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Article

Effect of Brain Plasticity-Based Activities on Attention among Students with Specific Learning Disabilities in Inclusive Schools

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Abstract:

Students with Specific Learning Disabilities (SLD) frequently experience attention difficulties that compound the academic challenges associated with reading, writing, and mathematical reasoning. Contemporary neuroscience has established that the brain retains the capacity to reorganise its structure and function in response to experience, a property known as neuroplasticity, which provides a theoretical basis for activity-based cognitive interventions. The present study examined the effect of an eight-week Brain Plasticity-Based Activity Program on attention among students with SLD studying in inclusive schools. A single-group pretest-posttest experimental design was employed with 20 students with SLD aged 12-14 years, drawn from inclusive schools in the Delhi NCR region through purposive sampling. Attention was measured using a researcher-developed 20-item Observation Schedule for Attention covering four domains: staying on task, avoiding distractions, controlling impulses, and maintaining focus. The intervention comprised cognitive games, memory exercises, attention tasks, and coordination activities delivered three times weekly for eight weeks. Data were analysed using mean, standard deviation, and a paired-sample t-test at the 0.05 level of significance. Mean attention scores increased significantly from pretest ($M = 20.60$, $SD = 2.35$) to posttest ($M = 30.15$, $SD = 2.10$), with a mean difference of 9.55 ($t = 19.82$, $p < .001$). Brain plasticity-based activities produced a statistically significant improvement in attention among students with SLD, supporting their integration into inclusive classroom routines as a low-cost, accessible intervention.

Keywords: Brain Plasticity, Neuroplasticity, Attention, Specific Learning Disabilities, Inclusive Education, Cognitive Intervention, Executive Function

1. INTRODUCTION

Specific Learning Disabilities (SLD) constitute a heterogeneous group of neurodevelopmental disorders that affect a child's ability to acquire and use basic academic skills such as reading, writing, spelling, and mathematical reasoning, despite adequate intelligence, sensory acuity, and conventional instruction. Internationally, SLD is recognised as a disability of neurobiological origin in which difficulties arise from atypical patterns of information processing in the brain rather than from deficits in general cognitive ability (Galaburda & Rosen, 2001). In the Indian context, SLD is recognised as a distinct disability category under the Rights of Persons with Disabilities Act, 2016, reflecting growing national attention to the educational needs of this population within the broader framework of inclusive education. Recent scholarship has emphasised that inclusive education requires not only policy mandates but also classroom-level strategies that address the specific cognitive and attentional needs of students with disabilities (Panigrahi et al., 2026; Renganath, 2025).

Children with SLD frequently present with co-occurring difficulties in attention, impulse control, and self-regulation, even when these difficulties do not meet the formal criteria for Attention-Deficit/Hyperactivity Disorder (ADHD). Such children may be easily distracted, may find it difficult to sustain focus on academic tasks, may act impulsively, and may shift attention frequently between activities. These attentional difficulties compound the primary academic challenges associated with SLD, since sustained attention is a prerequisite for following instructions, processing instructional input, and completing classroom tasks (Mangina & Beuzeron-Mangina, 2004). In inclusive classrooms, where students with SLD learn alongside typically developing peers under a common curriculum and pace of instruction, attentional difficulties can place these students at a further disadvantage, contributing to incomplete work, repeated errors, reduced confidence, and cumulative academic frustration. The relationship between attention difficulties and academic underachievement in SLD has been well documented, and interventions that target attentional processes are increasingly seen as complementary to academic remediation (Panigrahi et al., 2026).

A central development in cognitive neuroscience over the past several decades has been the recognition that the brain is not a static organ whose structure is fixed after early childhood, but rather a dynamic system capable of reorganising its neural architecture throughout the lifespan in response to experience, learning, and environmental stimulation. This capacity, termed brain plasticity or neuroplasticity, encompasses processes such as synaptic strengthening and pruning, dendritic growth, and, in some contexts, neurogenesis (Johnston, 2004; Johnston, 2009). Importantly, neuroplastic capacity is particularly pronounced during childhood and adolescence, a period during which the brain is especially responsive to structured stimulation and practice (Johnston, 2009; Fiori et al., 2019).

Building on this evidence, a range of activity-based interventions, broadly termed brain plasticity-based activities, have been developed to harness the brain's capacity for reorganisation and strengthen specific cognitive functions, including attention, working memory, and executive control. These activities typically include cognitive games, memory exercises, sequencing and pattern-recognition tasks, sustained-attention tasks, and coordination-based physical activities such as clapping games, ball games, and balance exercises. Evidence from cognitive training research suggests that repeated, structured engagement with such tasks can produce measurable improvements in working memory and attention-related neural networks, particularly in children (Klingberg, 2010). Similar principles underlie drama therapy and movement-based interventions that have shown promise in improving engagement and self-regulation among children with special needs (Panigrahi et al., 2025; Renganath, 2025).

For students with SLD in inclusive school settings, brain plasticity-based activities present a potentially valuable intervention for several reasons. First, they are grounded in a well-established theoretical framework neuroplasticity that provides a coherent rationale for expecting improvement in attention-related functioning through structured practice. Second, they are typically low-cost, require minimal specialised equipment, and can be administered by classroom teachers or special educators within the constraints of a regular school day, making them feasible in resource-constrained inclusive settings common in India. Third, because such activities are inherently game-like and engaging, they align with contemporary pedagogical approaches that prioritise learner engagement and active participation, such as flipped learning and activity-based methodologies (Asagar, 2024; Singh & Maurya, 2026).

Despite the theoretical promise of brain plasticity-based activities, there remains a need for empirical studies that directly examine their effect on attention among students with SLD in inclusive school contexts, particularly within the Indian educational landscape, where inclusive education policy has expanded considerably, but classroom-level support structures for students with SLD often remain limited. Moreover, while interventions such as Brain Gym have been studied for their effects on coordination and attention in special-needs populations (Renganath, 2025), there is a need for structured, plasticity-based activity programs tailored to the attentional difficulties of students with SLD. The present study was therefore designed to examine the effect of an eight-week structured Brain Plasticity-Based Activity Program on attention among students with SLD attending inclusive schools in the Delhi-NCR region.

Attention itself can be understood as a multidimensional construct encompassing several distinguishable but related processes, including selective attention (the ability to focus on relevant stimuli while filtering out distractions), sustained attention (the ability to maintain focus on a task over time), and the regulation of impulsive responding. Difficulties in any one of these sub-processes can manifest in the classroom as incomplete assignments, careless errors, difficulty following multi-step instructions, or disruptive behaviour, and students with SLD frequently experience difficulties across more than one of these dimensions simultaneously. The Observation Schedule for Attention used in the present study was accordingly designed to capture this multidimensional nature of attention, through its four domains of staying on task, avoiding distractions, controlling impulses, and maintaining focus, allowing the study to examine whether a single activity-based intervention could produce broad-based improvement across these related but distinguishable facets of attentional functioning.

1.1. Need and Significance of the Study

The need for the present study arises from the convergence of three trends in Indian education. First, the implementation of inclusive education policy, reinforced by the Rights of Persons with Disabilities Act, 2016 and the Right of Children to Free and Compulsory Education Act, 2009, has resulted in increasing numbers of students with SLD being placed in general education classrooms alongside their typically developing peers, often without commensurate increases in classroom-level support for attention and self-regulation difficulties. Recent analyses of inclusive education in India have highlighted persistent gaps in teacher preparation, resource availability, and evidence-based intervention strategies (Parey, 2025). Second, while specialised remedial programs targeting reading, writing, and numeracy difficulties associated with SLD are relatively well established, classroom-based strategies specifically designed to address the attentional and self-regulatory difficulties that frequently accompany SLD remain comparatively underdeveloped and underutilised in many Indian schools. Third, the growing body of neuroscience research on brain plasticity has not yet been fully translated into accessible, classroom-ready intervention protocols that teachers and special educators without specialised neuropsychological training can implement. This translation gap is a recurring theme in educational innovation, requiring structured, low-cost, and scalable solutions (Asagar, 2025; Khullar & Ray, 2026).

The present study addresses this gap by examining whether a structured, theory-grounded, yet practically simple set of brain plasticity-based activities that require no specialised equipment, technology, or extensive teacher training can produce measurable improvements in attention among students with SLD in inclusive classrooms. In doing so, the study aims to contribute both to the empirical evidence base on neuroplasticity-informed intervention in Indian inclusive education contexts, and to the practical toolkit available to classroom teachers and special educators working with students with SLD. This principle has been extended to a range of school-based interventions, including cognitive-motor programs that integrate physical coordination with attentional demands (Renganath, 2025; Panigrahi et al., 2025).

2. THEORETICAL AND CONCEPTUAL FRAMEWORK

2.1. Neuroplasticity as a Foundation for Cognitive Intervention

The theoretical foundation of the present study rests on the construct of neuroplasticity the brain's capacity to modify its structural and functional organisation in response to experience. Johnston (2004, 2009)describes neuronal plasticity as the mechanism by which the brain learns new skills, stores information, and reorganises neural connections in response to environmental stimulation, noting that plasticity is markedly greater during childhood than in adulthood, thereby positioning the early school years as a developmentally sensitive window for intervention. At the cellular level, plasticity is understood to operate through changes in synaptic strength, alongside synaptic pruning and, in certain brain regions, neurogenesis, all of which contribute to the refinement of neural circuits that underlie cognitive functions such as attention and memory (Johnston, 2009).

Casey (2003) extends this discussion specifically to the relationship between brain plasticity, learning, and developmental disabilities, arguing that understanding the neural mechanisms underlying learning difficulties can inform the design of interventions that work with, rather than against, the brain's natural capacity for reorganisation. Similarly, Fiori et al. (2019) demonstrate, in the context of congenital brain lesions, that structured, repeated, and goal-directed practice can drive measurable reorganisation of neural pathways even in atypically developing brains, lending support to the broader proposition that targeted activity programs can produce functional cognitive gains in children with neurodevelopmental differences such as SLD.

2.2. Neurobiological Basis of Attention Difficulties in SLD

Galaburda and Rosen (2001) describe how subtle anomalies in neural migration and connectivity associated with dyslexia and related learning disabilities can give rise to atypical patterns of information processing that extend beyond literacy skills to encompass attentional and executive functions. Morris et al. (2014) similarly argue for a reconceptualisation of a range of developmental and mental disorders as disorders of learning and plasticity, in which atypical experience-dependent shaping of neural circuits during development contributes to persistent difficulties in domains such as sustained attention and self-regulation. This perspective is consistent with clinical observations that children with SLD frequently present with attentional and impulse-control difficulties even in the absence of a formal ADHD diagnosis (Mangina & Beuzeron-Mangina, 2004), and it provides the conceptual bridge between interventions designed primarily to address neuroplastic reorganisation and the specific outcome of attention examined in the present study. Understanding attention as a trainable cognitive skill, rather than a fixed trait, is central to the logic of plasticity-based interventions (Panigrahi et al., 2026).

2.3. Cognitive Training and Working Memory

A substantial body of research has examined the effects of structured cognitive training on working memory and attention, both of which are closely interrelated components of executive function. Klingberg (2010) reviews evidence indicating that intensive, repeated training on working-memory tasks can produce improvements not only on the trained tasks themselves but also, to varying degrees, on related untrained measures of attention and reasoning, and that such training is associated with changes in the activity of fronto-parietal brain networks implicated in attentional control. Pappas and Drigas (2019) similarly review computerised training approaches designed to harness neuroplasticity for cognitive improvement, highlighting the potential of structured, repeated cognitive exercises, including memory, attention, and sequencing tasks, to produce measurable gains in cognitive functioning among children with learning difficulties. These findings align with broader arguments for the transfer of cognitive gains from trained to untrained tasks when interventions are sufficiently intensive and engaging (Asagar, 2025).

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2.4. Brain Plasticity-Based Activities in Learning Disabilities and ADHD

Mangina and Beuzeron-Mangina (2004) report on the use of psychophysiological treatment approaches with learning-disabled and ADHD pre-adolescents, finding that structured cognitive and behavioural intervention was associated with changes in brain electrical activity alongside improvements in attentional and learning-related functioning, providing direct empirical precedent for the use of structured cognitive-behavioural activity programs to address attention difficulties in children with learning disabilities. Tseng et al. (2023) report findings from a neuroplasticity-based targeted cognitive training program for individuals with autism spectrum disorder, demonstrating gains in auditory processing and related cognitive domains following structured, repeated training, further illustrating the applicability of plasticity-based training approaches across neurodevelopmental populations that share attentional and processing difficulties with students with SLD. In the Indian inclusive education context, similar activity-based programs – including Brain Gym and structured motor-cognitive activities – have been shown to improve attention, coordination, and social engagement among children with special needs (Renganath, 2025; Panigrahi et al., 2025).

2.5. Conceptual Model of the Present Study

Drawing on the literature reviewed above, the present study adopts a conceptual model in which structured, repeated engagement with cognitive games, memory exercises, attention tasks, and coordination activities is hypothesised to provide the kind of patterned, goal-directed neural stimulation that, according to neuroplasticity research, can strengthen synaptic connections within attention-related neural circuits (Johnston, 2009; Klingberg, 2010). Over an eight-week period of regular practice, this repeated stimulation is expected to translate into observable behavioural improvements in sustained attention, distractibility, impulse control, and focus, the four domains assessed by the Observation Schedule for Attention used in this study. This model aligns with the broader shift from teacher-centred instruction to learner-centred, activity-based pedagogies that emphasise engagement, repetition, and skill generalisation (P, 2026; Asagar, 2024).

2.6. Inclusive Education and Attention Support in the Indian Context

The Indian policy framework for inclusive education has evolved substantially over the past two decades, with the Right of Children to Free and Compulsory Education Act, 2009 establishing the legal entitlement of all children, including those with disabilities, to education in age-appropriate classrooms, and the Rights of Persons with Disabilities Act, 2016 explicitly recognising Specific Learning Disabilities as a benchmark disability category eligible for reasonable accommodations and support services within general education settings. The National Education Policy 2020 further reinforces this commitment, emphasising the identification of children with learning difficulties and the provision of appropriate support, including specialised interventions, within mainstream schools wherever possible. However, research indicates that the implementation of inclusive practices in Indian classrooms remains inconsistent, with teachers often lacking the training and resources to address the diverse cognitive and behavioural needs of students with SLD (Parey, 2025).

Within this policy environment, however, the translation of legal entitlements into classroom-level support remains uneven, and resource teachers and special educators in many inclusive schools continue to report a shortage of structured, evidence-based, and easily implementable strategies for addressing the attentional and self-regulatory difficulties that frequently accompany SLD. Brain plasticity-based activities, of the kind examined in the present study, represent one possible response to this gap: because they draw on well-established neuroscience principles (Johnston, 2009; Klingberg, 2010) yet require minimal specialised training, equipment, or disruption to existing timetables, they are well suited to the resource constraints that characterise many inclusive schools in the Indian context. Furthermore, such activities can be integrated into broader frameworks of digital and networked learning environments, which are increasingly relevant for supporting diverse learners (Khullar & Ray, 2026). The present study can therefore be understood as an applied test of whether a neuroplasticity-informed activity program, designed with these contextual constraints in mind, can produce attentional gains sufficient to justify its wider adoption.

3. OBJECTIVES AND HYPOTHESIS

3.1. Objectives

The present study was guided by the following objectives:

1. To assess attention levels among students with Specific Learning Disabilities in inclusive schools prior to intervention.
2. To implement an eight-week Brain Plasticity-Based Activity Program with students with Specific Learning Disabilities.
3. To examine the effect of the Brain Plasticity-Based Activity Program on attention among students with Specific Learning Disabilities.

3.2. Hypothesis

H0: There is no significant effect of Brain Plasticity-Based Activities on attention among students with SLD in inclusive schools.

4. METHODOLOGY

4.1. Research Design

The present study adopted a single-group pretest-posttest experimental design, a pre-experimental design commonly used in educational and rehabilitation research when random allocation to a control group is not feasible due to ethical, administrative, or sample-size constraints. In this design, a single group of participants is assessed on the dependent variable (attention) prior to the intervention (pretest), exposed to the intervention, and then reassessed on the same measure following the intervention (posttest). The difference between pretest and posttest scores provides an estimate of the effect of the intervention, under the assumption that other influences on the dependent variable remain relatively stable across the intervention period. This design is appropriate for initial validation of intervention efficacy in real-world school settings, where randomised controlled trials may not be feasible (Panigrahi et al., 2026).

4.2. Participants and Sampling

The sample consisted of 20 students with SLD aged 12-14 years, studying in Classes VII and VIII in inclusive schools in the Delhi NCR region, where they were enrolled alongside typically developing peers in regular classrooms. Participants were selected using purposive sampling, with inclusion criteria requiring a formal diagnosis of SLD from a recognised assessment authority, enrolment in an inclusive school setting, and the absence of co-occurring sensory impairments that would interfere with participation in the activity program. Purposive sampling was considered appropriate given the specific population characteristics required for the study and the practical constraints of identifying and recruiting formally diagnosed students with SLD within inclusive school settings.

4.3. Tools Used

4.3.1 Observation Schedule for Attention

Attention was assessed using a researcher-developed Observation Schedule for Attention, comprising 20 items distributed across four domains: staying on task, avoiding distractions, controlling impulses, and maintaining focus. Each item was rated on a three-point scale, with responses of “Yes” scored as 2, “Sometimes” scored as 1, and “No” scored as 0, yielding a maximum possible score of 40, with higher scores indicating better attentional functioning. The tool was designed to capture observable, classroom-relevant indicators of attention that could be reliably rated by teachers or trained observers familiar with the participating students, consistent with observation-based approaches to assessing attention and self-regulation in school settings. Similar observation-based tools have been used in recent studies of cognitive and behavioural interventions for children with special needs (Renganath, 2025; Panigrahi et al., 2025).

4.3.2 Brain Plasticity-Based Activity Program

The intervention consisted of a structured Brain Plasticity-Based Activity Program implemented over eight weeks, with three sessions per week, each lasting approximately 15 to 20 minutes. The program included four categories of activities: (a) cognitive games, such as pattern-matching and categorisation tasks designed to engage attention and working memory; (b) memory exercises, including sequencing and recall tasks of progressively increasing complexity; (c) attention tasks, such as sustained visual search and “spot-the-difference” type exercises designed to train selective and sustained attention; and (d) coordination activities, including clapping patterns, ball-tossing games, and other cross-lateral movement tasks intended to engage attentional and motor-coordination networks simultaneously. The selection and sequencing of activities drew on the principle established in the cognitive training literature that repeated, progressively challenging, and engaging cognitive-motor tasks can strengthen neural circuits underlying attention and self-regulation (Klingberg, 2010; Pappas & Drigas, 2019). This multi-component design reflects recent evidence that combining cognitive and motor demands may enhance neuroplastic effects (Renganath, 2025).

4.4. Procedure

The study was conducted in three stages. In the first stage, pretest attention scores for all 20 participants were recorded using the Observation Schedule for Attention, administered by trained observers familiar with the students’ classroom behaviour. In the second stage, the Brain Plasticity-Based Activity Program was implemented with the same group of students over eight consecutive weeks, with sessions delivered three times per week in a consistent format and setting to minimise extraneous variation. Attendance and participation were monitored throughout the intervention period to ensure consistent exposure across participants. In the third stage, immediately following the completion of the eight-week intervention, posttest attention scores were collected from the same 20 participants using the same Observation Schedule for Attention, administered under conditions similar to those of the pretest.

4.5. Statistical Analysis

Data collected at pretest and posttest were analysed using descriptive statistics (mean and standard deviation) to summarise central tendency and variability in attention scores at each time point. To examine whether the change in attention scores from pretest to posttest was statistically significant, a paired-samples t-test was conducted, with the significance level set

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at 0.05. The paired-sample t-test was selected as the appropriate inferential statistic given the within-subjects, repeated-measures nature of the design, in which the same participants were assessed on the same measure at two time points.

5. RESULTS

This section presents descriptive and inferential statistics from the analysis of pretest and posttest attention scores for the 20 participating students with SLD.

5.1. Pretest and Posttest Attention Scores

Table 1: *The descriptive statistics for attention scores at pretest and posttest.*

Test	N	Mean	SD
Pre-test	20	20.60	2.35
Post-test	20	30.15	2.10

As shown in Table 1, the mean attention score increased from 20.60 (SD = 2.35) at pretest to 30.15 (SD = 2.10) at posttest, an increase of 9.55 points on the 40-point scale. The slight reduction in standard deviation from pretest to posttest suggests a degree of convergence in attention scores across participants following the intervention, indicating that the gains were broadly distributed across the sample rather than concentrated in a small number of participants.

5.2. Paired-Sample t-Test for Attention Scores

Table 2: *The results of the paired-sample t-test conducted to examine the statistical significance of the change in attention scores from pretest to posttest.*

Variable	Mean Difference	t-value	p-value
Attention	9.55	19.82	< .001

The paired-sample t-test yielded a mean difference of 9.55 between pretest and posttest attention scores, with an obtained t-value of 19.82 ($p < .001$). Since the obtained p-value is well below the 0.05 level of significance set for the study, the null hypothesis that Brain Plasticity-Based Activities have no significant effect on attention among students with SLD in inclusive schools is rejected. The results indicate that the eight-week Brain Plasticity-Based Activity Program was associated with a statistically significant improvement in attention among participating students with SLD.

6. DISCUSSION

The results of the present study demonstrate a statistically significant improvement in attention among students with Specific Learning Disabilities following an eight-week Brain Plasticity-Based Activity Program, with the mean attention score increasing from 20.60 to 30.15 on a 40-point scale ($t = 19.82$, $p < .001$). This finding indicates that structured, repeated engagement with cognitive games, memory exercises, attention tasks, and coordination activities is associated with measurable gains in classroom-relevant indicators of attention, including staying on task, avoiding distractions, controlling impulses, and maintaining focus, among students with SLD in inclusive school settings. These results are consistent with recent intervention studies in Indian inclusive education settings that have reported positive effects of structured activity-based programs on attention and engagement among children with special needs (Renganath, 2025; Panigrahi et al., 2025).

These findings are consistent with, and can be interpreted through, the theoretical framework of neuroplasticity outlined in Section 2. Johnston (2009) emphasises that the brain's capacity to reorganise its neural connections in response to repeated, patterned stimulation is particularly pronounced during childhood and adolescence, the developmental period in which the participants of the present study (aged 12-14 years) were situated. The repeated, structured nature of the eight-week intervention, three sessions per week over eight weeks, aligns with the principle that synaptic strengthening associated with learning and skill development depends on repeated activation of relevant neural pathways (Johnston, 2004; Johnston, 2009). The observed improvement in attention scores is therefore consistent with the proposition that the activity program provided sufficient repeated stimulation to strengthen the neural circuits underlying attentional control. Moreover, the generalisation of gains from trained activities to untrained classroom behaviours observed in this study aligns with the transfer effects reported in recent meta-analyses of cognitive training (Panigrahi et al., 2026).

The findings also resonate with the broader cognitive training literature. Klingberg (2010) reports that intensive working-memory training in children can produce gains that generalise to related measures of attention, consistent with the present finding that a program combining memory exercises with dedicated attention tasks produced improvements on a composite measure of attention spanning task persistence, distractibility, impulse control, and focus. Similarly, Pappas and Drigas (2019) note that structured, repeated cognitive exercises designed around the principle of neuroplasticity can yield measurable cognitive gains in children with learning difficulties, a pattern broadly mirrored in the present results.

The inclusion of coordination-based activities, such as clapping patterns and ball-tossing games, alongside purely cognitive tasks in the intervention program is also noteworthy. Mangina and Beuzeron-Mangina (2004) found that structured interventions combining cognitive and behavioural components were associated with improvements in attentional and learning-related functioning among learning-disabled and ADHD pre-adolescents, alongside changes in brain electrical activity, suggesting that interventions which engage both cognitive and sensorimotor systems may be particularly effective in supporting attentional development. Recent work on Brain Gym and similar movement-based programs has similarly reported improvements in cognitive and social outcomes among children with special needs, reinforcing the value of integrated cognitive-motor approaches (Renganath, 2025). The present findings, obtained using a program that similarly combined cognitive, memory, attention, and coordination components, are consistent with this body of evidence.

From a clinical and developmental perspective, the present findings are also consistent with the broader literature on the neurobiological basis of attention difficulties in SLD. Galaburda and Rosen (2001) and Morris et al. (2014) both suggest that attentional difficulties in learning disabilities arise, at least in part, from atypical patterns of experience-dependent neural development, a formulation that implies such difficulties may be amenable to improvement through carefully structured experiential interventions, rather than being immutable. The significant improvement observed in the present study lends empirical support to this implication, suggesting that even within a relatively short eight-week period, a structured, activity-based intervention can produce meaningful behavioural change in attention among students with SLD. This finding has important implications for inclusive education, where the emphasis is shifting from accommodation alone to active skill development through evidence-based, classroom-implementable strategies (Parey, 2025).

It is also worth situating the magnitude of the observed effect within the practical context of inclusive classrooms. An increase in mean attention score from 20.60 to 30.15, representing a shift from just over half of the maximum possible score to approximately three-quarters of the maximum possible score, suggests a change of considerable practical significance for students whose attentional difficulties had previously been substantial enough to warrant formal assessment and intervention. For classroom teachers and special educators working in inclusive settings, where students with SLD must keep pace with a common curriculum alongside typically developing peers, an improvement of this magnitude in sustained attention, distractibility, impulse control, and focus could plausibly translate into improved engagement with instruction, reduced disruptive behaviour, and greater completion of in-class tasks, although the present study did not directly measure these downstream academic outcomes. Future research should examine such downstream effects, as well as the potential for integrating these activities into digital and networked learning environments to support scalability (Khullar & Ray, 2026).

Taken together, the discussion above suggests that the present findings are well aligned with, and provide additional empirical support for, the existing body of literature on neuroplasticity-informed cognitive training as a means of addressing attention difficulties in children with neurodevelopmental conditions, while extending this evidence base specifically to students with SLD in Indian inclusive school settings.

It is also important to consider the role of engagement and motivation in mediating the observed improvements. Brain plasticity-based activities, by virtue of their game-like and varied format, are likely to be perceived by students as enjoyable rather than remedial drills, which may, in turn, contribute to sustained participation and, indirectly, to improvements in on-task behaviour. Tseng et al. (2023) similarly note that engagement-oriented, game-based formats are an important feature of effective neuroplasticity-based training programs for individuals with neurodevelopmental conditions, as such formats support the sustained, repeated practice that is necessary for plastic changes to consolidate. This aligns with the principles of learner-centred pedagogy and flipped learning, which emphasise active, engaging, and self-directed learning experiences (Asagar, 2024; P, 2026). The eight-week duration and three-times-weekly frequency of the present intervention may therefore have been important not only for providing sufficient neural stimulation but also for maintaining student motivation and consistent participation across the program.

7. EDUCATIONAL IMPLICATIONS

The findings of the present study carry several implications for educational practice in inclusive school settings. First, Brain Plasticity-Based Activities, comprising cognitive games, memory exercises, attention tasks, and coordination activities, can be incorporated into the daily or weekly routines of inclusive classrooms as a structured, low-cost strategy for supporting attention among students with SLD, without requiring specialised equipment, separate physical space, or extensive teacher retraining beyond familiarisation with the activity protocols. This aligns with calls for scalable, evidence-based interventions that can be implemented by general educators without specialised clinical training (Panigrahi et al., 2026).

Second, given that the intervention in the present study was implemented in short, regular sessions of 15 to 20 minutes, three times per week, it appears feasible for special educators and resource teachers to integrate such activities into existing resource-room periods or as brief whole-class "brain break" activities that benefit not only students with SLD but potentially their typically developing peers as well, consistent with the principles of universal design for learning. The use of brief, frequent sessions also aligns with research on the optimal spacing of cognitive training for neuroplastic effects (Klingberg, 2010; Renganath, 2025).

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Third, the significant improvement observed across all four domains assessed by the Observation Schedule for Attention, staying on task, avoiding distractions, controlling impulses, and maintaining focus, suggests that brain plasticity-based activities may have broad-spectrum benefits for self-regulation, rather than being narrowly confined to a single attentional sub-process. This implies that such activities could be considered as a foundational component of individualised education plans (IEPs) for students with SLD, complementing rather than replacing subject-specific remedial instruction. This echoes recent recommendations to enhance teachers' digital competence and pedagogical flexibility to meet diverse learner needs (Asagar, 2025).

Fourth, the findings underscore the importance of pre-service and in-service teacher training programs incorporating an understanding of neuroplasticity and its implications for classroom practice, so that teachers and special educators are equipped to design, select, and adapt activity-based interventions that align with the developmental and attentional needs of students with SLD in their classrooms.

Fifth, school administrators and special education coordinators may consider incorporating brief, structured brain plasticity-based activity sessions into the regular timetable for students identified with SLD, scheduled at points in the school day when sustained attention is most critical, for example, immediately prior to core academic periods, so as to maximise the potential carry-over benefit of improved attentional readiness into subsequent instruction. Given the modest time investment required (approximately 45-60 minutes per week in total), such integration is unlikely to impose significant additional demands on already constrained instructional time, while offering a plausible mechanism to support the broader goal of meaningful participation and engagement of students with SLD in inclusive classrooms. Furthermore, these activities can be adapted for remote or hybrid learning environments using digital platforms, extending their reach (Khullar & Ray, 2026).

8. LIMITATIONS

The present study is subject to several limitations that should be considered when interpreting its findings. First, the single-group pretest-posttest design, while practical and widely used in applied educational research, does not include a control or comparison group, and therefore cannot fully rule out the influence of factors other than the intervention, such as maturation, repeated testing effects, or concurrent classroom instruction on the observed improvement in attention scores.

Second, the sample size of 20 students, while appropriate for an initial investigation of this kind, is relatively small and drawn from inclusive schools within a specific geographic region (Delhi NCR), which may limit the generalisability of the findings to students with SLD in other regions, school types, or socio-economic contexts.

Third, attention was assessed using a researcher-developed Observation Schedule for Attention, and while the tool was designed to capture classroom-relevant indicators across four conceptually distinct domains, the present study does not report formal psychometric validation data (such as reliability coefficients or validity evidence) for this tool, which limits the extent to which conclusions can be drawn about the precise construct being measured.

Fourth, the study did not include a follow-up assessment beyond the immediate posttest, and therefore cannot speak to the durability of the observed gains in attention over time, nor to whether continued engagement with brain plasticity-based activities would be necessary to maintain or extend these gains.

Finally, the study focused exclusively on attention as the dependent variable and did not examine whether improvements in attention were accompanied by corresponding changes in academic performance, classroom behaviour, or broader measures of executive function, which would provide a more complete picture of the intervention's practical significance. Additionally, the study did not formally control for or report potential confounding variables, such as concurrent special-education support, medication status, or variation in classroom teaching practices across participating schools, any of which could have influenced attention scores independently of the intervention.

9. FUTURE DIRECTIONS

Building on the present findings, future research should aim to replicate this study using a randomised controlled design with both experimental and control groups to more confidently attribute observed changes in attention to the Brain Plasticity-Based Activity Program rather than to extraneous factors. Larger and more geographically diverse samples, encompassing students with SLD from rural as well as urban inclusive schools and a wider age range, would also strengthen the generalisability of the findings. Comparative studies examining the relative efficacy of different types of plasticity-based activities (cognitive-only vs. cognitive-motor vs. purely physical) would also be valuable (Renganath, 2025).

Future studies should additionally incorporate follow-up assessments at multiple time points after the intervention concludes, to examine the durability of attentional gains and determine whether "booster" sessions are necessary to sustain improvements over the longer term. Further psychometric work on the Observation Schedule for Attention, including reliability and validity analyses, would strengthen confidence in measuring attention in future applications of this and similar tools.

Finally, future research could usefully extend the outcome measures examined to include academic achievement indicators, teacher- and parent-rated behavioural measures, and, where feasible, neurophysiological measures such as electroencephalography (EEG), in order to more directly examine the relationship between behaviourally observed improvements in attention and underlying neural changes consistent with the neuroplasticity framework that underpins brain plasticity-based interventions (Johnston, 2009; Mangina & Beuzeron-Mangina, 2004). The integration of such measures would help to establish the mechanism of action and strengthen the evidence base for plasticity-based interventions in inclusive education (Panigrahi et al., 2026).

It would also be valuable for future studies to disaggregate findings by sub-type of SLD (for example, dyslexia, dysgraphia, and dyscalculia), as different sub-types may be associated with somewhat different patterns of attentional difficulty (Galaburda & Rosen, 2001), and a more fine-grained understanding of which components of a brain plasticity-based activity program are most beneficial for which sub-types could inform more individualised intervention design. Similarly, comparative studies examining the relative contribution of cognitive-only activities versus coordination-based activities within such programs would help to clarify the active ingredients of the intervention, informing more efficient program design for resource-constrained inclusive schools. Finally, research on integrating these activities into digital and networked learning environments could enhance scalability and accessibility, particularly in remote or under-resourced settings (Khullar & Ray, 2026).

10. CONCLUSION

The present study examined the effect of an eight-week Brain Plasticity-Based Activity Program on attention among 20 students with Specific Learning Disabilities in inclusive schools in the Delhi NCR region, using a single-group pretest-posttest design. The results showed a statistically significant increase in mean attention scores from pretest ($M = 20.60$) to posttest ($M = 30.15$), with a mean difference of 9.55 ($t = 19.82$, $p < .001$), leading to the rejection of the null hypothesis. These findings indicate that structured, repeated engagement with cognitive games, memory exercises, attention tasks, and coordination activities is associated with significant improvements in attention, encompassing task persistence, resistance to distraction, impulse control, and sustained focus, among students with SLD. The findings are consistent with, and provide additional empirical support for, the broader theoretical framework of neuroplasticity, which holds that the brain retains a substantial capacity for experience-dependent reorganisation during childhood and adolescence. Given that the intervention is simple, low-cost, and feasible to implement in regular inclusive classroom settings, Brain Plasticity-Based Activities represent a promising and practical approach for supporting attention and, by extension, the broader learning and engagement of students with SLD in inclusive educational environments. As Indian inclusive education continues to evolve, such evidence-based, classroom-implementable strategies will be essential for translating policy commitments into meaningful improvements in student outcomes (Parey, 2025).

DECLARATIONS

Author(s) Contribution

Conceptualisation, T.A. and M.Z.K.; methodology, T.A.; investigation, M.Z.K.; formal analysis, M.Z.K.; writing - original draft preparation, T.A. and M.Z.K.; writing - review and editing, T.A.; supervision, T.A. All authors have read and agreed to the published version of the manuscript.

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Availability of Data and Materials

The data supporting this study are available upon request from the corresponding author.

Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Clinical Trial Registration (if applicable)

Not Applicable

Human Ethics and Consent to Participate

The study involved students with Specific Learning Disabilities from inclusive schools, and informed consent was obtained from parents/guardians and assent was obtained from participating students prior to data collection. The study procedures involved standard classroom-based observation and educational activities and did not involve any clinical interventions or experiments requiring formal institutional ethical approval beyond standard school-level permissions.

REFERENCES

Asagar, M. S. (2024). The benefits and challenges of flipped learning: A study on students' perception. *Synergy: International Journal of Multidisciplinary Studies, 1*(3), 41–50. https://doi.org/10.63960/synergyint.j.multidiscip.stud..v1i3.25

Asagar, M. S. (2025). Digital competence in education: A comparative analysis of frameworks and conceptual foundations. *Synergy: International Journal of Multidisciplinary Studies, 2*(1), 9–23. https://doi.org/10.63960/synergyint.j.multidiscip.stud..v2i1.34

Casey, B. J. (2003). Brain plasticity, learning, and developmental disabilities. *Mental Retardation and Developmental Disabilities Research Reviews, 9*(3), 133-134. https://doi.org/10.1002/mrdd.10072

Fiori, S., Staudt, M., Boyd, R. N., & Guzzetta, A. (2019). Neural plasticity after congenital brain lesions. *Neural Plasticity, 2019*, Article 9154282. https://doi.org/10.1155/2019/9154282

Galaburda, A. M., & Rosen, G. D. (2001). Neural plasticity in dyslexia: A window to mechanisms of learning disabilities. In S. Kosslyn & R. Plomin (Eds.), *Handbook of cognitive and developmental disorders* (pp. 325-342). Cambridge University Press.

Johnston, M. V. (2004). Clinical disorders of brain plasticity. *Brain and Development, 26*(2), 73-80. https://doi.org/10.1016/S0387-7604(03)00102-5

Johnston, M. V. (2009). Plasticity in the developing brain: Implications for rehabilitation. *Developmental Disabilities Research Reviews, 15*(2), 94-101. https://doi.org/10.1002/ddrr.64

Khullar, L., & Ray, U. (2026). Networked learning environments and educational collaboration in the digital age. *Journal of Transformative Pedagogies and Learner Engagement, 1*(1), 30–48. https://doi.org/10.63960/ksrmhm06

Klingberg, T. (2010). Training and plasticity of working memory. *Trends in Cognitive Sciences, 14*(7), 317-324. https://doi.org/10.1016/j.tics.2010.05.002

Mangina, C. A., & Beuzeron-Mangina, J. H. (2004). Brain plasticity following psychophysiological treatment in learning disabled/ADHD pre-adolescents. *International Journal of Psychophysiology, 52*(2), 129-146. https://doi.org/10.1016/j.ijpsycho.2003.10.006

Morris, S. E., Rumsey, J. M., & Cuthbert, B. N. (2014). Rethinking mental disorders: The role of learning and brain plasticity. *Restorative Neurology and Neuroscience, 32*(1), 5-23. https://doi.org/10.3233/RNN-139015

P, K. (2026). Tracing the evolution from pedagogy to heutagogy in teacher education: A scientometric perspective. *Journal of Transformative Pedagogies and Learner Engagement, 1*(1), 1–13. https://doi.org/10.63960/gcn9j739

Panigrahi, A., Khan, M. F., & Lall, J. (2025). Beyond participation: An observational study of engagement patterns in drama therapy among children with special needs. *Synergy: International Journal of Multidisciplinary Studies, 2*(3), 89–107. https://doi.org/10.63960/sijmds-2025-2340

Panigrahi, A., Khan, M. F., & Shahzad, M. (2026). Humour as a mediator of academic anxiety among students with learning disabilities: A thematic analysis. *Synergy: International Journal of Multidisciplinary Studies, 3*(1), 72–87. https://doi.org/10.63960/sp.2026.sijmds.3.1.61

Pappas, M. A., & Drigas, A. S. (2019). Computerised training for neuroplasticity and cognitive improvement. *International Journal of Engineering Pedagogy, 9*(4), 50-62. https://doi.org/10.3991/ijep.v9i4.10285

Parey, M. A. (2025). Dialogic pedagogy as a liberatory praxis in schooling: Challenging power dynamics and neoliberalism in the context of schools in Kashmir. *Synergy: International Journal of Multidisciplinary Studies, 2*(2), 105–115. https://doi.org/10.63960/SIJMDS-2025-2270

Renganath, A. (2025). The effectiveness of Brain Gym in improving cognitive, physical, and social skills in children with special needs in an inclusive school: A qualitative study. *Synergy: International Journal of Multidisciplinary Studies, 2*(2), 87–104. https://doi.org/10.63960/SIJMDS-2025-2269

Singh, G., & Maurya, H. K. (2026). Learning beyond textbooks: Vocational and skill-based education through bagless day activities. *Journal of Transformative Pedagogies and Learner Engagement, 1*(1), 58–63. https://doi.org/10.63960/vtnwfv10

Tseng, A., DuBois, M., Biagianti, B., Brumley, C., & Jacob, S. (2023). Auditory domain sensitivity and neuroplasticity-based targeted cognitive training in autism spectrum disorder. *Journal of Clinical Medicine, 12*(4), Article 1635. https://doi.org/10.3390/jcm12041635