Original Article
ISSN (Online): 2582-7472

ShodhKosh: Journal of Visual and Performing Arts
June 2024 5(6), 50–64

BHARATANATYAM ENHANCING KIDS WITH ASD & ID

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ABSTRACT

Bharatanatyam is an Indian classical dance that originated in the Hindu temples of Tamil Nadu in southern India. Bharatanatyam dance is a tradition steeped in Indian history and culture. Today, Bharatanatyam is a dance style that encompasses religious and non-religious themes, as well as fusion styles. Characterized by precise movements, sharp edges, and expressive body language, this tradition has delighted audiences for generations. Like many other aspects of Indian tradition, this art form has struggled through times of oppression. However, with the efforts of teachers and students all over the world, Bharatanatyam has been revived to continue to serve the people who find joy in the formal and intuitive expressions embodied in the structure of the dance. It serves as a transforming experience that empowers youngsters with disabilities and autism. Bharatanatyam helps individuals discover their voices, build confidence, and enhance the physical and cognitive abilities needed to overcome life's obstacles. This art form facilitates communication, promoting inclusivity and comprehension among youngsters with varying abilities. Observing the beauty of Bharatanatyam in these young individuals serves as a powerful reminder of the significant influence that art and culture can have on the human spirit, surpassing boundaries and honouring diversity.

Keywords: Bharatanatyam, Youngsters, Southern India

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DOI
10.29121/shodhkosh.v5.i6.2024.1055

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

1. INTRODUCTION

Bharatanatyam, over 2000 years old, is not only aesthetically and culturally pleasing but also harmonizes the body, mind, and soul of the dancers. Neurological problems in children arise from abnormalities in the brain, nervous system, or muscle cells. This study involved teaching Bharatanatyam to three children under the age of 8 who have neurological and developmental disabilities such as ASD (Autism Spectrum Disorder) and ID (Intellectual Disability). Their cognitive abilities were assessed by basic brain and motor functions such as sketching, colouring, verbal fluency, reaction time, and sustained attention.

2. BHARATANATYAM AND THE HUMAN BODY PARTS IT ENGAGES

Bharatanatyam (Arpita Chatterjee, B. C..2013) includes the fundamental elements of classical dance such as mudras (hand gestures), abhinaya (facial expressions), and padams (storytelling dances). The dancers utilize hand-and-eye movements significantly to convey various emotions. It combines passion, music, rhythm, and expression.

Bharatanatyam focuses on mudras and emphasizes padartha abhinaya, where each phrase is expressed by hand gestures. Dancers communicate their inner sensations through the nine sentiments of navarasa, aiding in the release of their emotions.

This outlines the various movements of the head (shiro), eyes (drishti), and neck (greeva) as well as the classification of body parts (anga) utilized in Bharatanatyam. The movements resemble yoga exercises for the eyes, neck, and head. These exercises primarily serve as therapy for that specific body component.

In dance, the bodily limbs are categorized as 1. Anga. 2. Pratyanga and 3. Upaanga. When body parts are utilized in varying ways to convey a specific behaviour.

The 6 Angas consist of Chest, Waist, Bottom, Hands, Head, and Legs. Some Bharatanatyam experts also incorporate movements of the neck. The 6 pratyangas are thighs, knees, shoulders, arms, and stomach.

Bharatanatyam experts consider the wrists, elbows, and ankles as well.

The 12 Upaangas in Bharatanatyam are Glance, Eyebrows, Eyelids, Eyeballs, Cheeks, Nose, Gums, Lips, Teeth, Tongue, Chin, and Face. Some Bharatanatyam specialists also include the heels, fingers, feet, and palms as part of the Upaangas.

3. IMPORTANT RULE FOR DANCE

The text Natya Sastra says the Sloka

Yetho Hasta Thatho Drishti
YethoDrishtisThathoManah
YethoManasThathoBaavo
YethoBaavasThathoRasah

Translation

Wherever the hand goes, the eyes follow
Wherever the eyes go, the mind follows
When the mind is engaged, expression results
Where there is an expression, there is beauty.

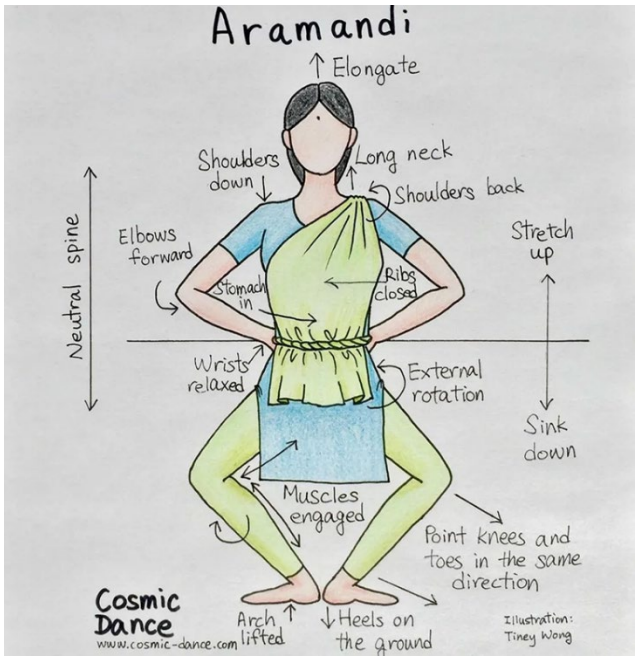
– Abhinaya Darpana, Sloka No. 247 (This coordination is issued with neural disability individuals)

4. SYMBOLISM WITH BODILY POSITIONS

The gestures and facial expressions communicate the emotions and mood of the story. Posture is a crucial element of Bharatanatyam dance, consisting of three fundamental positions: Aramandi (half-sitting), Muzhumandi (full sitting), and Samam (standing).

Body posture is the spatial position of a person's body, the alignment of body components in relation to each other and the surroundings at a specific moment, and is affected by the joints in the body. Posture can be defined as a state of muscular and skeletal equilibrium that safeguards the body's supporting components from harm, regardless of the position they are in. A good posture optimizes control efficiency with minimal effort in physiological and biomechanical terms. Proper alignment of the body segments is essential for maintaining healthy posture and reducing muscle strain and stress along the entire kinetic chain.

The fundamental stance in Bharatanatyam is known as Aramandi, which means 'half-sitting'. The entire dance sequence is choreographed based on this position.



5. BHARATANATYAM MUSIC THERAPY

Music therapy is integrated into Bharatanatyam dance. Music therapy focuses solely on music and provides an additional advantage to Bharatanatyam dancers. The sound of thattukazhi and Nattuvangam triggers muscle memory and enhances attentiveness when played by the guru or nattuvanars.

6. BHARATANATYAM WITH YOGA POSES

Bharatanatyam incorporates a minimum of 20 yoga asanas, such as Dhanurasana (the bow pose), Chakrasana (the wheel stance), Vrikshasana (the tree poses), and Natarajasana (the pose of dancing Shiva). Temple statuary portrays 108 karanas the ancient temple dance poses performed by devadasi temple dancers who incorporated yoga asanas into their routines (Arpita Chatterjee, 2013).

Bharatham can effectively contribute to mental well-being and psychotherapy. Mastering this dance instils a feeling of accomplishment and resolve in the dancer. Consistent practice fosters a robust and healthy physique and helps prevent ailments. This dance style enhances the hamstring muscles such as semitendinosus, semimembranosus, and biceps femoris.

The temple sculptures predominantly depict positions and mudras from Bharatanatyam and yoga. Both are traditional customs in our country. Therefore, as yoga may heal various disorders, the subsequent dance movements following its poses also have a good likelihood of achieving the same result.

7. NEUROBIOLOGY OF BHARATANATYAM

7.1. BRAIN DANCING [2]

Dancing is typically linked with physical movements, postures, and expressions that involve the use of our limbs, face, and muscles. Dancing is a result of the sophisticated control center known as the human brain. Bharatanatyam necessitates the utilization of:

The cortico-spinal tract is the pathway that enables voluntary limb movements by connecting the brain to the spinal cord. The cerebellum is responsible for learning and coordinating new motions.

The basal ganglia assist in habit formation and the selection of physical motions.

Here are the three key character qualities of Bharatanatyam and the cognitive processes involved in a dancer's execution of them.

8. THE ARAMANDI

It necessitates the use of the vermis is a small section of the cerebellum responsible for maintaining postural control and gait. Sitting in aramandi challenges the performers midline posture, core muscles, and balance. When sitting in aramandi, the performers cerebellum activates to sustain the posture by engaging the rigidity and maintaining the performers midline straight.

The brain has numerous central pattern generators (CPGs) responsible for coordinating diverse postures, movements, and actions that we commonly perform.

For example, when a 10-month-old new born is learning to stand independently, its brain is actively forming a neural pathway for this posture. Eventually, this activity will become habitual, requiring less conscious effort from the baby.

When I began learning bharatanatyam, it took some time for my brain to establish a circuit for the posture and balance required for the aramandi pose. Assuming this stance is challenging because to the increased gravitational force acting on my feet when they are positioned close together and spread out to the sides at a 180-degree angle. This significantly impacts my equilibrium, similar to attempting to keep a pen with a slender base standing upright. Similar to the new 'standing circuit' in the baby, I required a new 'aramandi circuit' to perfect this stance.

9. SYMMETRY OF STEPS

Bharatanatyam places a strong focus on the symmetry of movement as one of its key qualities. The process involves precise and straight-lined movements that need flawless alignment of the body's trunk, limbs, and head simultaneously.

9.1. EFFORTS TO ACHIEVE PERFECT SYMMETRY NECESSITATE

a) Para-vermis: The para-vermis is located adjacent to the cerebellar lobes and plays a role in regulating limb motions. To execute my symmetrical dance step, I must coordinate the movement of my hands, legs, and fingers in a specific manner. This is facilitated by the cortico-spinal tract (CST), which enables communication between the brain and the spinal cord. The para-vermis regulates motions, while the spinal cord and other related brain areas execute the movement.

b) Sensoria Reference: This pertains to the sensory input that the brain receives from the muscles and joints in our limbs.

10. EXECUTING A BHARATANATYAM PERFORMANCE

A Bharatanatyam routine (Minton, S., 2000) combines steps and abhinaya (emotional expression) in a scripted sequence. Extensive practice is necessary for the development of muscle memory. For precise execution of a task, these are the key components:

The hippocampus is a crucial brain region that plays a key role in the formation of new long-term memories. Memories encompass significant life events as well as mundane daily occurrences, such as breakfast choices. However, it has additional functions. The hippocampus is implicated in motor sequence learning and storing procedural memory (Edwards, S.2016).

During a dancing routine, it is important to focus on the steps and sequence and encode them efficiently in order to later recall them. This stage is essential for aiding my hippocampus in correctly storing the sequence. Finally, the hippocampus, along with the cerebellum and other association areas in the brain, assists in remembering and executing the sequence of the full routine. The cerebellum also regulates motor learning.

Basal Ganglia and Habituation: The basal ganglia is located deep within the brain structure. It is the region of the brain that oversees motor learning, action selection, reward processing, emotional responses, and habit building.

11. AUTISM SPECTRUM DISORDER (ASD)

(Margaret Kurzius-Spencer et. al., 2018) explained about Autism spectrum disorder (ASD), intellectual disability (ID), and behavioural problems commonly co-occur, leading to increased impairment, diagnostic confusion, and treatment delays. Using data from a large surveillance population of children with ASD, the objectives of the present study were to compare the relative risk of common behavioural problems in children with ASD, with and without co-occurring intellectual disability.

Autism spectrum disorder (ASD) is a neurodevelopmental condition resulting from variations in brain function. Individuals with Autism Spectrum Disorder (ASD) can exhibit a wide range of abilities. Some individuals with ASD may possess sophisticated conversational abilities, while others may be nonverbal. Some individuals with Autism Spectrum Disorder require extensive assistance in their everyday activities, while others are capable of functioning independently with minimal or no aid.

Struggle in forming and sustaining connections, interacting with classmates and adults, and grasping social norms in educational or professional settings. Healthcare practitioners may notice individuals with ASD due to their co-occurrence of disorders including anxiety, depression, or attention-deficit/hyperactivity disorder, which are more prevalent in those with ASD compared to those without ASD.

12. INDICATIONS AND MANIFESTATIONS

Individuals (Cueto S., et. al., 2017). with Autism Spectrum Disorder (ASD) frequently experience challenges in social communication and engagement, as well as exhibit restricted or repetitive behaviours and interests. Individuals with ASD may exhibit distinct learning styles, motor skills, and attention patterns. These traits can create significant difficulties throughout life. It is vital to recognize that individuals without ASD may also exhibit some of these symptoms.

Challenges include difficulties with basic motor skills like throwing, catching, and kicking a ball, as well as more complex activities such as playing sports or participating in community programs. Additionally, issues with posture, fidgeting, clumsiness, and toe walking are present.

Various motors, sensory, and musculoskeletal disorders may be the root cause of the motor challenges faced by a kid with ASD.

- Low muscle tone - muscle tone is the level of activity present in our muscles during rest. Children with ASD frequently experience hypotonia, leading to increased effort and energy expenditure during movement, as well as changes in sensory input related to muscle activity.
- Motor planning challenges impact the child's capacity to effectively time, sequence, and carry out a movement. These symptoms are commonly associated with clumsiness, frequent falls, poor balance, or poor coordination.

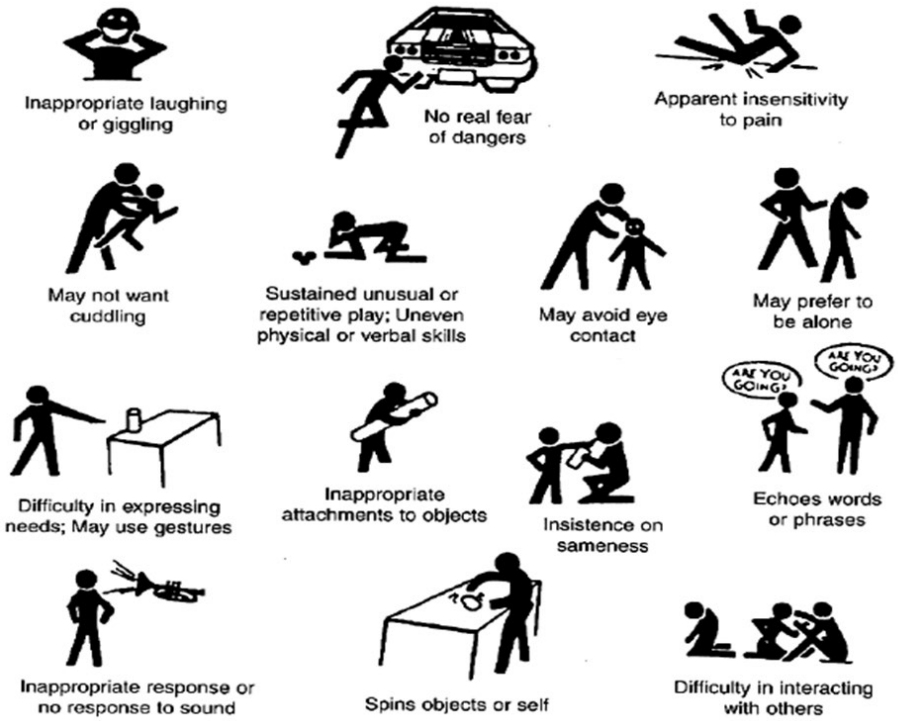
Children (Alloway T. P., et. al.,2006) with ASD generally have weak core strength due to their low muscle tone and motor planning issues. Children with ASD struggle to activate the appropriate core muscles and lack the necessary power and endurance to use these muscles effectively throughout daily tasks.

- Poor posture can be caused by low muscle tone and weak core strength, affecting a child's ability to learn advanced motor skills, fine motor skills, and can also affect their focus and engagement in the classroom.
- Tight muscles and joints can develop due to inadequate motor skills and posture.

Delayed achievement of, poor, or inefficient balance reactions refer to the child's delayed or ineffective automatic responses to maintain an upright position when losing balance and to protect themselves from damage during a fall.

A paediatric physiotherapist will evaluate the child's motor skills, identify any underlying issues, and create an intervention plan to address and enhance these issues, thereby improving the child's overall functioning. Possible strategies for a physiotherapy intervention strategy include:

- Prescribed workouts targeting muscle strength, posture, endurance, motor planning, and balance reactions
- Utilizing sensory feedback techniques to enhance a child's perception of their body posture and motions
- Suggestions for taping, orthotics, or other bracing techniques to improve the child's body alignment, posture, and body awareness during physical activities. • Guidance and assistance to engage in community-based physical activity programs that will enhance their physical abilities and stamina.



13. INTELLECTUAL DISABILITY

Intellectual disability (ID) refers to limits in cognitive functioning and capabilities, encompassing conceptual, social, and practical abilities like language, social interactions, and self-care. These constraints can result in a person experiencing slower or different development and learning compared to a typically developing individual. Intellectual disability can occur at any point prior to an individual reaching 22 years of age, including before birth.

Intellectual disability is the prevalent developmental disability. An individual is considered to have an intellectual impairment if they meet three criteria, as defined by the American Association of Intellectual and Developmental Disabilities. IQ is less than 70.

Adaptive behaviour may be significantly limited in one or more of the following domains: conceptual, social, or practical skills required for community living, job, and recreation. The syndrome appears before to the age of 22.

What are the primary causes? Common aetiologies of intellectual impairments include:

Genetic disorders. Intellectual disabilities can be caused by faulty genes inherited from parents, faults during gene combination, or other factors. Genetic diseases such as Down syndrome, Fragile X syndrome, and phenylketonuria (PKU) are examples.

Pregnancy complications. An intellectual handicap may occur due to inadequate development of the fetus in the mother's womb. For instance, there could be an issue with the baby's cell division. Maternal alcohol consumption or contracting infections such as rubella during pregnancy might result in offspring with intellectual disabilities.

Complications during childbirth. Complications during labour and birth, like inadequate oxygen supply to the baby, can lead to intellectual impairment.

Illnesses or exposure to harmful substances. Illnesses like as pertussis, measles, or meningitis can lead to cognitive impairments. They can also result from severe starvation, inadequate medical treatment, or exposure to toxic substances like as lead or mercury.

Intellectual impairment is not transmissible; it cannot be acquired from others. We are aware that it is not a form of mental disorder, such as depression. Intellectual impairment has no known cures. Nevertheless, children with intellectual limitations can acquire many skills. They may require additional time or have a different learning style compared to other children.

Several advantages encompass the subsequent skills:

- Eye-hand coordination
- Self-confidence
- Fine and gross muscle development
- Problem solving
- Observation

Creating a visual representation for analysis.

Drawing and colouring can provide insights into children's physical and cognitive abilities. It is utilized in most initiatives and research conducted by Harvard psychologists. This experiment involves analyzing colouring and sketching using simple statistical techniques instead of clinical data.

Here are the components involved in colouring and drawing. The efficiency of these can be assessed through the diagrams created by children.

1) Motor skills
2) Creativity
3) Cognitive development
4) Strategic Planning Abilities
5) Ocular-Manual Coordination
6) Visual Cognition
7) Focus Duration
8) Promoting Healthy Emotional Release and Expression
9) Linguistics
10) Creativity
11) Critical Thinking
12) Pre-Writing Skills
13) Pre-Mathematical Skills
14) Memory

14. CRAYON COLOURING FOR EXPERIMENTATION

Colouring with crayons is associated with various benefits such as experimentation, coordination of finger, hand, arm, and shoulder, cognitive thinking, patience, hand dominance, pencil grasp, small muscle coordination, interpreting images, object manipulation, motor skills development in children, eye-hand coordination, crossing the imaginary midline, and bilateral coordination. Many occupational therapists and psychologists who conduct research are using this strategy.

15. EXPERIMENT

The experiment takes place at Sangiliandapuram middle school in Trichy, Tamilnadu. Three children with disabilities were chosen to learn Bharatanatyam. They received instruction in Bharatanatyam for a duration of 6 weeks, attending classes 3 days a week. It took them about two weeks to master basic leg tapping, Aramandi, and a few mudras. The children appeared more joyful and enthusiastic in learning, as they were energetically participating in activities upon my arrival to class each day. No coercion was employed, and children willingly participated in every stage of the experiment.

Children's familiarity with and preference for colourful images in school are being utilized to assess the impact of Bharatanatyam on their motor skills and neural activity (Becker S., & Burgess N., 2001).

The children's verbal and nonverbal communication skills, as well as eye movements, were periodically analyzed to determine the findings.

15.1. EXPERIMENT SAMPLES

The initiative aims to investigate the impact of Bharatanatyam on three children with neurological and motor function deficits.

Sample 1: A 7 year old girl with ASD (Autistic Spectrum Disorder)

Sample 2: A 7 year old girl with ID (Intellectual Disability)

Sample 3: A 10 year old boy with ID (Intellectual Disability)

16. HYPOTHESIS

Bharatanatyam training is believed to improve brain function and motor skills in children with Autism Spectrum Disorder (ASD) and intellectual disabilities.

16.1. TESTING HYPOTHESIS

This investigation aims to determine if practicing Bharatanatyam improves brain function and motor skills. The above hypothesis will be investigated following the steps outlined. If the samples show improvement after practicing Bharatanatyam, the hypothesis will be confirmed.

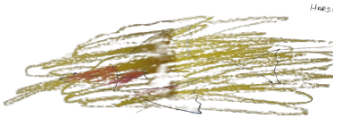
Table 1

Table 1

Sample	Neural disorder	Before	After
1	ASD		
2	IQD		
3	IQD		

Table 2

Table 2

Sample	Neural disorder	Before	After
1	ASD		

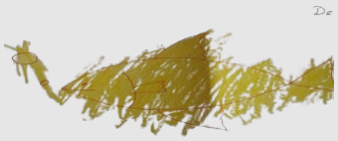
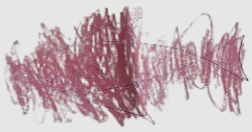
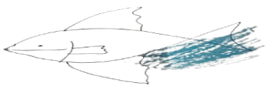
2	IQD		
3	IQD		

Table 3

Table 3

Sample	Neural disorder	Before	After
1	ASD		
2	IQD		
3	IQD		

16.2. EXPERIMENT PROCEDURE

1) The children received Bharatanatyam lessons three days a week for a duration of six weeks.
2) The children were assigned a basic chore of colouring a picture before they began rehearsing the dance. They had instruction in Bharatanatyam for 20 minutes.
3) In Bharatanatyam, students learned namaskaram, aramandi, ganaslogam, thattadavu, and a few mudhras.
4) Subsequently, they were provided with the same picture to colour right after the dance sessions.
5) The two-toned images of each child were compared, and the time taken to colour them was recorded and examined.
6) The three children were provided with identical pictures without prior Bharatanatyam practice, and both images were compared along with the time required.

7) One day throughout the project, a specific sample, Sample 2, did not participate in the dancing activity. Her coloured images were then analysed alongside the photographs of the other two children who did dance.
8) Analysed the time taken to answer when their name was called before and after the Bharatanatyam session.
9) The children learned Drishti bedha (Eye motions) in Bharatanatyam, and their capacity to concentrate on a single point was evaluated.

17. ANALYSIS

17.1. ANALYSIS 1

1) All samples were allotted 15 minutes to complete colouring a basic diagram before engaging in Bharatanatyam.
2) The participants were instructed to colour the diagram again after a 20-minute Bharatanatyam session, after the initial colouring task.

Sample 1:

1) During the trial, individuals with ASD coloured the picture and then performed Bharatanatyam within a time frame of 10 to 13 minutes.
2) She coloured the same picture in 5 minutes following Bharatanatyam sessions.
3) She appeared more focused and less distracted after her Bharatanatyam practices.
4) The colouring was more uniform and stayed within the lines better than the one she usually coloured.

Sample 2:

1) Individuals with intellectual disabilities often completed colouring the diagram within 5 minutes and 30 seconds to 7 minutes before the Bharatanatyam sessions.
2) She completed colouring the identical picture in under 3 minutes.
3) Her colouring appeared fairly even but seemed gloomy and improved.
4) One day, she was too preoccupied to play outside and did not take part in the experiment. That day, she didn't even attempt to colour the second diagram. Due of the monotony of repeating the task.

Sample 3:

1) 1.Who with an intellectual disability completed colouring the diagram in 12 minutes before the Bharatanatyam lessons.
2) 2. He did not colour the diagram and instead remained mostly inactive compared to the other 2 instances.
3) 3. He finishes colouring the diagram 5 minutes after the Bharatanatyam sessions.
4) 4. He had the least vibrant colouring compared to the other two girls and demonstrated better progress in Bharatanatyam sessions.

17.2. ANALYSIS 2

1) The samples were instructed to colour on days when they did not engage in Bharatanatyam practice.
2) They were provided with the image below and coloured it as shown in the samples.
3) They were presented with the identical image once more after one hour had passed. Devoid of 20 minutes of Bharatanatyam instruction. Here are the results.

17.3. ANALYSIS 3

Analysis 3 was conducted by examining the diagrams in part 1 and part 2 below. Part 1 diagrams were coloured before practicing Bharatanatyam, while Part 2 diagrams were coloured roughly an hour after the dance practice.

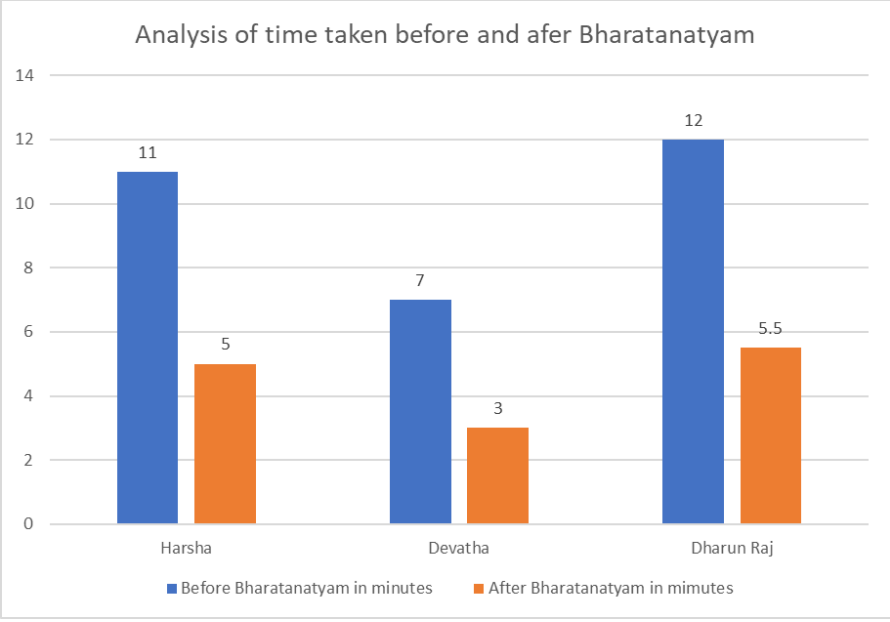
Colouring the diagrams in part 1 required approximately 10-12 minutes, whereas colouring the diagrams in part 2 took 9-10 minutes for all the samples. The colouring and gradient quality do not exhibit significant differences compared to analysis 1.

The performance is inconsistent for extended periods within the same day, during the 4-week project duration. The colouring of the picture demonstrates the children's ability to handle crayons and maintain close lines, indicating their focus.

However, the variation or speed was lacking in all three samples. Therefore, the impact decreases as the time interval between practice and drawing increases.

18. INFERENCE

18.1. INFERENCE FROM ANALYSIS



Article 1. X- axis –Minutes Y-axis- samples

1) The coloured pictures in part 1 are depicted before Bharatanatyam, whereas the coloured pictures in part 2 are shown after Bharatanatyam.

2) Part 2 in all three instances has superior colour coverage compared to the photographs in part 1. part 2 drawings.
3) The lines made with crayons are closer together compared to the lines in part 1 drawings.
4) Colouring in the random outer area has decreased in both samples with lower IQ. Specifically, sample 2 and 3.
5) The duration has been reduced by half in all three samples.
6) Sample 1 with Autism had the fastest time reduction and coloured more quickly than the other samples.
7) Sample 3, which had an IQ impairment, had more increase in colouring quality and reduced the time taken to colour the picture.
8) Sample 2 did not exhibit significant alterations in colouration, but the duration was reduced by half, similar to the other samples.
9) The eye motions have stabilized and are no longer roaming, which is a significant factor in reducing the time taken to finish the picture.
10) The samples were steadier and remained stationary without being distracted while drawing, unlike before.
11) They were colouring rapidly and handling crayons with increased precision, as seen by the quality of their work.
12) The response time when their name is called has only decreased by an average of 2 or 3 seconds across all three samples. However, the need to continuously mention their names has decreased.
13) These children with special needs exhibit delayed responses when addressed or engaged in conversation. Typically, they only reply by making 3 to 5 repeated calls. However, they only reacted after being called by their names two or three times following the dancing. Occasionally, they promptly responded when summoned.
14) The samples attempted to learn Dhrishti bedha but struggled to do so despite multiple efforts, including physically guiding their fingers to move their eyes in different directions.

18.2. ANALYSIS 2 INFERENCE

Analysis 2 aimed to determine if children's time reduction and colouring quality in part 2 of analysis 1 improved due to practice and familiarity gained during part 1 of the trial. All three samples displayed a lack of interest in colouring the same picture a second time, much to my surprise. They made no attempt to finish the colouring and remained idle for a long period.

The purpose of analysis 2 is to enhance the analysis 1 and its inference.

18.3. ANALYSIS 3 INFERENCE

Analysis 3 found that the impact of Bharatanatyam on participants' functional abilities decreased when the gap in time following practice exceeded one hour. Due to the project's short duration and lack of extensive training, it is not possible to gather and analyze the long-term effects. The article in "The Hindu" provides an example of a long-term influence on an individual with ASD, indicating that it is possible to observe durable and long-lasting results after years of practice, despite

the limited project period. Article Long-term enhancement of brain function and motor skills can be achieved by providing extended training to the three samples.

19. CONCLUSION

Bharatanatyam has a clear impact on the brain and neurons of children, as shown in Analysis 1. The crayon colouring was completed efficiently and quickly. We were investigating whether children completed colouring tasks more quickly when the tasks were repetitive.

As stated in Analysis 2, it was evident that the children shown minimal interest and were bored by the repetitive task. They did not even react the second time Bharatanatyam was not taught.

Therefore, the theory is confirmed as motor abilities and cognitive functioning appear to improve following Bharatanatyam practice sessions

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

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