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Article

The Effectiveness of Brain Gym in Improving Cognitive, Physical, and Social Skills in Children with Special Needs in an Inclusive School: A Qualitative Study

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Abstract

This qualitative study explores the effectiveness of Brain Gym exercises in enhancing cognitive, physical, and social skills in children with special needs within an inclusive school setting. Brain Gym consists of 26 movement-based activities designed to support coordination, attention, and learning readiness. The study follows five students aged 5–11, each with varying developmental challenges, over a 10-month intervention period. A case study methodology was used, employing daily observation, lesson planning, and tracking of Individualised Education Plan (IEP) goals. Students participated in Brain Gym sessions three to five times per week, with movements tailored to support targeted academic and analysed behavioural goals. Results indicated noticeable improvements in areas such as attention, literacy, motor coordination, and social interaction. While outcomes varied across individuals, trends suggested Brain Gym contributed positively to classroom engagement and skill acquisition. Limitations of the study include the small sample size, absence of a control group, limited representation of the full spectrum of disabilities, potential influence of other teaching methods and therapies, and reliance on observational data without formal triangulation. Although informal feedback was received from teachers and parents, it was not systematically collected or analysed. These findings suggest that Brain Gym may be a valuable complementary tool in inclusive education, warranting further research with larger and more diverse samples and the inclusion of controlled variables.

Keywords: Brain Gym, Cognitive, Physical, Social Skills, Special Needs, Inclusive, School

1. INTRODUCTION

This research investigates the application and impact of Brain Gym activities on children with special needs. Developed by Paul E. Dennison and Gail E. Dennison, Brain Gym is an educational program consisting of twenty-six movements designed to support sensorimotor abilities and ease learning (Dennison & Dennison, 2010). These movements are categorised into four main types: midline movements, energy exercises, deepening attitudes, and lengthening activities. Each category aims to activate specific brain functions such as coordination, balance, emotional regulation, and attention, ultimately supporting readiness to learn.

Brain Gym is part of a broader framework called Educational Kinesiology (or "Edu-K"), a discipline that emphasises the connection between movement and learning. The term "educational" stems from the Latin word *educere*, meaning "to draw out," while "kinesiology" derives from the Greek word *kinesis*, referring to motion. This philosophy suggests that purposeful movement can "draw out" a learner's innate potential (Brain Gym International, n.d.). Brain Gym activities are used across age groups and ability levels to support

development in various cognitive, physical, and social domains.

The theoretical basis for using Brain Gym with children with special needs is grounded in constructivism and neuroplasticity. Constructivist theories propose that children construct knowledge through active engagement with their environment (Piaget, 1977; Vygotsky, 1978). When children are provided with opportunities to move, manipulate, and explore, they can more effectively internalise concepts and build meaning. Brain Gym aligns with this by offering movement-based engagement as a pathway to learning. Similarly, research in neuroplasticity shows that the brain can change and reorganise itself in response to repeated experience and stimulation (Diamond, 2013; Sousa, 2016). This makes repetitive, intentional physical movement a valuable tool in supporting brain function in children with developmental differences.

Cognitive skills refer to the core mental abilities that enable learners to think, remember, pay attention, and solve problems (BrainAbilityPlace, n.d.). For children with special needs—such as those with Autism Spectrum Disorder (ASD), ADHD, Down Syndrome, or learning disabilities—developing these cognitive skills can be particularly challenging. Brain Gym aims to address these cognitive demands by improving focus, memory, and problem-solving through physical movement. Figure 1 shows the sub-skills under cognitive skills (BrainAbilityPlace, n.d.).

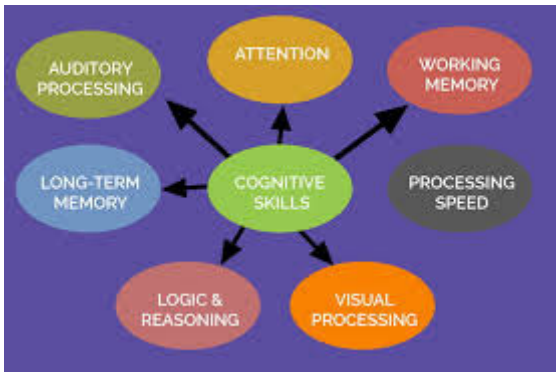

Figure 1: The sub-skills under cognitive skills

Physical skills—particularly fine and gross motor coordination—are essential for fostering independence, classroom participation, and overall development. Children with special needs often experience delays or difficulties in achieving motor milestones. Brain Gym's structured activities provide opportunities to build these foundational motor abilities in ways that are embedded into learning routines.

Social skills, including communication, empathy, and cooperation, are also crucial for inclusion. Students with special needs may face significant barriers to building relationships and navigating social contexts, particularly in inclusive classroom environments. Brain Gym's focus on group movement and shared routines may support increased social engagement and confidence, as anecdotal and early observational studies have suggested (Koester, 2000).

Inclusion in education emphasises equal opportunities for children with and without special needs to learn together in the same environment. It promotes belonging, participation, and access to learning (UNESCO, 2009). Inclusive practices are strengthened by interventions that are simple, adaptable, and beneficial for diverse learners. Brain Gym, with its low-resource, movement-based design, aligns with these principles.

RESEARCH AIM

This study aims to explore the effectiveness of Brain Gym in improving cognitive, physical, and social skills in children with special needs within an inclusive school setting, using a qualitative case study approach grounded in real-world classroom observations.

LITERATURE REVIEW

A literature review involves examining existing studies and sources related to the research topic to understand what has already been explored and where gaps remain. This review examines prior research on Brain Gym's effectiveness in improving **cognitive**, **physical**, and **social** development in children, especially those with special needs.

Cognitive and Academic Skills

Several studies have explored Brain Gym's impact on cognitive and academic development. Koester (2000), in a report frequently cited in Brain Gym literature, conducted a nonequivalent control group study with 205 students. Daily Brain Gym activities were associated with improved reading outcomes, though this study has not been formally peer-reviewed. Similarly, Irving (1996) examined the PACE process—a foundational Brain Gym sequence—among first-year nursing students and reported reduced anxiety and improved performance, but the study is unpublished and based on self-report data.

Harris (2016) documented a pre-post study involving 19 special education fifth graders, claiming notable gains in reading and math. However, this study has limited accessibility and lacks peer-reviewed validation. In contrast, Hyatt (2007), writing in a peer-reviewed journal, offered a critical perspective, concluding that most claims made by Brain Gym proponents lack empirical support.

Khalsa et al. (2012), in a peer-reviewed study unrelated to Brain Gym specifically, found that movement-based interventions such as yoga improved student attention and engagement. Jensen and Kenny (2004) suggested that cross-body movements—found in Brain Gym—may promote proprioceptive awareness and executive function, though Brain Gym was not the main focus of their study.

Emotional and Social Development

Indumathi (2019), in a doctoral thesis published via Shodhganga (an Indian thesis repository), examined teacher trainees who underwent Brain Gym and Pranayama exercises. The study found improvements in emotional maturity and social intelligence. Although not peer-reviewed, the thesis adds qualitative insight into Brain Gym's perceived benefits.

Kamala (2019), through a master's thesis in Shodhganga, investigated Brain Gym therapy's effect on ADHD and academic performance. The findings suggested positive gains, although the methodology and peer validation remain unclear.

Physical and Motor Skill Development

Several studies have addressed Brain Gym's influence on physical and motor skills. Jalilinasab et al. (2021), in a controlled study from Iran, found improvements in motor coordination among Brain Gym participants. However, the study appears in grey literature, not peer-reviewed databases. Pratiwi and Pratama (2020) also found gains in student concentration after four weeks of Brain Gym, though the study is similarly difficult to verify in scholarly indexes.

Nafiah, Gifari, and Oktaviani (2025) explored the PACE sequence's effect on learning concentration, concluding that Brain Gym positively influenced student focus. This study, however, is reported in non-peer-reviewed outlets. Stephenson et al. (2007), in a peer-reviewed publication, cautioned educators about using perceptual-motor programs like Brain Gym, noting that empirical evidence linking such programs to improved academic outcomes is weak. Similarly, Watson and Kelso (2014) compared Brain Gym to general physical activity in students with developmental disabilities and found no consistent advantage for Brain Gym, raising questions about its unique effectiveness. Nagarkar (2018) investigated Brain Gym's role in supporting children with Autism Spectrum Disorder (ASD), reporting improvements in quality of life and academic and behavioural areas. However, this study was not published in a peer-reviewed journal and appears primarily in grey literature.

METHODOLOGY

Research Design

This study employed a **qualitative case study design** to explore the effectiveness of Brain Gym activities on cognitive, physical, and social skill development in children with special needs. A case study design is well-suited to investigate real-world phenomena within their natural context, offering deep insights into participant behaviour and response over time (Moser & Korstjens, 2017; Guralnick, 2011).

Sampling Strategy

The sampling method used was **convenience sampling**. Participants were selected from the group of students already assigned to the researcher as part of her role as a special educator. As such, the researcher did not have

control over participant selection. However, the sample reflected diversity in age, diagnosis, and developmental needs, offering valuable insight into Brain Gym's application across varied profiles (Moser & Korstjens, 2108).

Participants

Five students with distinct developmental challenges participated in the study. Three were in Kindergarten 2 (ages 5–6), and two were in Grade 5 (ages 10–11). Diagnoses included ADHD, global developmental delay, expressive language disorder, and autism spectrum disorder. Pseudonyms were used to protect student identities.

Setting

The study took place in an inclusive IB school where children with special needs received both in-class support and pull-out sessions. Brain Gym was administered 3–5 times per week before one-on-one sessions, lasting 3–5 minutes. Occasionally, group Brain Gym sessions were conducted with Early Years students.

Ethical Considerations

Parental consent was obtained at the start of the academic year via a signed undertaking and through the IEP document, which explicitly listed Brain Gym as a method used to support goal achievement. Children were too young for formal assent, but Brain Gym activities were conducted in an enjoyable and non-coercive manner. **Confidentiality** was strictly maintained: individualised data were shared only with the respective student's family, and pseudonyms were used in the research. Observational notes, videos (when taken), and progress reports were securely stored.

Data Collection

Data were collected through **direct observation** and **IEP goal tracking**. Each child's daily responses to Brain Gym activities were recorded in structured lesson plans maintained in Google Sheets. Observations included attention, engagement, skill use, and behavioural responses. Videos were occasionally recorded to supplement field notes. Student progress was reviewed weekly and reflected in triannual report cards.

Data Analysis

Although primarily qualitative in design, the study also included **quantitative tracking of IEP goal achievement**. Each IEP domain (e.g., language, numeracy, motor skills) included specific measurable goals. Weekly tracking allowed the researcher to evaluate progress and adjust strategies. Observational data were analysed through **domain-wise thematic reflection**, identifying patterns of change, resistance, and responsiveness across time.

Trustworthiness

To ensure rigour and validity in qualitative research, the following principles were observed:

1. **Credibility**: The researcher is a certified Brain Gym 104 practitioner, trained in person by SensAble Child and certified by Brain Gym International. She is a licensed special educator under the Rehabilitation Council of India with 13 years of experience in inclusive schools. Triangulation of data was achieved through observational notes, videos, IEP tracking, and teacher-parent communication.
2. **Dependability**: A consistent weekly routine of Brain Gym sessions, observations, and IEP tracking was followed for each child. The intervention was implemented over 10 months, ensuring stability and consistency.
3. **Confirmability**: All raw data, including lesson plans, IEP goals, and intervention notes, were systematically documented and securely stored. Analysis was based on observable progress and aligned with IEP objectives, minimising researcher bias.
4. **Transferability**: While findings are context-specific, the diversity of the sample—spanning age, gender, and diagnosis—suggests that similar inclusive settings may benefit from using Brain Gym as a supplemental strategy.

RESULTS

This section presents a qualitative synthesis of individual student responses to Brain Gym interventions over a 10-month period. Five students participated, each with unique developmental profiles and Individualised

Education Plans (IEPs). Pseudonyms are used throughout to ensure confidentiality.

Student Profiles

Arun

Arun exhibited increased task engagement and attentiveness. Improvements were noted in orientation skills (e.g., fewer letter/number reversals), handwriting legibility, and visual tracking. His ability to follow instructions became more consistent, and his verbal communication progressed from simple phrases to complete sentences. In literacy, he demonstrated improved sight word recognition, phonics awareness, and early reading fluency. Numeracy skills included sequencing and number comparison. Arun also gained independence in self-help tasks such as dressing and using classroom tools. He achieved 66% of his IEP goals, including full attainment in writing, phonological awareness, visual perceptual skills, early education concepts, and self-help domains.

Ravi

Ravi showed increased confidence and initiative, often leading Brain Gym activities for his peers. Improvements were observed in visual discrimination, auditory perception, and handwriting neatness. He demonstrated growing competence in phonics, sight word reading, and number identification. His communication developed to include sentence-level expression of needs. Participation in physical education and group activities also improved. IEP goal tracking indicated steady progress across cognitive, motor, and social domains.

Kabir

Kabir displayed improved attention regulation and faster task completion. He initiated academic tasks with minimal prompting and followed multi-step instructions with increasing accuracy. Language gains included storytelling, sequencing, and oral recitation. His reading skills advanced to include CVC word decoding and recognition of sight words. Writing abilities progressed from name writing to structured word copying. Numeracy skills developed to include backward counting, number comparison, and basic arithmetic using manipulatives. Kabir's classroom behaviour also reflected improved focus and social modelling.

Meera

Meera responded positively to Brain Gym routines, frequently requesting the activities before academic work. Her ability to initiate tasks, maintain focus, and follow classroom directions improved steadily. She demonstrated reading comprehension of grade 3-level texts and made progress in vocabulary and grammar. In mathematics, she achieved accuracy in multi-digit operations with some support. Improvements in self-regulation and personal awareness were noted, including understanding of privacy and appropriate behaviour.

Taran

Taran sustained attention on academic work for longer periods and demonstrated improved verbal expression of emotions. His social engagement increased, including greater willingness to share materials and participate in group work. Although he did not meet all his IEP goals, Taran showed a heightened interest in literacy activities and responded more positively to classroom routines. He met selected numeracy goals, including subtraction and long division. Gains in self-regulation were observed through consistent behaviour in personal care routines.

CROSS-CASE OBSERVATIONS

The following common trends emerged across all five cases:

1. **Cognitive Skills**: Improved attention, task initiation, phonemic awareness, and early literacy skills were observed. Students demonstrated increased accuracy in letter-sound correspondence, sight word reading, and number recognition.
2. **Physical and Motor Skills**: Enhanced handwriting, improved gross motor participation (e.g., PE, swimming), and increased independence in self-care routines were documented.

3. **Social and Behavioural Development**: Students showed improved peer interaction, greater emotional expression, increased classroom participation, and better routine compliance.
4. **Academic Readiness**: Engagement in academic tasks improved, with some students exceeding expected outcomes in reading and numeracy.

These findings suggest that Brain Gym activities may support gains in multiple developmental domains when implemented consistently in an inclusive setting. However, individual variability was present, and progress was influenced by factors such as diagnosis, baseline skill levels, and parallel interventions.

IEP GOALS VS. ACHIEVED SKILLS

1. Arun

- Attention, Classroom Behavior and Following Instructions
    - By Feb 2024, when given instructions in the classroom, Arun will begin the task with only 1 prompt within 1 minute of receiving the instruction at 100% accuracy for 5 consecutive days.
    - By Feb 2024, when given a task to complete, Arun will listen carefully to instructions, assemble necessary materials, begin working neatly and promptly, remain focused until the task is completed, examine the product to ensure it is complete, and check back with the person who assigned the task by following all 6 steps with 100% accuracy on 4/5 tasks.
- Language & Communication Skills
    - By Oct 2023, Arun will answer simple questions in a conversation such as, how are you, what are you doing using verb noun phrase.
    - By Nov 2023, Arun will listen to very simple stories with visuals and answer very simple one word question with and without options.
    - By Dec 2023, When given a story, Arun will use pictures to tell the story with 80% accuracy in 4/5 trials.
    - By Nov 2023, When asked by the teacher, Arun will sing or state the days of the week with 100% accuracy with not more than 3 verbal prompts.
- Literacy: Reading
    - By April 2024, Arun will follow words left to right and top to bottom with return sweep.
    - By April 2024, Arun will read days of the week with 70% accuracy.
    - By Nov 2023, When asked,Arun will name all upper and lower case letters with 80% accuracy four of five trials.
    - By Dec 2023, When presented with a list of CVC words, Arun will correctly read the words with 70% accuracy 4 of 5 trials.
- Phonics & Phonological Awareness
    - By November 2023, Arun will identify rhyming words through pictures.
    - By November 2023, Arun will orally blend three phonemes or read words using sight word approach with 90% accuracy.
    - By Nov 2023, When presented with single syllable words, Arun will distinguish the initial and final sounds with 80% accuracy in four of five trials.
    - By October 2023, Arun will find the beginning letter of simple CVC words with 80% accuracy, with or without 2 options.

- By October 2023, Arun will identify the ending sound- letter association given a picture for a CVC word with 80% accuracy.
- By Nov 2023, Arun will match like sounds in words at the beginning position with pictures.
- By Nov 2023, Arun will sequence the letters correctly from a to z.

- Writing Skills
  - By Feb 2024, Arun will print own first name.
  - By Feb 2024, Arun will learn to copy his first name with correct alignment and spacing in a four line notebook.
  - By Dec 2023, Arun will write lower case and upper case letters.
  - By Dec 2023, Arun will write numbers upto 20.
  - By Dec 2023, Arun will learn the correct directionality of strokes for the letters.
  - By Jan 2024, When using a whiteboard or letter tiles Arun will copy words from a visual model with 90% accuracy 4 out of 5 trials.
  - By Jan 2024, With pencil and paper, Arun will copy words independently from a visual model with 90% accuracy 4 out of 5 trials.
- Visual Perceptual Skills
  - By Nov 2023, Arun will show understanding of spatial positions left, right, up, down, near, far, on, under and in between.
  - By Nov 2023, Arun will continue the simple pattern given 123123 and draw/place the shapes/ pictures.
  - By Nov 2023, Arun will learn to arrange 4 pictures in the correct order from memory.
  - By Nov 2023, After looking at a picture or photo for one minute, Arun will be able to recall details(yes or no questions only) with 80% accuracy 4 out of 5 trials.
  - By Jan 2024, Arun will be able to do visual figure ground discrimination worksheets and activities (being able to find out a specified image/text in a busy background)- hidden picture puzzles and finding certain details, finding 3-4 specified objects/letters/numbers in a busy worksheet with many objects, finding the shadow, colouring as per number code or colour code 4-5, finding the 5 differences with 90% accuracy 4 out of 5 trials.
- Auditory Perceptual Skills
  - By March 2024, After listening to the teacher read a series of words, Arun will correctly repeat a series of 3 words with 80% accuracy 4 of 5 trials.
  - By Dec 2023, When presented with a set of 3 oral directions, Arun will accurately complete the tasks assigned in the correct order with 80% accuracy 4 of 5 trials.
  - By Nov 2023, When given questions about categories, Arun will respond to yes/no questions with 80% accuracy for 4 out of 5 sessions. (e.g. ”Is a shirt something to eat?” answer--”No”)
  - By Feb 2024, When given questions using descriptors, presented aloud, Arun will tell appropriate categories with 80% accuracy for 4 out of 5 sessions. (e.g. “Which is little, an airplane or an ant?” answer “Ant”)
- Numerical Skills
  - By Nov 2023, Arun will sequence numerals upto 20 with 80% accuracy.

  - By April 2024, Arun will learn to name and identify numerals 0 to 50.
  - By April 2024, Arun will be able to tell, identify or choose before, after and in between number.
  - By April 2024, Arun will be able to tell bigger or smaller number.
- Early Education Concepts
  - By Oct 2023, Arun will learn to identify and name rectangle and square.
  - By Oct 2023, Arun will be able to identify tall and short with pictures.
  - By Oct 2023, Arun will understand concept of conservation. eg: 5 counters placed in different ways is still 5 counters.
- Self-Help Skills
  - By Dec 2023, Arun will learn to wear shoes properly: open velcro, put feet in, secure velcro.
  - By Dec 2023, Arun will learn buttoning and unbuttoning.
  - By April 2024, Arun will learn to independently pull down and pull up his shorts properly.
- Gross & Fine Motor Skills
  - By Jan 2024, Arun will learn to put glue: glue stick and squeeze out liquid glue.
  - By April 2024, Arun will colour and fill the space more within the outline.
  - By Feb 2024, Arun will learn to cut slanting and curvy lines.

Arun's achievement showed enhanced arousal levels, energy, and task focus. He began engaging in academic tasks with greater interest. He showed reduced reversals in letters and numbers, demonstrating better orientation. He showed improved handwriting legibility and formation. He also showed more consistent eye contact. He showed increased attention, class participation and more instances of following instructions. He started answering simple questions using verb noun phrase which then proceeded to a complete simple sentence with usage of pronouns. He listened to simple visual stories and answered simple questions in a word or phrase with or without options. He could tell a simple story by looking at the pictures. He could sing or state the days of the week with less than three verbal prompts. He started following words left to right, top to bottom with a return sweep. He could identify the days of the week with 70% accuracy after 10 months. He could name upper and lower case letters with 80% accuracy. He could identify CVC words, given two options. He could identify rhyming words through pictures. He started reading CVC words with 90% accuracy using the sight word approach. He could identify the beginning and ending letter in CVC words with 80% accuracy. He could match beginning letters in words with pictures. He was able to sequence the letters a to z with some prompts. He could print his first name and copy his full name with appropriate alignment and spacing in a four line notebook. He could write uppercase letters in six months and lower case letters by ten months. Though some reversals were present at times, he could write numbers upto 20. He could copy words from a visual model, using letter tiles and later using pencil and paper. He was able to achieve visual spatial skills, visual rhythm, visual memory and visual figure ground discrimination skills. Auditory memory and auditory comprehension improved when he was able to repeat a series of 3 words, complete 3 tasks orally directed, answer yes no questions about categories and tell appropriate categories when given questions using descriptors. He could sequence numerals upto 20, identify numerals upto 50 and tell bigger or smaller numbers upto 20. Early Education concepts were achieved when he identified and named the 4 basic shapes, identified tall and short and understood the concept of conservation. Self help skills improved when he learnt to wear velcro shoes independently, buttoning and unbuttoning and pull up and down his shorts. Arun learnt to squeeze out glue, colour and fill the space more within the outline and cut slanting and curvy lines. He achieved 66% of his IEP goals and was able to achieve 100% goals in phonics and phonological awareness, writing skills, visual perceptual skills, early education concepts and self help skills.

2. Ravi

- Language & Communication Skills
    - By Mar 2024, Ravi will speak more audibly.
    - By Dec 2023, Ravi will start to communicate his needs, wants and resolve conflicts with his peers by using a simple sentence with 90% accuracy.
- Literacy: Reading
    - By Dec 2023, Ravi will correctly identify the front and back of an age appropriate book.
    - By Dec 2023,When given KG1 sight word list, Ravi will learn to accurately read with 90% accuracy 3 out of 4 trials.
    - By Feb 2024, Ravi will be able to identify or read the days of the week with 80% accuracy, 3 out of 4 trials.
- Phonics & Phonological Awareness
    - By November 2023, Ravi will identify rhyming words through pictures.
    - By December 2023, Ravi will identify pictures beginning with a given sound with 80% accuracy.
    - By December 2023, Ravi will identify pictures ending with a given sound with 80% accuracy.
    - By December 2023, Ravi will identify the beginning sound- letter association given a picture for a CVC word with 80% accuracy.
    - By December 2023, Ravi will identify the ending sound- letter association given a picture for a CVC word with 80% accuracy.
    - By January 2024, Ravi will correctly associate the letters with their sound with 90% accuracy.
- Writing Skills
    - By Jan 2024, Ravi will sit in the correct posture (feet firmly planted on the ground, back upright and slightly bend, paper tilted to the right) while writing.
- Visual Perceptual Skills
    - By December 2023, Ravi will be able to do simple visual discrimination activities and worksheets with 80% accuracy. (find the odd one, match the same shape, find the detail in a picture etc)
    - By December 2023, Ravi will continue the simple pattern given 121212, 122122, 112112, 123123 and draw/place the shapes/ pictures.
    - By December 2023, Ravi will learn to arrange 3 pictures in the correct order from memory.
    - By Nov 2023, Ravi will be able understand and apply spatial directions(left, right, up, down, near, far, inside, outside, in between) in activities and worksheet with 80% accuracy.
- Auditory Perceptual Skills
    - By February 2024, Ravi will be able to identify common animal and environmental sounds heard with 80% accuracy.
    - By December 2023, When presented with a set of 3 oral directions, Ravi will accurately complete the tasks assigned in the correct order with 80% accuracy 4 of 5 trials.
    - By January 2024, When given questions about categories, Ravi will respond to yes/no questions with 80% accuracy for 4 out of 5 sessions. (e.g. ”Is a shirt something to eat?” answer--”No”)

    - By January 2024, When given questions using descriptors, presented aloud, Ravi will tell appropriate categories with 80% accuracy for 4 out of 5 sessions. (e.g. "Which is little, an airplane or an ant?" answer "Ant")

- Numerical Skills
    - By April 2024, Ravi will learn to name and identify numerals 20 to 50.
    - By Dec 2023, Ravi will learn to write numbers within the square box in the notebook with 90% accuracy.
    - By February 2024, Ravi will do backward counting 20 to 1 with 80% accuracy.
    - By January 2024, Ravi will able to tell which quantity is more or less, within 15 with 80% accuracy.
- Early Education Concepts
    - By December 2023, Ravi will be able to identify and name the four primary colours.
    - By December 2023, Ravi will be able to name the classification categories: animals, birds, vehicles, clothes.
    - By November 2023, Ravi will understand concept of conservation. eg: 5 counters placed in different ways is still 5 counters.
- Gross & Fine Motor Skills
    - By April 2024, Ravi will learn to eat faster.
    - By April 2024, Ravi will eat more quantity of food.
    - By April 2024, Ravi will participate more in activities such as jumping, running and in the PE and swimming lessons.

Ravi's achievement enthusiastically demonstrated Brain Gym activities to his classmates and family. He led Brain Gym exercises for his peers, indicating increased confidence. His visual perceptual skills improved significantly; response accuracy and speed increased. There were notable improvements in handwriting and task neatness. There were improvements in his cognitive skills: he could identify the front and back of an age appropriate book by term 2, he started reading kindergarten 1 sight words with 90% accuracy, he identified and read the days of the week with 90% accuracy, he identified rhyming words through pictures, identifying pictures beginning and ending with a given sound with 80% accuracy, identifying beginning and ending letter sound association for a CVC word with 80% accuracy and correctly associating letters with their sounds with 90% accuracy. He achieved many visual perceptual skills such as visual discrimination, patterns, visual memory and spatial directions. He was also able to achieve all auditory perceptual skills goals such as identifying animal and environmental sounds, completing 3 oral directions and responding to questions about categories and descriptors with 80% accuracy. He achieved numerical skills goals such as identifying and naming numbers 20 to 50, writing numbers within the square boxes of his notebook, backward counting 20 to 1 and more or less concept within the number 15. All early education concept goals such as naming primary colour and classification categories and understanding concept of conservation were achieved. He also showed improvement in physical skills when he achieved goals such as eating more quantity of food faster and participation in running, jumping, PE and swimming. His social skills improved: he started speaking more audibly by term 3, he started communicating his needs and wants using a simple sentence.

3. Kabir

- Attention, Classroom Behavior & Following Instructions
    - By Dec 2023, Kabir will complete easy and medium level attention enhancement activities.
    - By Feb 2024, When given instructions in the classroom, Kabir will begin the task with only 1 prompt within 1 minute of receiving the instruction at 100% accuracy for 5 consecutive days.

    - By Feb 2024, When given a task to complete, Kabir will listen carefully to instructions, assemble necessary materials, begin working neatly and promptly, remain focused until task is completed, examine product to ensure it is complete, and check back with the person who assigned the task by following all 6 steps with 100% accuracy on 4/5 tasks.

- Language & Communication Skills
    - By Dec 2023, When given a story, Kabir will use pictures to tell the story with 80% accuracy in 4/5 trials.
    - By Jan 2024, When asked by the teacher, Kabir will recite poems, rhymes, songs and stories with repeated patterns with 80% accuracy in 4/5 trials.
    - By Jan 2024, When asked by the teacher, Kabir will retell stories in logical and/or sequential order with 80% accuracy in 4/5 trials.
    - By Dec 2023, When asked by the teacher, Kabir will follow three step oral directions with 80% accuracy in 4/5 trials.
    - By April 2024, When asked by the teacher, Kabir will sing or state months of the year with 100% accuracy with not more than 3 verbal prompts.
- Literacy: Reading
    - By April 2024, Kabir will read months of the year with 80% accuracy.
    - By Dec 2023, When given KG1 sight word list, Kabir will learn to accurately read with 90% accuracy 3 out of 4 trials.
    - By Nov 2023, When asked, Kabir will name all upper and lower case letters with 80% accuracy four of five trials.
    - By Dec 2023, When presented with a list of CVC words, Kabir will correctly read the words with 80% accuracy 4 of 5 trials.
- Phonics & Phonological Awareness
    - By Dec 2023,When asked, Kabir will identify the representative sounds of all lowercase letters with 80% accuracy four of five trials. achieved 2nd term
    - By Nov 2023, Kabir will identify rhyming words through pictures.
    - By Jan 2024, When given a set of three words, Kabir will be able to tell one more rhyming word.
    - By Nov 2023, Kabir will orally blend three phonemes to read CVC words.
    - By Nov 2023, When presented with single syllable words, Kabir will distinguish the initial, middle and final sounds with 80% accuracy in four of five trials.
    - By Oct 23, Kabir will identify the ending sound- letter association given a picture for a CVC word.
    - By Jan 2024, Kabir will identify and orally complete the patterns heard (auditory closure) with 80% accuracy.
- Writing Skills
    - By Nov 2023, Kabir will be able to draw a diamond shape with 80% accuracy in 4 /5 trials.
    - By Feb 2024, Kabir will print own first name.
    - By Dec 2023, Kabir will write lower case and upper case letters.

- By Dec 2023, Kabir will write numbers upto 20 independently.
- By Jan 2024, When using a whiteboard or letter tiles Kabir will copy words from a visual model with 90% accuracy 4 out of 5 trials.
- By Jan 2024, With pencil and paper, Kabir will copy words independently from a visual model with 90% accuracy 4 out of 5 trials.

- Visual Perceptual Skills
  - By Jan 2024, Kabir will be able to do visual figure ground discrimination worksheets and activities (being able to find out a specified image/text in a busy background)- hidden picture puzzles and finding certain details, finding 3-4 specified objects/letters/numbers in a busy worksheet with many objects, finding the shadow, colouring as per number code or colour code 4-5, finding the 5 differences with 90% accuracy 4 out of 5 trials.
  - By Nov 2024, Kabir will continue the simple pattern given 121212 112112 122122 123123 and draw/ place the shapes/ pictures.
  - By Nov 2023, Kabir will learn to arrange three daily life events in the order that they occur with 90% accuracy 4/5 trials (visual temporal sequencing).
  - By Nov 2023, Kabir will learn to arrange 3-4 pictures in the correct order from memory.(visual sequential memory)
- Auditory Perceptual Skills
  - By Feb 2024, Kabir will develop auditory rhythm- will be able to say rhyming words and sing rhymes and songs.
  - By Feb 2024, after listening to a pattern of sounds made by the teacher, Kabir will duplicate the pattern heard with 80% accuracy 8 of 10 trials.
- Numerical Skills
  - By April 2024, Kabir will learn to name and identify numerals 0 to 50.
  - By Jan 2024, Kabir will be able to tell, identify or choose before, after and in between number.
  - By April 2024, Kabir will be able to tell bigger or smaller number.
  - By Jan 2024, Given two collections of objects, Kabir will compare the collections using the terms more, less and equal with 100% accuracy 4/5 trials.
  - By Feb 2024, Kabir will do backward counting 20 to 1 with 80% accuracy.
  - By March 2024, Given two or more sets of manipulatives, Kabir will apply the concept of addition (upto 20) to combine the sets and find the total amount with 80% accuracy in 4/5 trials.
  - By March 2024, Given two of manipulatives, Kabir will apply the concept of subtraction (upto 20) to find the difference in numeric value between the two sets with 80% accuracy in 4/5 trials.
  - By April 2024, Given picture worksheets, Kabir will apply the concept of addition and subtraction upto 20 with 80% accuracy in 4/5 trials.
- Early Education Concepts
  - By Oct 2023, Kabir will be able to identify tall and short with pictures.
- Speech Sounds
  - By the end of the year, Kabir will be able to produce the /sh/ sound in the medial position.

- By the end of the year, Kabir will be able to produce the /s/ sound in all the positions- initial, medial and final.

Kabir 's achievement modelled positive behaviors like drinking water slowly for peers. He demonstrated enhanced phonemic blending skills and reading fluency of CVC words.He also demonstrated quicker completion of classroom activities. At the end of ten months, Kabir could complete easy and medium level attention enhancement activities, initiate classroom activities with only one prompt and complete tasks by listening to the instructions, assembling materials, remaining focused and ensuring that the product is checked back to the teacher. There was a notable improvement in language skills. Within three months, he started telling stories through pictures, retelling stories in the logical order and singing or stating the months of the year. In ten months, he recited poems, rhymes, songs and stories and followed three step oral directions. He read months of the year, kindergarten sight words, all upper and lower case letters and CVC words. Strong phonological awareness was developed when Kabir associated sounds to letters, identified rhyming words through pictures, orally told rhyming words, blended three phonemes together, distinguished initial, medial and final sound, identified ending sound letter association for a CVC word and orally completing patterns heard. His writing skills showed positive growth as he drew diamond shape, printed his first name, wrote upper and lower case letters, wrote numbers upto 20 and copied words on a whiteboard and paper. He developed visual perceptual skills such as visual figure-ground discrimination, patterns, visual temporal sequencing and visual sequential memory. Alongside, he developed auditory rhythm too. In numeracy, he could name numerals upto 50, tell before, after and in between numbers upto 30, tell bigger or smaller numbers upto 40, identify more, less or equal quantities, backward count 20 to 1, add and subtract upto 20 with manipulatives and picture worksheets. He learnt to identify tall and short and could produce the sounds */sh/* and */s/* in the different positions.

4. Meera

- Attention, Classroom Behavior & Following Instructions
    - By December 2024, when given instructions in the classroom, Meera will begin the task with 4 prompts at 100% accuracy for 5 consecutive days.
- Literacy
    - By December 2024, Meera will study some part of the novel- 'Hungry To Read' and learn:
        - to orally summarise the main events of a chapter
        - new vocabulary
        - to answer direct and inferential questions from the chapter
        - grammar exercises based on the chapter
        - to predict what will happen next
    - By November 2024, Meera will be able to describe an object or a familiar person in five written sentences.
    - By December 2024, Meera will be able to describe an event she has experienced in four sentences.
    - By December 2024, Meera will be able to make simple and compound sentences with familiar words. (1 prompt for compound sentences)
    - By November 2024, Meera will learn to answer direct questions by using the words from the question.
    - By December 2024, Meera will learn to answer inferential and indirect questions with 50% accuracy.
- Numeracy Skills
    - By December 2024, Meera will be able to do addition with and without carryover of a 5 digit number with 70% accuracy.

- By December 2024, Meera will be able to do subtraction with and without borrowing of a 5 digit number with 60% accuracy.
- By December 2024, Meera will learn multiplication 3 digit x 3 digit with prompts for the steps.

- Gross & Fine Motor Skills, Self- Help Skills
  - By December 2024, Meera will ensure own privacy by using the cubicle to change into her swimsuit.

Meera's achievement pro-actively requested Brain Gym activities before academic tasks, showing a preference for the routine. She exceeded learning expectations in literacy and numeracy. When given instructions in the class, she began the task with 4 prompts with 100% accuracy. With some guidance, her ability to focus attention, participate in the classroom discussion, read, understand and follow two step instructions and reducing the instances of speaking in a loud tone improved. She was able to answer direct questions from a grade 3 level novel and passages. She showed some improvement in describing an object, person, making simple and compound sentences, answering inferential questions, attaining new vocabulary, comprehending fiction and non fiction passages and some grammar concepts. In numeracy, she was able to do addition of a 5 digit number with carryover with 70% accuracy and subtraction of a 5 digit number with borrowing with 60% accuracy. She learnt to multiply 3 digit x 3 digit with some prompts for the steps. As a growing girl, she understood the importance of ensuring her own privacy by changing into her swimsuit in a cubicle.

5. Taran

- Attention, Classroom Behavior & Following Instructions
  - By January 2025, when given instructions in the classroom, Taran will begin the task with only 2 prompts within 1 minute of receiving the instruction at 100% accuracy for 5 consecutive days.
  - By March 2025, during class, Taran will not hum/ sing with no more than 2 reminders each day on 4/5 days.
- Literacy
  - By April 2025, Taran will study the novel- 'Hungry To Read' and learn:
    - to orally summarise the main events of a chapter
    - new vocabulary
    - to answer direct and inferential questions from the chapter
    - grammar exercises based on the chapter
  - to predict what will happen next
- Social Emotional Skills
  - By March 2025, Taran will learn to share school material with his peers at appropriate times.
- Auditory Perceptual Skills
  - By April 2025, Taran will improve auditory discrimination by responding to verbal instructions.
- Numeracy Skills
  - By October 2024, Taran will learn and remember the meaning of expanded form and learn the steps.
  - By November 2024, Taran will learn the meaning of predecessor and successor.
  - By November 2024, Taran will subtract with borrowing with no mistakes.
  - By November 2024, Taran will subtract in column form from a vertically written question correctly.

- By April 2025, Taran will learn multiplication 3 digit x 3 digit correctly.
- By October 2024, Taran will learn division in long division method from a vertically written question correctly.

- Gross Motor Skills, Self-Help Skills
  - By January 2025, Taran will insure own privacy by closing the bathroom door when using the bathroom, using bathroom only for tucking in his shirt.
  - By January 2025, Taran will learn not to touch or scratch his private part in public view.

Taran's achievement showed increased ability to focus on academic work for up to 30 minutes. He started expressing emotions verbally, an improvement in social-emotional skills. His weekly behavior charts indicated better behavior, and social interactions improved. In five months, when given whole group instructions in the classroom he began the task with 2 prompts with 100% accuracy. He stopped humming or singing during lessons with no more than 2 reminders on 4/5 days. Though he did not achieve his literacy IEP goals, he showed improved interest in literacy novels and passages, making sentences and comprehension. He started to share school material with peers. He achieved the auditory discrimination goal. In numeracy, he achieved the goals of expanded form, predecessor and successor, subtract with borrowing, subtract in column form and long division from a vertically written expression. As a growing boy, he ensured his own privacy by closing the bathroom door, tucking his shirt in only in the bathroom and not scratching or touching his private part in front of others.

DISCUSSION

This qualitative case study investigated the impact of Brain Gym activities on the cognitive, physical, and social development of five children with special needs in an inclusive school setting. The findings suggest that consistent, structured Brain Gym sessions can support increased attention, motor coordination, academic readiness, and emotional regulation. These outcomes are consistent with movement-based learning theories and previous studies indicating that physical activity may enhance learning readiness (Khalsa et al., 2012).

Students demonstrated individualized improvements aligned with their IEP goals. For instance, Arun and Kabir progressed in phonological awareness and writing fluency, while Ravi and Meera showed enhanced self-regulation and academic engagement. Taran exhibited gains in attention and behavioural control. These patterns reflect the theoretical lens of **constructivism** and **neuroplasticity**, which emphasise experiential learning and the brain's capacity to reorganise through repeated, purposeful activity (Piaget, 1977 Diamond, 2013).

However, several limitations must be acknowledged. First, the study lacked a control group, which prevents direct comparison of Brain Gym outcomes against a non-intervention baseline. Second, children were simultaneously exposed to other pedagogical strategies, therapies, and developmental supports both within and outside the school. These **extraneous variables** may have contributed to observed improvements, making it difficult to isolate Brain Gym's effects. Third, the sample size was small (n = 5), and the use of **convenience sampling** limits the representativeness of the results. A further limitation relates to the **scope of disabilities represented**. Although the sample included children with ADHD, Autism Spectrum Disorder, Expressive Language Disorder, and Global Developmental Delay, the study does not capture the diversity of all 21 disability categories listed under India's Rights of Persons with Disabilities (RPWD) Act, 2016.

Implementation challenges were also evident. General education teachers often conflated Brain Gym with general brain breaks, leading to inconsistent application. Even after receiving orientation, many educators lacked confidence in independently facilitating the program. This reflects broader challenges in embedding specialised interventions within inclusive classrooms, as described by Florian and Black-Hawkins (2011).

IMPLICATIONS OF THE STUDY

- For educators, Brain Gym may serve as a low-cost, easily implementable strategy to improve student readiness, attention, and self-regulation. Embedding it into daily routines could enhance engagement without requiring additional teaching time or resources. However, clear training is essential to avoid misapplication or dilution of its intended outcomes.

- For therapists, Brain Gym can complement occupational and speech therapy goals, especially in enhancing fine motor coordination, midline crossing, and sensorimotor integration. Therapists working in schools may consider co-planning movement breaks or recommending specific Brain Gym sequences aligned with therapeutic objectives.
- For policymakers and school leaders, the findings suggest the need for greater integration of movement-based programs into inclusive education policy and curriculum planning. Systematic professional development and monitoring can support sustainable and accurate implementation. However, caution should be exercised before large-scale adoption until further empirical evidence is available.

CONCLUSION

This study explored the use of Brain Gym as a supplementary strategy to support cognitive, physical, and social development in children with special needs within an inclusive school setting. Observations across five case profiles suggest that, when implemented consistently and intentionally, Brain Gym activities may contribute to improvements in attention, task engagement, fine motor skills, and social interaction. While these outcomes are promising, the findings must be interpreted within the limitations of a small, non-randomised sample and the presence of other concurrent interventions. The study does not claim definitive causal effects but highlights Brain Gym's potential as a practical, movement-based approach that aligns with inclusive and holistic education frameworks. Given the preliminary nature of these findings, future research should employ controlled study designs, include a broader range of disabilities, and utilise standardised outcome measures to evaluate the program's effectiveness. If supported by further evidence, Brain Gym may hold value as part of a multimodal support strategy in inclusive education.

FUTURE SCOPE OF THE STUDY

Further research should involve larger and more diverse participant groups, include children with varied disabilities, and apply controlled, mixed-method designs to assess the independent effects of Brain Gym. Additionally, longitudinal studies are needed to understand whether gains in attention, behaviour, and academic performance are sustained over time. Standardised outcome measures and triangulation with parent and teacher reports can strengthen the reliability and generalisability of findings.

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Authors' Contribution

This is a single-author study. The author conceptualised the research, designed the methodology, conducted the intervention and observations, analysed the data, and wrote the manuscriptt.

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Availability of Data and Materials

Due to the sensitive nature of the data involving minors with special needs and institutional confidentiality policies, the raw data (including IEP goals, observation notes, and videos) are not publicly available. Summarised findings and methodological details are transparently reported in the manuscript.

Declaration of Conflict

The author declares no conflict of interest in relation to the content or findings of this study.

Clinical Trial Number

Not Applicable.

Human Ethics and Consent to Participate

This study does not involve clinical or biomedical research. Informed parental consent was obtained for all participants through institutional IEP procedures. No identifying information is shared, and pseudonyms were used to maintain confidentiality. The research complies with ethical practices for educational settings involving minors.

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