognition, and musical goals. Music therapy assessment and multi-modal problem analysis help identify significant strengths, potentials and resources, which may not be apparent in other formalized assessments. Thus, it can facilitate the development of a systematic method for measuring response to therapy.

INTRODUCTION

There has been an increasing interest and acceptance of traditional music, such as Indian classical music, in evidence-based research in music therapy. Indian Classical music with its complex structure of the *saptasvaras* (notes), form, *Śruti* (pitch perception and processing), *laya* (the tempo or rhythm), *rāga* (melodic frameworks), *tāla* (rhythmic cycle of beats), and the fragrance of the rāgas pervading through emotions or *rasas* can be effective with children and adults with neurodiverse needs. Each of these elements can be broken into its unique patterns and frameworks within the massive construction of Indian classical music to generate a positive outcome (Bhat, 2021). Improvements in mental strength, range of motion, balance, communication, cognition, and socialization are among the possible combined goals (Paul, 2000). Through the component of emotional intelligence, music can help in alleviating various anxiety disorders (Bhat, 2021). Autism Spectrum Disorder is characterized by a wide range of severity in symptoms in three fundamental areas: social interaction, restricted interests/repetitive behavior and language (Mehta, 2013). Pervasive Developmental Disorder (PDD-NOS) is included as an autism spectrum disorder in the DSM V[1], and the present case report explores how structured music intervention can help achieve non-musical goals like enhancing self-esteem, developing coping skills, facilitating verbal and non-verbal communication, building social relationships, and enhancing receptive and expressive communication through a multimodal approach.

[1] The fifth edition of the American Psychiatric Association's Diagnostic and Statistical Manual, DSM-5, redefined autism. With the DSM-5, what was previously included in the DSM-IV-TR now becomes autism spectrum disorder. In the DSM-5, Asperger's Disorder, Rett's Disorder, Childhood Disintegrative Disorder, and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) become autism spectrum disorders. (PEKD, 2012) Furthermore, the DSM-5 also reduces social-related characteristics of autism to social communication impairment and repetitive/restricted behavior, although terms such as Asperger's and PDD-NOS are still commonly used. (Kefalas)(PEKD-2012)

Music is an essential topic for cognitive science research for three reasons. Primarily, music is increasingly recognized as a universal human trait, playing a key role in a range of everyday activities and life stages. Second, music plays a crucial role in both ontogenetic development and human evolution (especially concerning language). Third, from the perspective of studying the human mind, music operates on the perceptual, cognitive, and emotional levels simultaneously, making it an ideal object for understanding domain-general temporal and emotional processing, as well as motor activities and interactions (Pearce, 2012). Musical engagement (active/ passive) enables a host of cognitive functions. For instance, music engages sensory processes, attention, memory-related processes, perception-action mediation ("mirror neuron system" activity), multisensory integration, activity changes in core areas of emotional processing, processing of musical syntax, musical meaning, and social cognition (Koelsch, 2009). While many neurotypical children develop language and communication naturally, those with neurological disorders often have difficulty learning and using language. For instance, children with Autism or associated conditions may find it difficult to communicate similarly to typically developing children. They may communicate using non-verbal means or use language in unusual ways or behave differently due to sensory processing challenges, sensory overload, auditory problems, cognitive deficits, comprehension problems, or poor social-emotional reciprocity.

Several studies have found music therapy useful in treating people with disabilities of all types, but it is particularly effective with children, adolescents, and adults with autism. Autism inclusion is a prominent strategy and students with autism are frequently integrated into non-traditional classrooms, such as music classes (Duvall, 2020). Howard Gardner, an American developmental psychologist who propounded the Theory of Multiple Intelligences in his book "Frames of Mind," laid down a fine perspective, contrary to traditional psychological theories and other conventional methods of measuring the intelligence factor in neurodivergent children. Gardner's notion of intelligence as pluralistic emerged from his observation that individuals who demonstrated substantial talent as diverse as chess, music, athletics, politics, and entrepreneurship had capacities in these domains that should be taken into account when conceptualizing intelligence (Seider, 2011). In Gardner's view, we have a range of intellectual capacities, including musical intelligence, bodily-kinaesthetic intelligence, interpersonal intelligence, intrapersonal intelligence, spatial-visual intelligence, verbal-linguistic intelligence, and logical-mathematical intelligence. The good news is that musical intelligence is so powerful that it can enable all other seven types of intelligence to be developed simultaneously by learning an instrument and studying the arts (Gardner, 1999). Gardner mentions several criteria for determining intelligence, such as in autistic savants, stroke victims, and other exceptional populations. Accordingly, certain individuals exhibit unusually high or low levels of a particular capacity in comparison to others (Gardner, 1999). This criterion provides a solid foundation for people with neuro-diverse needs to explore dimensions in music to stimulate their multi-senses and engage themselves in education beyond academics while focusing on their specific interest areas and working toward meaningful goals. Interestingly enough, music education has found that abilities, which develop in music education and music intervention, are transferrable to other domains (Hallam, 2010). Thus, involvement with music is measurable in terms of social benefits. More precisely, the cultivation of musical behavior plays a major role in adolescent and adulthood adjustment and well-being as an indicator of broader socio-emotional communication abilities.

Unlike any other art form, music evokes deep emotions (Sanivarapu, 2015). Plato believed that different music modes would evoke different emotions, and many would agree that major and minor chords are perceived differently depending on the mode; e.g., in music, major chords are perceived as pleasant, whereas minor chords are pathos (Trimble & Hesdorffer, 2017). We cannot indulge in music without feeling joy, happiness, love, tenderness, humor, compassion, and so on and when we allow these emotions to be a part of our learning and delivering process, our interventions become richer and more meaningful having an everlasting impact in our lives. In Classical Indian aesthetic vocabulary, the emotive presence in Indian rāgas (melodies) is referred to as '*rasa*'. It defines the essential flavor of vocal music, instrumental music, and performing arts which help us easily connect to a range of responses and effects like a startling effect, emotional contagion, positive feeling, or surprise effect. Śṛṅgāra (love/joy), Hāsya (humour), Kāruṇya (compassion), Raudra (anger), Veera(valour), Bhayānaka (terror/fear), Bībhatsa (disgust/frustration), Adbhuta (surprise/wonder) and Śānta (peace or tranquillity) are the Navarasas or nine emotions evoked by classical rāgas. Positive rasas like Śṛṅgāra, Kāruṇya, Veera, Śānta, and Adbutha help us easily connect to a neuro-diverse child and invoke a response, based on the child's current state of mind, situation, and adaptation.

Another factor to consider is the pace/ tempo or movement/ rate of change in time; faster music can be happier, whereas slower music can be less so.

The experience of listening to music or learning to play a musical instrument is multi-sensory. Instrumental learning requires certain skills; reading musical notation through a complex symbolic system, translating it into sequential, bimanual motor activity dependent on multisensory feedback; developing fine motor skills coupled with metric precision; memorizing long musical passages; and improvising within given musical parameters are some of them (Miendlarzewska, & Trost, 2014) Unlike most other motor activities, music performance necessitates the precise timing of several hierarchically organized actions as well as control over pitch interval production (Zatorre, 2005). Music Therapists (MTs) can help clients set goals to improve cognitive functioning, memory skills, word retrieval, motor skills, emotional and affective development, recalling memories and events from the past, improving behaviour and social skills, and developing interpersonal and intrapersonal skills, all of which can lead to greater acceptance. When it comes to music therapy, musical preferences, music listening patterns, and musical selection are crucial (Kopacz, 2005). As a result, a music therapist must devise a reliable method for determining such preferences (Standley, 1996).

In developing Music Therapy-specific treatment models, Music Therapists (MTs) draw on a variety of non-music-based therapy methods. Many widely used Music Therapy (MT) techniques are based on psychological theories and treatment models. An intriguing link that has received less attention in the Indian context is that between music therapy and cognitive behaviour therapy. Cognitive-behavior therapy (CBT), is a type of psychotherapy that teaches people to recognize and modify harmful or troubling thought patterns that cause their behavior and emotions to change (Hofmann, 2012). CBT is based on the idea that cognition influences emotional responses, which modulate and influence behavior. The Multimodal Approach, for example, contends that psychological issues must be addressed through seven distinct but interconnected modalities: behaviour, affect, sensation, imagery, cognition, interpersonal factors, and drug/biological considerations (Lazarus, 2004).

In any music therapy intervention, it is very important to have a reliable assessment model to report the patient's problems, music behavior, and music therapy intervention with planned goals. Cassity and Cassity (2006) use a procedure to collect information on the music behavior and activity therapy assessment. The multimodal model involves methodical assessment and intervention across a patient's BASIC I.D (or basic identity) to consider all those factors that form or represent an individual's personality vectors. Prof Arnold A. Lazarus states in the book 'The Practice of Multimodal Therapy: Systematic, Comprehensive, and Effective Psychotherapy' that we are essentially biological and neurophysiological beings and our personalities are a product of our ongoing behaviors, affective processes, sensations, images, cognitions, interpersonal relationships, and biological functions. *(*Lazarus, 1989*).* This model is eclectic in approach as it includes a whole gamut of therapies. Due to the wide diversity in music therapy practice and because music therapists work in settings representative of many schools of psychotherapy, this model becomes more amenable for treatments in a multimodal profile. The model thus includes the following multimodal categories for children, adolescents, and adults seeking music therapy intervention; Behavior, Affect, Sensation, Imagery, Cognitive, Interpersonal, and Drugs. Once the patient's case history is taken, the (PMTQ) Psychiatric Music Therapy Questionnaire is administered to construct the patient's multimodal profile. A PMTQ's objective is to identify a client's problem-oriented behavior so that music therapy interventions can be tailored accordingly. The PMTQ's content is derived from a knowledge base connected to psychiatric music therapy assessment (Cassity, 2006). Part I of this survey uses a five-point Likert scale to measure music preferences. An inventory of 75 items is included in Part II, Multimodal Problem Analysis, to identify problems that music therapists can treat. Based on a 5-point Likert scale, clients rate themselves on each item from Strongly Disagree (1) to Strongly Agree (5). In Part III, a music therapist will be able to assess the client's performance on fifteen different behaviors following the conclusion of the interview. Upon administering the PMTQ, the therapist documents the client's problems based on their rating and analysis and then selects the appropriate music therapy interventions for the client (musictherapy.aau.dk, 2020).

Case background: I present the case of Rahul (R), 29 years who was diagnosed with PDD at the age of 16. He is cared for by his mother, while his father has been away from the family for many years. According to his mother, Rahul was never accepted by his father. Despite his many academic failures, his mother has been pushing him hard to finish his matriculation. Due to constant conflicts with his mother and with the other parent refusing to accept him, Rahul usually stays isolated, engages in self-talk, and displays socially inappropriate behavior. Since his mother is already a stressed parent, it is quite difficult to help her understand the triggers for all his symptoms and behavioral manifestations. He was referred for music therapy to reduce some of his persistent and dominant symptoms and simultaneously engage him in music. As per his diagnosis, his intellectual functioning ranges from mild to borderline range of intelligence. Significant difficulty in pragmatic language usage, verbal reasoning, and logical thinking was indicated in his tests. A lowered self-esteem marked by anxiety in social interaction and a sense of loneliness was also seen. Supervision and guidance in social situations with peers and experience-based learning along with vocational training were recommended in his assessment. During the initial observations, he appeared anxious and showed uneasiness in giving continuous eye contact while maintaining a conversation. He could follow simple instructions. Persistent echolalia, irrelevant responses, excessive yawning, stretching and stimming were noticed when anxious. Loud and irrelevant laughter was observed. Self-talk and self-instruction while working on a task or responding were also noticed.

Specific observations: He is a keen learner and eager to please. He enjoys being around peers for group learning. He responds to verbal greetings and handshakes spontaneously. He exhibits exceptional skills in music and grasps music vocabulary quickly. He has good pitch and rhythm sense. However, his behavioral patterns of self-talk, stimming, echolalia and other socially inappropriate behavior interrupt his learning. He tends to get very tensed and anxious when he is late for the sessions and refuses to focus for the first few minutes. He enjoys art and yoga.

After the PMTQ assessment and construction of the multimodal profile, I have used Carnatic music therapy intervention with ongoing tracking of assessment for one month, six months, and twelve months in certain core domains: communication, sensory/physical response, behavior, emotional /affect, cognition, social and musical. I have used a table to indicate the 'high', 'medium', 'low or none responses for each of the processes within every domain with specific comments for every domain. Following a review of R's history and the administration of the PMTQ for adults, the following BASIC I. D was derived.

BASIC I. D

MODALITY	PROBLEMS *(Included Problem area codes in different assessment areas as per the PMTQ manual)*
Interpersonal	IS-3 uncooperative behavior in group settings, difficulties in following rules. IS-5 difficulty in bonding with others as evidenced by lack of friendship and excessive conflicts with parents. IS-7 has difficulty involving self in music community groups; wanders easily.
Behavior	B-1 Lack of assertiveness resulting in difficulties meeting or communicating needs, expressing feelings, likes, and dislikes. B-3 Lacks awareness of personal space/boundaries; interrupts during group activities; displays inappropriate verbal/ nonverbal social behavior to peers and the therapist
Affect	A-1 Difficulties expressing and identifying feelings or emotions in self and others and expressing verbally or nonverbally;

	restricted emotional expression; lack of congruity between affect and verbalization A-3 gets angry while coping with frustration; experiences anger, stress, frustration which may result in impulsive behavior A-4 exhibits excitability; self-talking, touching self A-7 Free-floating anxiety, restlessness, muscle rigidity A8 Impulsive emotional outbursts like excessive laughing and repetition of irritable lines /noises; lacks self-control
Cognitive	C-1 Low self-esteem; negative self-concept; makes negative self-statements C-10 difficulty following directions; inability or unwillingness to listen or comprehend directions
Drugs / Medication/ physical wellbeing/ Physical communication problems	D-3.1 difficulty in maintaining a conversation D-3.5 attempts to communicate but makes irrelevant comments about the topic discussed.

Following the BASIC I. D, Rahul's Multimodal Music Therapy profile was constructed.

I. **MUSIC PREFERENCES:** 'R' 's favourite music is country music, western classical, Carnatic bhajans, instrumental music, and popular film music. He dislikes folk music. He is keen to learn and showcase his skills on a platform individually or in a group. He engages himself with his keyboard as a leisure activity at home. He cannot name any composer or favourite performer but enjoys music innately. He is pitch-perfect and enjoys both melody-based and fast-paced rhythmic compositions.

II. MULTIMODAL PROBLEM ANALYSIS

INTERPERSONAL *(Problem area codes in different assessment areas as per the PMTQ)*	**Problem**	**Music Therapy Intervention**
IS-3	uncooperative behavior in group settings, difficulties in following rules	• Involve him in a group choir to cultivate group cohesion and awareness • Use Tibetan bowls or Indian chimes assigned to each member with directions and work towards completion • Use his preferred compositions to involve him fully and set rules that need to be compulsorily followed. E.g. Singing a line 2 times; singing a para twice and coming back to the first line and then passing on to the next member; not singing when others are singing

IS-5	difficulty in bonding with others as evidenced by lack of friendship and excessive conflicts with parents	• Encourage bonding during group singing. • Encourage him to raise his hand and speak in case of difficulties to help others understand him better. • Turn-taking music lessons. E.g., Singing one or two lines of a Nottuswaram and passing on to the next person in the team; sequential *svara prasthāras (logical note sequences)* in the increment and decrement format while turn taking. sa, ṛ, gā, ma, pa, dha, ni, sa´ ṛ, gā, ma, pa, dha, ni, sa´ gā, ma, pa, dha, ni, sa´ ma, pa, dha, ni, sa´ pa, dha, ni, sa´ ni, sa´ sa´ logical pattern progressions in Swara patterns.
IS-7	has difficulty involving self in music community groups; wanders easily	• Introduce parallel activities like playing Jenga, Uno, and singing along with the parallel activity. • Allow adjustment time for sensory overload issues. • Positive/ social reinforcements whenever he has participated in music community groups to encourage his behavior.
AFFECT	**Problem**	**Music Therapy Intervention**
A-1	Experiences difficulty to verbally or nonverbally express/identifying feelings /emotions in self or others; restricted emotional expression; lack of congruity between affect and verbalization	• Involve him in a song discussion activity focussing on the emotion of the song. Help him identify and express specific feelings and appropriate ways of expressing them. Prompt generalization to his life situation. E.g. The rasa (emotion) felt while singing kalyāni or Yamuna kalyāni (usually invokes joy or devotion); The emotion felt while listening to Shubha Pantuvarāli or Chakravākam (usually invokes pathos) • Ask him to write about his feelings while listening to a song. • Have him bring songs or passages to the session related to issues he has faced at home or elsewhere
A-3	gets angry while coping with frustration; experiences anger, stress, frustration which may result in impulsive behavior	• Break down the monotony of negative emotions by allowing him to sing a song of his choice or by placing him on his choice-based activity.

		• Assign a rhythm instrument like the western drums or Cajon to break his frustration and anger.
A-4	exhibits excitability behaviours; self-talking, touching self	• Use Sanskrit shlokas (long verses) or sing logical sequences at 3 speeds • For 'touching self' use social stories to help him understand appropriate behavior in a social setting.
A-7	Free-floating anxiety, restlessness, muscle rigidity	• Utilize relaxation with music; engage him to listen to soft music or veena strings. • Simple breathing, pranayama while listening to veena strings • Encourage him to sing his favourite film song. • Involve him in group musical games.
A-8	Impulsive emotional outbursts like excessive laughing and repetition of irritable lines /noises; lack of self-control	• Utilize calming music • Redirect behavior towards positively reinforced activities or through relaxation or breathing exercises.
COGNITIVE	**Problem**	**Music Therapy Intervention**
C-1	Low self-esteem; negative self-concept; makes negative self-statements	• Re-iterate/ emphasize each of his music accomplishments through photos or video recordings, the sound of applauding, and feedback from other parents and caregivers. • Each time a negative statement is made, set a doable musical goal and encourage with verbal praise and applause.
C-10	difficulty following directions; spatial concepts	• Use music activities designed to teach concepts such as right from left and up from down. E.g., Imitation of tala beats (rhythm) once with the left hand and then the right. • Observe and practice spatial awareness when asked to move next to/ behind/ in front of, during group music activities.
BEHAVIOR	**Problem**	**Music Therapy Intervention**
B-1	Lack of assertiveness resulting in the inability to meet or communicate needs, difficulty verbalizing needs, feeling, likes and dislikes.	• Encourage him to communicate and respond to peers. Build in a habit of greeting each other • Engage in group music activities. Have the group toss a ball to one another in the presence of background music. When the music stops, the person holding the ball

		will verbally respond to a question posed by the therapist. • Encourage him to speak about difficulties or positive or negative emotions that he experiences during any musical activity or while listening to or singing a composition.
B-3	Lacks awareness of personal space/boundaries; interrupts during group activities; displays inappropriate verbal/ nonverbal social behavior to peers and therapist	• Place him in a structured music group (e.g., a performance group like a choir), provide directions about proper social skills in group situations, and explain the structure and rules of the activity. • Redirect to appropriate behavior. • Explain personal spaces and boundaries through social stories and videos.
DRUGS/ MEDICATION /PHYSICAL WELLBEING/ VERBAL COMMUNICATION PROBLEMS	**Problem**	**Music Therapy Intervention**
D-3.1	difficulty in maintaining a conversation	• Conduct instrumental activity and response activities where the therapist plays a musical antecedent and the patient responds with a musical consequent verbally. E.g., the therapist starts the first two lines of a composition on the veena, the patient has to recognize and render the next two lines. • Encourage him to sing a composition with good diction. • Encourage to participate in a "fill in the blank" singing activity or song-writing activity.
D-3.5	attempts to communicate but makes irrelevant comments about the topic discussed.	• During music discussion, redirect the patient's responses by asking questions related to the topic or composition till he arrives at a suitable choice of answers.

III. POST INTERVIEW OBSERVATIONS

'R' had difficulties sitting in a composed manner with proper eye contact and posture. It was a new setting. He was keen to engage in music and showed retention in simple instructions. Although he took some time to follow instructions, they didn't have to be repeated. He showed a low self-esteem. He was constantly distracted by his mother's presence and was anxious. He was well-groomed and seemed to have a favourable attitude towards participation in music therapy activities.

IV. METHOD

Weekly 2 music therapy sessions of 60 mins each were rendered for 12 months. Both receptive music therapy *(passive listening)* and active music therapy *(participation-based and active engagement)* were intervened during sessions. A systematic administration of Carnatic music therapy intervention in its varied forms like chanting Ōmkara[2], Sanskrit ślokas[3], bhajans[4] in different languages, devotional compositions, classical music lessons in different *Svara* combinations, and *rāgas* set to different speeds were used for intervention. A combination of active and passive music therapy was administered through both individual and group music therapy sessions. R's mother's cooperation and involvement in the therapy process were encouraged. Compositions in the following rāgas were administered; nōṭṭusvaras[5] in Śankarābharaṇaṃ, bhajans, dāsarapadas[6], ślokas in kalyāni, yamuna kalyāni, tilang, hamsadwani, peelu. rāgas conveying the emotion/rasa of joy, heroism, peace, and devotion were predominantly used. During days of meltdowns, a lot of individual and group warm-up vocal exercises along with parallel activities were intervened to relax him first and then continue with the therapy process. Passive listening of vīṇā[7] playing was introduced on days of complete breakdown. Tibetan bowls, small Congo, and Indian brass cymbals were used to redirect attention during socially inappropriate behavior to reorient attention, pace, and play along with the rhythm of the composition.

Vocal improvisations with rāgas *(melodic frameworks)* like mōhana, kalyani, Śankarābharaṇaṃ, hamsadwani, valachi, rēvathi, madhyamāvathi, ābhogi, gambhēra nāta, amruthavarśini, hamsānandi were used to identify and differentiate the rasas (emotions) from various rāgas. The scales of these rāgas were transferred to the keyboard to explore, improvise and use as a leisure activity back home. śrī śāradā bhujaṅga prayātāṣṭakam, acyutāṣṭakam by *Ādi Śaṅkarācāryaḥ*, nāmarāmāyaṇaṁ by *Sri Lakshmanacharya* were some of his specific musical milestones, although derived from ancient Sanskrit texts.

V MUSIC THERAPY INTERVENTION PROGRESS

Table 1-Communication

	1 month				6 months				12 months			
COMMUNICATION	High	Med	Low	None	High	Med	Low	None	High	Med	Low	None
Initiates conversation				●			●				●	
Use of single words			●				●				●	
Use of Phrases		●				●				●		
Use of sentences		●				●				●		
Expressive language			●			●			●			
Receptive language			●				●			●		
Speech clarity/improvement in quality of need-based communication												
Nonverbal responses		●				●			●			
Purposeful body language			●				●				●	
Echolalia	●					●					●	

[2] Ōmkara chants are a form of meditation used in Indian therapeutic intervention.
[3] Ślokas- poetic forms in Sanskrit language with different meters
[4] Bhajans are devotional melodies with spiritual significance.
[5] nōṭṭusvaras are ornamental compositions with a western tinge composed by Sri *Muttusvāmi Dīkṣitar in* raga Śankarābharaṇaṃ
[6] dāsarapadas are devotional compositions in the Indian language Kannada
[7] vīṇā, is an ancient string instrument commonly used in the Indian classical music domain.

With reference to progress in communication, it was noticed that he could comprehend simple sentences and he could follow simple instructions. He could give reasons for being late to class. A lot of imitation behavior was seen. He is polite but confused while speaking. When we progressed to the 6 months and beyond, he could comprehend and respond better to verbal communication. He watches for facial expressions and non-verbal cues. Self-talking and echolalia were very high during the first month. Gradually these patterns declined when he started taking more music lessons, which kept him occupied. The researchers felt that he has an inherent passion to learn music.

Table 2- Sensory/ Physical response

	1 month				6 months				12 months			
SENSORY / PHYSICAL RESPONSE	High	Med	Low	None	High	Med	Low	None	High	Med	Low	None
Auditory perception		●				●				●		
Visual perception		●				●				●		
Auditory motor co-ordination		●			●				●			
Gross motor coordination												
Fine motor coordination												
Auditory discrimination		●			●				●			
Rhythmic body responses		●				●			●			
Sensitivity to Sound	●				●				●			

With reference to sensory/physical response, it was observed that he responds better to individual sessions than in a group. He is sensitive to other students singing in the wrong pitch or tune and can exhibit discomfort either by way of laughing continuously or touching and tapping his face. He gets very restless during group intervention due to sensory overload issues and his sensitivities to sound. His innate rhythm and melody sense helped him engage in music more often with better auditory-motor coordination and discrimination abilities.

Table 3-behavior

	1 month				6 months				12 months			
BEHAVIOR	High	Med	Low	None	High	Med	Low	None	High	Med	Low	None
Crying				●				●				●
Screaming				●				●				●
Hitting self				●				●				●
Hitting others				●				●				●
Touching self	●				●					●		
Spitting				●				●				●
Biting self				●				●				●
Biting others				●				●				●
Throwing				●				●				●
Headbanging				●				●				●
Running				●				●				●
Destroying property				●				●				●
Others	●					●				●		

With reference to his behavioural patterns, socially inappropriate behavior was seen while seeking attention or for self-stimulation. Social stories and posters on accepted behavior were used to help him understand appropriate public behavior and to prevent him from touching himself during one-to-one sessions. Through music, logical sequences(spatial reasoning) of notes were used in the second and third speed to divert his attention and focus on current learning.

Table 3- Emotional/Affect/Self-concept

	1 month				6 months				12 months			
EMOTIONAL / AFFECT / SELF CONCEPT	High	Med	Low	None	High	Med	Low	None	High	Med	Low	None
Self-expression			●			●				●		
Range of affect	●				●				●			
Anger		●						●				●
Frustration		●						●				●
Anxiety	●					●				●		
Perceiving emotions			●			●			●			
Understanding emotions			●			●			●			
Managing emotions			●				●			●		
Joy / Satisfaction		●				●			●			
Sharing feelings				●				●				●
Internal motivation				●			●			●		
Self esteem / confidence			●			●				●		
Overall self concept			●				●			●		
Self- image			●				●			●		
Overall Resilience												

In the domain of emotional affect/ self concept, it was noticed that he can read emotions of others during music sessions. He keenly observes expressions and self-talks and self instructs when he notices disturbing emotions and facial expressions from the therapist. He tends to get anxious if expressions are negative and blames himself. Due to mishandling at home and forced academic work after multiple failures, in almost every session a rasa or emotion like *Śṛṅgāra*(joy) or *veera* (valour) had to be used to relax him and help him focus during sessions. He does not initiate or share his feelings. Over some time, he learned to transfer his vocal lessons onto his keyboard, which kept him busy and avoid conflicts at home. Before R was initiated into music therapy sessions, his tests revealed lowered self-esteem, a sense of loneliness, and marked anxiety in social interaction. Over 12 months, with individual and group music therapy sessions, there was considerable improvement in his self-image and self-esteem.

Table 4-Cognition

	1 month				6 months				12 months			
COGNITION	High	Med	Low	None	High	Med	Low	None	High	Med	Low	None
Attention span			●			●				●		
Reasoning												
Focus			●			●				●		
Overall memory	●				●				●			
Understanding simple instructions			●			●				●		
Understanding visual cues		●			●				●			
Understanding visuals		●			●				●			
Body awareness			●				●			●		
Ability to learn new things	●				●				●			

Taking cognition into consideration it was noticed that, his attention span initially was low for his age as he was getting used to the new environment. He was a keen learner and grasped melody and rhythm fast. His auditory memory retention was very good from the beginning and this helped him grasp more compositions.

Table 5-Social

	1 month				6 months				12 months			
SOCIAL	High	Med	Low	None	High	Med	Low	None	High	Med	Low	None
Eye contact			●			●			●			
Eye-tracking			●			●			●			
Participation		●			●				●			
Sharing												
Interaction with peers			●			●				●		
Co-operation in taking turns			●			●				●		
Voluntary involvement		●			●				●			
Withdrawal symptoms				●				●				●
Adjustment		●				●				●		

As far a his social interactions are concerned, it was observed that, he enjoys interacting and socializing in a group with other adult students. He greets on his own. But, he was hyperacute during music sessions. He can be restless and anxious when the whole group is singing in the wrong pitch or rhythm. Artwork was given as a parallel activity to help him stay connected with his peers and to avoid sensory overload. Turn-taking during initial sessions was tough; eventually, he learned to respond with music only when his name was called out.

Table 6-Musical

	1 month				6 months				12 months			
MUSICAL	High	Med	Low	None	High	Med	Low	None	High	Med	Low	None
Musical aptitude	●				●				●			
Sound perception	●				●				●			
Pitch perception	●				●				●			
Melody Perception	●				●				●			
Rhythm identification and processing		●			●				●			
Auditory Motor Control		●				●				●		
Vocalization	●				●				●			
Responding to emotions in music			●			●				●		
Creativity and improvisation			●			●				●		
Movement to music			●			●				●		
Rhythm on instruments				●			●			●		
Singing words / Phrases	●				●				●			
Singing/playing whole compositions	●				●				●			
Memory Retention and recall			●		●				●			

Due to his exceptional musical skills, and innate aptitude for music, it was easy to connect with him through music engagement. He could grasp large chunks of music at once. Not many prompts were required for forthcoming sessions due to his ability to recall information easily. At the end of 12 months, he had showcased his music abilities across three platforms within his capacities.

Impressions and recommendation

In observing throughout the intervention phase, the researchers felt that he will need much encouragement from parents and mentoring adults in his environment to be able to cope with issues of adulthood. The learning environment has to be less stressful. He has the capabilities to perform well in subjects that are practical and experience-based and do not involve high reasoning skills and abstract thinking. He needs to be constantly engaged in music and art to reduce socially inappropriate behavior. Before he was initiated into music therapy sessions, his tests revealed lowered self-esteem, a sense of loneliness, and marked anxiety in social interaction (589). Over 12 months with individual and group music therapy sessions, considerable improvement was seen in his self-image and self-esteem with more confidence in interacting with his peers, therapist, and others. *Refer to Table 3- Emotional/Affect/Self-concept.* His focus and attention have considerably increased from 2-line shlokas to whole compositions and pages of scripts. His retention is strong and can be invoked easily even if not practiced for months. *Refer to Table 4-Cognition.* He can transfer the learning to other domains, use music as a leisure activity, and avoid conflicts at home. E.g., transferring vocal lessons to musical instruments; painting and working on math while passively listening to music. Due to his perception abilities for sound, pitch, melody, and rhythm including a musical aptitude, he can respond to a variety of compositions including Ślokas, Swara patterns, rhythmic patterns, peppy compositions, tunes with a western classical tinge, and

Carnatic classical compositions. He can participate in music activities without getting distracted and with a minimum verbal prompt for at least one to three minutes. *Refer to Table 6-Musical.* With adequate guidance and support, he can be upskilled to participate in individual and group music sessions without repetitive physical movements, sounds, words, or any other self-stimulatory behavior.

Conclusion: The progress of the MT intervention was most apparent in the following domains—understanding emotions, initiating interactions, responding, and managing self-stimulation, engaging in social interaction with social reciprocity. This study illustrated that MT is an effective intervention for improvement in interpersonal, behavior, affect, sensory, cognition, and communication in adults with autism **(587)**. A positive change is seen in self-image due to defined personal goals and an individualized intervention plan. This report provides an outline of the procedures that could be used in a clinical setting to plan music therapy treatment, as well as approaches that could be used to provide individualized intervention for adults with autism and mediate their challenges. Indian classical music therapy, when used appropriately, with proper assessment, multimodal problem analysis, and structured intervention strategies can have a positive impact on people with autism. Individualized goals that are designed toward specific benefits in the interconnected modalities through the multimodal approach can be systematically planned and music intervention implementation can be tracked with proper data plotting and subjective analysis of the data **(587)**.

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