



A Pilot Study: Exploring feasibility and Efficacy of Online Administration of Brain Function Therapy Program in Children with Attention Deficit and Hyperactivity Disorder (ADHD)

Chandanshive AB^{1,2*} and Chitre A²

¹Department of Psychology, Chandmal Tarachand Bora Arts, Commerce and Science College, India

²PhD Scholar, Savitribai Phule Pune University, India

***Corresponding author:** Ajit B Chandanshive, Associate Professor, Department of Psychology, Chandmal Tarachand Bora Arts, Commerce and Science College, Shirur Dist-Pune 412210, India, Tel: 9960760650; Email: ajitpsychology@gmail.com

Received Date: July 31, 2024; **Published Date:** August 09, 2024

Abstract

Objective: To determine the efficacy of Brain Function Therapy Program (BFT), a computerized online brain stimulation activity for improving attention, cognitive proficiency and behavior regulation in children with Attention Deficit and Hyperactivity Disorder and Analyze feasibility of conducting an online BFT program. Methods: Sample consisted of 14 children in the age group 7 years and above with average intelligence and having established diagnosis of ADHD. Baseline evaluation was done using battery of cognitive tests (Cognitive proficiency index of WISC IV) and behavior rating (Conners 3, Behavior rating inventory of executive functioning). Children participating underwent BFT program and were assessed after 12 sessions. Outcome was measured in terms of Shift in cognitive test performance and behaviour rating on Conners 3 and BRIEF 2. Paired t test was used to determine pre and post-test changes. Results: A Total of 9 children completed 12 sessions pre-posttest. Cognitive proficiency index and attention showed significant improvement from pre to post ($p < 0.05$).

Conclusion: Online BFT program seems to be feasible as only one child among the participants was not able to continue due to unavailability of laptop and internet facility. Positive shift in cognitive proficiency, reduction in hyperactivity and inattention behavior in children with ADHD was observed even after few sessions of online BFT program.

Keywords: Brain Function Therapy Program; Attention Deficit and Hyperactivity Disorder; Cognitive Proficiency; Behavior Regulation; Inattention; Feasibility; Efficacy

Abbreviations

BFT: Brain Function Therapy; ADHD: Attention Deficit and Hyperactivity Disorder; CPI: Cognitive Proficiency Index; BRIEF: Behaviour Rating Inventory of Executive Function; WISC: Weschler's Intelligence Scale for Children.

Introduction

Attention Deficit and Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder that involves persistent patterns of inattention and/or hyperactivity. Inattention

manifests behaviourally in ADHD as wandering off task, lacking persistence, having difficulty sustaining focus and being disorganized. It begins in childhood and requires substantial presence of symptoms before 12 years of age. Academic underachievement and behavior problems are common in children with ADHD [1,2]. ADHD is seen in 4-5 percent of grade school children and higher rates in males than in females [3]. Study by Venkata JA, et al. [4] has found high prevalence of ADHD of around 11.32% in primary school children in India. Presence of ADHD can have adverse effects on the academic achievement of children.

Cognitive Deficits in children with ADHD

Children with ADHD exhibit cognitive problems, especially executive dysfunction [5,6]. Executive functions are neurocognitive skills that involve goal-directed cognitive control of thought, action and emotion [7]. Executive dysfunction mainly inhibitory deficit is the primary cognitive dysfunction in ADHD children [8]. It involves ability to inhibit an inappropriate but dominant response while pursuing goal directed behaviors [9,10]. Children with ADHD are more likely to act before thinking and therefore often get in to trouble [11]. Inhibitory control is a key component of behavior-regulation. Behavior regulation represents a child's ability to regulate and monitor behavior effectively. It is capacity to observe and evaluate one's own behavior, awareness of impact of one's own behavior on other people and outcomes. Behaviour Rating Inventory for Executive functioning can be used to measure impairment in behaviour regulation [12]. Besides problem in behaviour regulation, children with ADHD perform poorly on processing speed and working memory tasks (i.e ability to remember information and process it at same time, such as is required to complete mental calculations). Scores on these two tasks is summarized in to single index score on Wechsler scale and is calculated as cognitive proficiency index (CPI). It represents a set of functions that involves proficiency in processing certain type of cognitive information. Efficiency in cognitive processing facilitates learning and problem solving [11,13,14]. Studies have found association with prefrontal cortex, cerebellum and basal ganglia to symptoms of ADHD causing inattention and inhibitory problems [15].

Treatment for ADHD

Most often, medication is used for treatment of ADHD however they are effective during school hours and provide short term reduction of symptoms [16,17]. Besides Medication, Behaviour interventions are found useful and have greater impact on ADHD Children [18]. However most experts agree that a multi modal treatment approach is often required for treating ADHD [16]. Considering the role of neurocognitive functions in children with ADHD, a neurorehabilitation program in form of cognitive training can provide a promising treatment plan in remediating deficits in children with ADHD. A Study on 20 primary school children with ADHD conducted by Khan NA, et al. [19] concluded that neuropsychological rehabilitation was effective in remediating deficits faced by children with ADHD. Children in the study underwent attention and fine motor training for 3 months. Cognitive training utilizes the principles of self-directed neuroplasticity. The basis of it is that neural circuits are involved in reinforcement and thus brain exhibits durable physical, biological changes with conscious voluntary directing of attention and practice with voluntary behaviour. Training involves repeated exercise of specific

cognitive process over an extended period of time after which there is gain in the performance and also transfer to another task [20-22]. Brain Function Therapy Program (BFT) is a cognitive training program that uses simple pragmatic approach involving training as a dominant strategy. Basis of it is that practice of a skill might actually play some part in the direct physiological reinstatement of that function. It is accepted that patient cannot perform a certain activity and psychological knowledge of learning is applied to teach the patient to perform it [23,24]. Brain function therapy program is available in India, there have been hitherto no available studies that have examined the efficacy of the program in clinical population. The present pilot study was conducted to explore efficacy of Brain Function Therapy Program (BFT) and study its effect on cognition and behavior in children with ADHD. Outcome measures as parent report of inattention, behaviour regulation, and cognitive proficiency are used to examine changes before and after intervention.

Present Study also aimed to examine the feasibility of using technology to reach children living in distant and diverse geographical location or those unable to come to centre due to time constraints. Need to provide services through digital mode was more realised during Covid 19 pandemic as many people found it challenging to get intervention services for their children. Post covid there has been upsurge in behavior difficulties among children. Lack of activity and increase in screen time has increased the problems in children and parents are finding it challenging to cope up with the same [25].

Methodology

Aim and objective of the study:

- To determine the efficacy of Brain Function Therapy Program (BFT) for improving attention, cognitive proficiency and behavior regulation in children with Attention Deficit and Hyperactivity Disorder.
- To analyze feasibility of conducting an online BFT program.

Hypotheses

- There will be no significant difference before and after BFT in children with ADHD in Inattention, Cognitive Proficiency and Behavior Regulation
- There will be no significant change in follow up rate of children with ADHD undergoing BFT program.

Methods

Venue of the Study

The present study was conducted in the out-patient department of a Child Guidance clinic in Mumbai.

Sample of the Study

Children with established diagnosis of ADHD visiting the clinic were enrolled through convenience sampling. 27 children were screened for eligibility for enrolling in the program. A group of 14 children were selected based on inclusion and exclusion criteria. Data could be analysed of 9 children.

Study Design

Pre and post study design

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Children with established diagnosis of ADHD as per DSM V criteria
- Parents who gave consent for the participation in the study
- Children with IQ 85 and above on standardized intelligence test
- Children above 7 years of age
- Children having internet connectivity at home

Exclusion Criteria:

- Children with sudden onset of symptoms
- Children with major medical condition
- Children who are unable to read English letters
- Children with vision or hearing impairment
- Children suffering from major psychiatric morbidity

Tools of the Study

Semi structured socio-demographic and clinical data sheet: A specially designed Performa containing necessary and basic information like name, age, sex, religion, education, socio economic status, birth order.

Conners 3 parent rating scale: The Conners 3rd Edition-Parent Short (Conners 3-P) is an assessment tool used to obtain a parent's observations about his or her child's behavior. This instrument is designed to assess Attention

Deficit/Hyperactivity Disorder (ADHD) and its most common co-morbid problems in children and adolescents aged 6 to 18 years old [11].

Behaviour Rating Inventory of Executive Function, Second Edition (BRIEF-2): It is designed to provide a better understanding of a child's self-control and problem-solving skills by measuring eight aspects of executive functioning that involves three index scores: behavior regulation (inhibit, self-monitor), emotional regulation (shift, emotional control) cognitive regulation (initiate, working memory, plan/organize, task-Monitor, organization of material). The executive functions are mental processes that direct a child's thought, action, and emotion, particularly during active problem solving [12].

Weschler's intelligence scale for children-IV Indian adaptation (WISC IVINDIA): It is fourth revision of the Weschler's scale devised by David Weschler. It is published in 2004. WISC-IV assesses intellectual functioning in children in the age group 6-16 years. It yields a general ability index, full scale IQ, and Four index scores i.e. verbal comprehension, perceptual reasoning, working memory and processing speed. The reliability and validity are well established. Cognitive proficiency index summarizes performance on the WISC IV working memory and processing speed index in a single score [13,26].

Brain function therapy (BFT): It is computerized based program Conceptualized by Dr. Mukundan CR [27] at the National Institute of Mental Health and Neurosciences (NIMHANS), Bengaluru. It is available at Axxonet system technologies. Program can be used to improve speed and accuracy of Neurocognitive processes. It has flexible difficulty and complexity levels. Data is obtained in terms of average time response and percentages. Some of the areas assessed on BFT program are word recognition, spatial comparison, working memory with number, working spatial memory, continuous performance, temporal sequence control, alpha numeric sequencing, response inhibition, reading speed, character recognition, number recognition and digit symbol substitution [28].

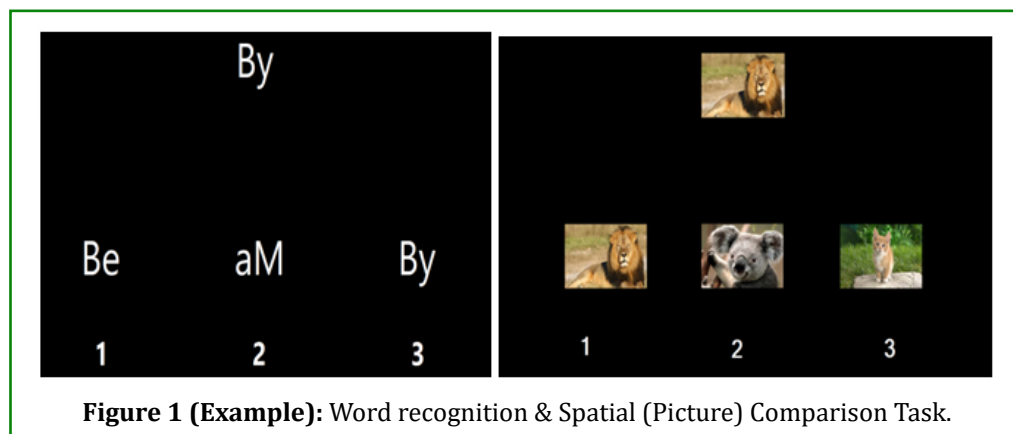


Figure 1 (Example): Word recognition & Spatial (Picture) Comparison Task.

Procedure

Selection and Evaluation

27 children were screened for eligibility for enrolling in the program. A group of 14 children were selected based on inclusion and exclusion criteria. Parent consent was obtained for children to participate in the program. Baseline evaluation that included data of Cognitive proficiency index of WISC IV, Conners-3 and BRIEF 2 was done before starting the sessions.

Intervention

Children attended total of 12 online BFT sessions of 30-40 minutes duration over the period of 1 month. Children attended almost thrice in a week. Online session planning involved helping parents download Ultra Viewer software that is freely available from Google search. Prior to starting of the sessions, a partner password to access the software remotely was sent. Zoom online platform was used for instructions. Parent /Caregiver attendance during session was mandatory. BFT Tasks included Word /Character Recognition, Spatial Comparison, Continuous Performance, Response Inhibition. Three Trials of each was given per session. Exposure Time and Number of items were uniform across trials.

Analysis

Out of 14 Children, a total of 9 completed 12 sessions. 5 children dropped out of the study. Three reported personal reasons as the study were conducted during festival time. One of the children could not attend due to poor internet connectivity and other could not attend due to time constraint. After completion of 12 sessions, post evaluation was done for them using Cognitive proficiency index of (WISC IVINDIA), Parent rating on Conners-3 and BRIEF 2.

Statistical Analysis

Statistical analysis was performed to assess changes in cognitive test performance, parent rating on behaviour scales after 12 sessions. Pre and Post-test comparison was done using the WISC IV Cognitive Proficiency index (CPI), Parent rating on Conners3 content scale and Parent report on Behaviour rating of executive functioning (BRIEF 2), a paired t-test was used.

Findings

Table 1 shows socio-demographic information. Out of the total number of children (n=9), 3 (38%) of children had ADHD combined type and 8 (89%) of children presented with learning and other behaviour problems like aggression and anxiety.

Socio demographic and Clinical variables		Study Group (N=9)
Mean Age in Years Mean (SD)		10.41 (4.50)
Education Mean (SD)		4.89 (2.31)
IQ Mean (SD)		101.56 (12.93)
Gender (Boys: Girls)		05:04
ADHD Type	Predominantly Inattentive	3 (38%)
	Predominantly Hyperactive	3 (38%)
	Combined	3 (38%)
Presence of seizure history		3 (38%)
Presence of significant Perinatal history		5 (63%)
Presence of other behaviour problems		8 (89%)
Presence of learning problems		8 (89%)

Table 1: Socio Demographic and clinical variables of study group.

Variables Connors ADHD index	Pre-test (N=9)		Post-test (N=9)		df	t test	p value
	Mean	SD	Mean	SD			
Inattention	77	10.32	68	11.6	8	-3.22	.012*
Hyperactivity	76	11.42	67	13.44	8	-2.86	.021*
Learning Problems	70	13.01	62	10.31	8	-3.46	.008**
Executive Functioning	68	12.26	66	14.23	8	-0.99	0.35
Aggression	67	17.96	70	15.89	8	0.85	0.42
Peer relation	59	16.82	64	16.05	8	0.64	0.539

Table 2: Comparison of Connors III content scales.

*p < 0.05, **p < 0.01

Content scale Scores of pre and post intervention show significant change in parent reporting of problems in the area of inattention and hyperactivity ($p < .05$). There is mean reduction in scores on inattention and hyperactivity post intervention. Statistically Significant change is also

noted in parent reported learning problems ($p < .01$). Parent reported lesser problem related to Inattention, hyperactivity and Learning post intervention. Overall, hyperactivity, impulsivity, and fidgety behaviour reduced as observed with improved sitting, attention and focus in these children.

Variables	Pre Test (N=9)		Post Test (N=9)		df	t test	p value
	Mean	SD	Mean	SD			
Behavior Regulation Index	61	11.14	59	9.87	8	-1.33	0.219
Emotional Regulation Index	60	6.62	55	10.63	8	-1.94	0.088
Cognitive Regulation Index	67	7.57	62	8.36	8	-2.85	.021*

Table 3: Comparison of subscales of Behavior Rating Inventory of Executive Functioning between Pre and Post-test.

* $p < 0.05$, ** $p < 0.01$

Content scale Scores of pre and post intervention show significant improvement in cognitive regulation on BRIEF 2 parent reporting. ($p < .05$). No statistically significant changes

were noted in behaviour and emotional regulation however there is improvement in terms of mean performance.

Variables	Pre-Test (N=9)		Post Test (N=9)		df	t test	p value
	Mean	SD	Mean	SD			
Cognitive Proficiency Index scores	89	8.86	96	9.69	8	2.91	.019*
Processing speed index	87	14.45	97	10.06	8	2.23	0.056
Working Memory Index	96	12.27	98	10.23	8	1.14	0.286

Table 4: Comparison of cognitive proficiency index scores between pre and post-test.

* $p < 0.05$, ** $p < 0.01$

Cognitive proficiency index showed significant improvement from pre to post intervention ($p < 0.05$).

Feasibility Findings

Parent feedback was taken after the BFT session. 55% of the parents rated the experience very good
Regular follow up Rate for the sessions was calculated to be around 64%.

Discussion

The purpose of the study was to examine changes in attention, cognitive proficiency and behaviour regulation after Brain function therapy program (BFT) in children with Attention Deficit and Hyperactivity Disorder. Findings demonstrate significant positive shift in cognitive proficiency and improvement in attention. It was found that repetitive targeted training exercises were beneficial along with positive feedback. Basis of this can be found in principle of self-directed neuroplasticity that is capacity to proactively modify cerebral function. According to this mind has ability to change brain function through the power of thought and can alter brain structure in potentially beneficial

ways, overcoming. Habituated and maladaptive responses [29]. Focusing attention on specific actions can allow for regulation of emotional and physical responses [30]. This is supported by studies that have shown structural brain changes after cognitive training [31,32]. Results have found focal volumetric grey matter increases in bilateral middle frontal cortex and right inferior posterior cerebellum in ADHD children after training than control group.

Studies have found effectiveness of cognitive training in ADHD. Velosa A, et al. [33] has emphasized usefulness of cognitive training in treatment of ADHD by meta-analysis of cognitive training studies. Stevenson CS, et al. [34] did randomized controlled trial to examine efficacy of cognitive remediation for management of adults with ADHD. Results found significant improvement in ADHD symptomology, organizational skills and reduced levels of anger. The improvement in symptomology and organizational skills were maintained one year after intervention. In the present study, parents have reported reduction of learning problems after Brain function therapy program. This is also supported by Chaturvedi RK, et al. [35] study that have shown effect of cognitive training on reading skills. They examined difference between pre and post session of Bright

mind based cognitive skill training on memory, confidence, concentration, intuition ability and blindfold reading. Findings of the study using paired t test concluded that there was a significant improvement on student's memory, confidence, concentration, intuition and skill of reading.

An important component of motivation is arousal and behaviour conditioning can produce long term changes in hippocampus influencing learning and Memory [36]. The nature of the task also would have been responsible bringing out positive changes post intervention as well. The BFT exercises used adaptive training that is difficulty of task was adjusted to child's performance and there was an inbuilt feedback system which gave immediate reinforcement in form of correct hits. According to Sagvolden T, et al. [37] ADHD children need immediate reinforcement than normal Children; slightly delayed reinforcement loses its potency. In case of behaviour regulation, positive shift was observed however it was not clinically significant. One of the reasons could be that Response inhibition task was difficult for some children and need more session work. To transfer skills in daily living activities may need a greater number of sessions. One of the objectives of the study was also to analyse feasibility of conducting an online BFT program. Feasibility is measured in terms of Retention or follow up rate of children enrolled in the study. Rate of follow up acceptable is between 50 to 80% [38,39]. Results indicate that follow up for the session was within acceptable rate. Also, more than 50% of the parents rated their experience as 'very good' for their children. Parents requested to continue with the sessions post study.

Challenges

There was recruitment challenge due to special feature of program. Technical glitches and connectivity issue were the main observed limitations while doing the BFT. For some children parent's poor understanding of technology usage affected the timely sessions of BFT. Some children who attended the BFT session towards the end of the day were seen to be tired and their performance affected because of that.

Conclusion

Positive shift in cognitive proficiency, reduction in hyperactivity and inattention behavior in children with ADHD was observed even after few sessions of online BFT program. Online BFT program seems to be feasible with acceptable follow up rate. BFT can be used in adjunct with remedial training. Future studies have to look at the time period and individual characteristics.

Acknowledgement

The authors would like to express their sincere appreciation to Indian Council of Social Science Research (ICSSR) for the financial support provided through research project grant (ICSSR/RPD/MN/2023-24/SC/101).

References

1. American Psychiatric Association (2013) Neurodevelopmental Disorder. In Diagnostic and Statistical Manual of Mental Disorders. 5th (Edn.), Washington, London, pp: 59-66.
2. Badeleh MT (2013) Attention Deficit Hyperactivity Disorder and Elementary Teachers' Awareness. Journal of Medical Sciences 13(8): 829-833.
3. Carlson NR (2007) Foundations of Physiological Psychology. 6th (Edn.), Pearson Education Asia.
4. Venkata JA, Panicker AS (2013) Prevalence of Attention Deficit Hyperactivity Disorder in Primary School Children. Indian Journal of Psychiatry 55(4): 338-342.
5. Craig F, Margari F, Legrottaglie AR, Palumbi R, de Giambattista C, et al. (2016) A Review of Executive Function Deficits in Autism Spectrum Disorder and Attention-Deficit/Hyperactivity Disorder. Neuropsychiatric Dis Treat 12: 1191-1202.
6. Willcutt EG, Doyle AE, Nigg JT, Faraone SV, Pennington BF (2005) Validity of the Executive Function Theory of Attention-Deficit/Hyperactivity Disorder: A Meta-Analytic Review. Biological Psychiatry 57(11): 1336-1346.
7. Carlson SM, Zelazo PD, Faja S (2013) Executive Function. In: PD Zelazo (Eds.), The Oxford Handbook of Developmental Psychology, Body and Mind, Oxford University Press 1: 706-743.
8. Sinha P, Sagar R, Mehta M (2008) Executive Function in Attention Deficit/Hyperactivity Disorder. Journal of Indian Assoc Child Adolescent 4(2): 44-49.
9. Simpson A, Carroll DJ (2019) Understanding Early Inhibitory Development: Distinguishing Two Ways that Children Use Inhibitory Control. Child Dev 90(5): 1459-1473.
10. Carlson SM, Moses LJ (2001) Individual Differences in Inhibitory Control and Children's Theory of Mind. Child Development 72(4): 1032-1053.

11. Conners K (2008) Conner 3rd (Edn.). Encyclopedia of Clinical Neuropsychology, pp: 675-678.
12. Gioia GA, Kenworthy L, Isquith PK, Guy SC (2015) Brief 2: Behavior Rating Inventory of Executive Function, 2nd (Edn.). Psychological Assessment Resources.
13. Devena SE, Watkins MW (2012) Diagnostic Utility of WISC-IV General Abilities Index and Cognitive Proficiency Index Difference Scores among Children with ADHD. *Journal of Applied School Psychology* 28(2): 133-154.
14. Weiss LG, Gabel AD (2008) WISC-IV Technical Report #6: Using the Cognitive Proficiency Index in Psychoeducational Assessment. Upper Saddle River, Pearson Education, New Jersey.
15. Arnsten AFT (2009) ADHD and the Prefrontal Cortex. *The Journal of Pediatrics* 154(5): S1-S43.
16. Gregg S (2005) Understanding and Identifying Children with ADHD. Appalachia Educational Laboratory, Charleston.
17. Kaplan IH, Sadock BJ (1998) Synopsis of Psychiatry: Behavioral Sciences: Clinical Psychiatry. 8th (Edn.), BJ Waverly Pvt Ltd, New Delhi.
18. Morisoli K, McLaughlin TF (2006) Medication and School Intervention for Elementary Students with Attention Deficit Hyperactivity Disorder. *International Journal of Special Education* 19(1): 97-106.
19. Khan NA, Jahan M, Kanchan A, Singh AR (2017) Management of Attention Deficit and Fine Motor Incoordination of Primary School Going ADHD (Inattentive Type) Children. *Acta Neuropsychologica* 15(3): 283-301.
20. Parvinchi D, Wright L, Schachar R (2014) Cognitive Rehabilitation for Attention Deficit/Hyperactivity Disorder (ADHD): Promises and Problems. *J Can Acad Child Adolesc Psychiatry* 23(3): 207-217.
21. Medow H (2011) Neuroplasticity-Biology of Psychotherapy. pp: 10(13): 1-44.
22. Willis SL, Schaie KW (2009) Cognitive Training and Plasticity: Theoretical Perspective and Methodological Consequences. *Restor Neurol Neurosci* 27(5): 375-389.
23. Beaumont JG (2008) Introduction to Neuropsychology. 2nd (Edn.), Guilford Press.
24. Buffery AW (1987) Brain Function Therapy: Computerized Neuropsychological Rehabilitation. Carrier Foundation Letter 124: 1-3.
25. UR A, Gupta S (2021) A Descriptive Survey Regarding Impact of Lockdown on School Going Children. *Nursing Health Care Int J* 5(2): 1-12.
26. Joseph M, Mao A (2012) Wechsler Intelligence Scale for Children 4th (Edn.) (India). PsyCorp.
27. (2023) Brain Function Therapy (BFT). Health Axxonet.
28. Christiana S, Anira R, Mukundan CR (2009) Technology in Rehabilitation. *Indian Journal of Clinical Psychology* 36(2): 11-22.
29. Schwartz JM, Begley S (2002) The Mind and the Brain: Neuroplasticity and the Power of Mental Force. Regan Books/Harper Collins Publishers.
30. Rueda MR, Posner MI, Rothbart MK (2005) The Development of Executive Attention: Contributions to the Emergence of Self-regulation. *Developmental Neuropsychology* 28(2): 573-594.
31. Klein T, Kendall B, Tougas T (2019) Changing Brains, Changing Lives: Researching the Lived Experience of Individuals Practicing Self-directed Neuroplasticity. Sophia the St Catherine University.
32. Hoekzema E, Carmona S, Ramos-Quiroga JA, Barba E, Bielsa A, et al. (2011) Training-Induced Neuroanatomical Plasticity in ADHD: A Tensor-Based Morphometric Study. *Human Brain Mapping* 32(10): 1741-1749.
33. Veloso A, Vicente SG, Filipe MG (2020) Effectiveness of Cognitive Training for School-Aged Children and Adolescents with Attention Deficit/Hyperactivity Disorder: A Systematic Review. *Front Psychol* 10.
34. Stevenson CS, Whitmont S, Bornholt L, Livesey D, Stevenson RJ (2002) A Cognitive Remediation Programme for Adults with Attention Deficit Hyperactivity Disorder. *Australian & New Zealand Journal of Psychiatry* 36(5): 610-616.
35. Chaturvedi RK, Verma V, Mishra K (2022) Differential Effect of Pre and Post Cognitive Skills Training Program: A Study on Healthy Young Children. *Smart Learning Environments* 9(7).
36. Pinel J (1997) Biopsychology. Pearson, New York.
37. Sagvolden T, Sergeant JA (1998) Attention Deficit/Hyperactivity Disorder: From Brain Dysfunctions to Behaviour. *Behav Brain Res* 94(1): 1-10.
38. Fewtrell MS, Kennedy K, Singhal A, Martin RM, Ness A, et

al. (2008) How Much Loss to Follow-up is Acceptable in Long-Term Randomised Trials and Prospective Studies? Archives of Disease in Childhood 93(6): 458-461.

What is a Pilot or Feasibility Study? A Review of Current Practice and Editorial Policy. BMC Medical Research Methodology 10(67).

39. Arain M, Campbell MJ, Cooper CL, Lancaster GA (2010)