**Building Foundations for Well-Being by Strengthening Brain Fitness:
Prevention and Early Intervention of Mental Health and Substance Abuse Problems**

Problem and a Solution. With a persistent national achievement gap;[i] adverse childhood experiences (ACEs) affecting almost half of U.S. children;[ii,iii] one in six U.S. children aged 6-17 experiencing a mental health disorder each year;[iv] and a staggering 52% national rise in adolescent major depressive episodes from 2005 to 2017,[v] more states and school districts are recognizing the need for a holistic approach in addressing the connections between ACEs, academic achievement, mental health and lifelong well-being. Research has established that ACEs compromise development of executive cognitive functions and associated self-regulation skills, and that the limitations in these specific skills are in turn associated with poor academic outcomes, failure to graduate from high school, mental health problems, unemployment, and incarcerations.[vi,vii,viii] Fortunately, there are proven, scalable, school-based interventions to strengthen executive function and self-regulation skills, thereby reducing the lifelong consequences of ACEs. These skills prime children's brains for learning and make it possible for them to better focus and effectively control their behaviors, and at the same time they can dramatically improve academic outcomes. The increased cognitive skills and academic learning together build a stronger foundation for lifelong well-being and positive contributions to society, the workplace, and community.

Executive Function and Brain Fitness—Evidenced-based Primary Prevention and Early Interventions for Improving Academics and Mental Health. Intervening early to improve children's abilities to succeed in school, improve self-awareness and self-control, and develop positive relationships with their peers is an important and actionable way to help protect vulnerable students from developing mental health issues in the future. Moreover, executive function is compromised in many psychiatric disorders[ix,x,xi,xii,xiii] and compromised executive function can limit a person's ability to effectively participate in treatment programs for these disorders.[xiv,xv,xvi,xvii] Therefore, strengthening children's executive function skills is both a primary prevention and an early intervention and should be considered as a necessary part of the continuum of mental health interventions in schools.

Taking a Holistic View to Support Well Being. Well-being depends on opportunities to learn, to work, to live without excessive stress, and to maintain body, brain, and mental health. Each of these vital elements of well-being profoundly affects the others. With this holistic view have come efforts to move "upstream" in identifying factors that promote or compromise health in any of the above areas. (See https://wellbeingtrust.org; https://www.nationalalliancehealth.org/home.) These efforts are urgent. For adults, as well as students, well-being affects attendance, productivity, new skill learning and the ability to adjust to change at work and/or school. Accordingly, 85% of large employers have wellness programs for employees.[xviii] Unfortunately, over 60% of employees are dissatisfied with these programs.[xix] In the last decade, drugs, alcohol, and depression have led to over 1 million deaths and have compromised many more lives. Related financial and emotional costs are significant—including the loss of productive human capital, the impact on families, and the associated health care expenses. Important efforts to address these problems more comprehensively have begun, including, for examples, housing for the homeless, special treatment programs for those exposed to trauma, better

integration of mental health with primary medical care, social media campaigns for teens, and advocacy for parity in coverage and reimbursement for mental health problems. However, development of individual executive cognitive function skills essential for the desired well-being outcomes, and for effective participation in many of the community-based programs developed to promote well-being, has yet to receive appropriate attention. This is especially true for effective and proven school-based, executive-function-promoting programs. These programs are neuroscience-informed, often technology-enabled, evidence-based and scalable interventions that promote development of executive cognitive function, and they are available today. (See https://www.brainfutures.org/wp-content/uploads/2020/02/Youth-Issue-Brief-November-2019.pdf.) Moreover, they have been shown to have particularly large effects in children who are raised in poverty with associated adverse childhood experiences.

How Brain Fitness Interventions Differ from Mental Health Treatments. Unlike mental health treatments, which require a diagnosis and usually involve targeted 1:1 therapy provided by a clinician, brain fitness and executive function interventions that strengthen critical executive function skills are a preventative tool that can be effectively delivered to all students in a classroom. Research shows that while those students with the greatest deficits benefit most from the interventions, students at all levels show benefits, and class-wide participation prevents those with greater deficits from feeling stigmatized.[xx] This is important because typically school-administered mental health screening is limited to a very small percentage of children, triggered only after symptoms have developed to disruptive levels; and even then treatment is too often not available. Furthermore, class-wide application makes it unnecessary to first administer costly assessments to select students for intervention, and also provides preventive intervention for children with compromised function that does not meet diagnostic thresholds (e.g., attention problem without a clinical diagnosis of ADHD, or poor self-control). Evidence-based interventions that improve attention or self-control make it less likely that children with "pre-diagnostic dysfunctions" in these areas will go on to develop clinical disorders requiring mental health treatments.

What Executive Function is and Why it Matters. Executive function (EF) is a set of cognitive skills supported largely by the prefrontal cortex (PFC), and includes: working memory (needed for managing and integrating information), inhibitory control (used to control thoughts, emotions, and behaviors), and cognitive flexibility (allowing the shift from one mind state or task to another).[xxi] The PFC brain networks also facilitate the integrated brain functions that give rise to higher-order skills including reasoning, problem solving, innovation, fluidity of ideas/solutions, and planning.[xxii] Executive function is crucial to learning, planning, reasoning, problem-solving, goal-directed action, and self-motivation.[xxiii] Research has shown that these functions help prime children's brains for learning and contribute to their success in school.

Executive function skills also have affective as well as cognitive impacts; and they help strengthen social and emotional learning (SEL) skills. EF capacities enable the prefrontal cortex to play a regulating role when a student is faced with an emotional trigger and/or when a student needs to discern the appropriate response in a given context. [xxiv] Additionally, cognitive flexibility allows students to have empathy for another's perspective and/or acknowledge their part in a conflict. Research underscores that students' capacity for self-regulation, emotion management, and empathic positive relations is as critical as subject content instruction to academic performance. EF skills are foundational to both academic achievement and prosocial behaviors, and they are better predictors of long-term school success than are early academic markers or IQ; whereas low EF skills predict not only

compromised academic outcomes, but also less successful and healthy life trajectories.[xxv]

Decades of research have identified processes through which ACEs compromise development of executive function and the brain systems that support them. [xxvi] These effects on neural development are evident in studies of brain electrical activity in infants as young as 9 months of age. These adverse early effects on brain development are then exacerbated by a host of factors associated with poverty that further limit opportunities for cognitive stimulation needed to develop executive function, and that create stress-related physiological changes that actively compromise brain and cognitive development.[xxvii]

The functional consequences are all too well documented. Children with weaker executive function skills engage less effectively with classroom learning activities[xxviii] and have lower reading and math achievement in elementary school.[xxix,xxx,xxxi,xxxii,xxxiii] A study of 2,000 children found that those with low executive function between ages 6 to 12 were more likely to repeat a grade, received more disciplinary actions in school, and were eight times more likely to drop out of high school than those without executive function deficits.[xxxiv] A study of 430 children found that their attention span-persistence (a component of self-regulation) at age 4 significantly predicted math and reading achievement at age 21 and also significantly predicted the odds of completing college by age 25—even after controlling for achievement levels at age 7, adopted status, child vocabulary skills, gender, and maternal education level.[xxxv] Low executive function in childhood is associated with many other negative life outcomes, including substance use, sexual risk-taking, physical illnesses (including obesity, diabetes, accidental injury), violence and criminality. [xxxvi,xxxvii] In longitudinal studies following as many as 1,000 children from ages 3-5 until they were 32 years old, 36 children with poor self-control at ages 3 and 5 exhibited impulsive aggression, hyperactivity, lack of persistence, inattention and impulsivity at ages 5, 7, 9, and 11 years. As teenagers, they were more likely to drop out of school, use drugs and become parents. By adulthood, they had higher rates of substance abuse and sexually transmitted infections, lower income and savings, higher unemployment and incarceration rates and a range of other health problems.[xxxviii] These outcomes are the antithesis of well-being at the individual and community level.

Executive Function and Mental Health. Most serious mental illnesses and many moderate mental health conditions are associated with or have decreased executive function:

- Cognitive dysfunction is a recognized feature of mood disorders, including major depressive disorder and bipolar disorder.[xxxix]
- Executive dysfunction is present in 25-40% of older adults with major depression[xl,xli] and predicts poor, slow, unstable response to treatment.[xlii,xliii]
- Bipolar disorder, at the group level, is associated with significant but modest cognitive deficits, including executive dysfunction.[xliv]
- Relative to healthy controls, patients with schizophrenia have deficits on all aspects of executive functions.[xlv] These cognitive deficits limit their education and work outcomes even when they receive medications that reduces other clinical symptoms.
- More generally, self-control has a large positive correlation with measures of mental health,[xlvi] and evidence-based brain fitness programs can yield positive effects on problematic behaviors including rumination, intrusive thoughts, and emotional over arousal.[xlvii]
- Low executive cognitive skills limit effective participation in treatment for mental illness.[xlviii]

Accordingly, strengthening children's executive function skills and building up cognitive reserve can

serve as a means of preventing future mental illness and improving treatment outcomes in those who do develop a mental illness.

Elementary School is the Time to Intervene for Robust Effects. Early childhood and the primary school years are key developmental periods for creating foundational brain circuitry, and the associated higher-order executive functions that are critical for students' mental, cognitive and physical health, and functional life outcomes. Evidence-based executive function skills programs, such as cognition-training games and mindfulness interventions yield impressive results for children's academic and behavioral outcomes. For example:

- A mindfulness intervention for elementary school students produced a 20% increase in self-reported well-being and a 24% decrease in aggressive behaviors, as assessed by classmates.[xlix] The students also achieved an average 15% increase in end-of-year math grades.
- Another mindfulness program used by 1st–5th grade students resulted in a 60% decrease in behavioral issues and a 43% decrease in teacher stress. Those students also achieved 28% higher grades in reading, math, and science.[l]
- For children with ADHD, one cognitive training program positively impacted brain function[li, lii], improved executive function dysfunctions that define the disorder, and decreased clinical symptoms to a similar extent as do medications in about 50% of children with or at high risk for ADHD.[liii] Students using that program at a high-poverty urban elementary school improved executive cognitive functions and achieved four times greater math proficiency and three times greater reading proficiency on state standardized tests when compared with those students who did not receive the training.[liv]

Conclusions

1. Nearly 50% of children in the United States suffer ACEs, often related to poverty, that compromise development of executive cognitive functions and related brain systems.
2. Children with poor EF are more likely to fail and dropout of school, abuse substances as adolescents and young adults, and be unemployed or incarcerated as young adults.
3. Poor executive function is a prominent aspect of many psychiatric illnesses including ADHD, depression, schizophrenia and substance abuse. In addition to being the source of clinical symptoms, poor executive function limits patient ability to make effective use of treatment.
4. Executive function and associated brain systems develop strongly during elementary school years, and schools constitute a national infrastructure for early intervention to improve EF and partially mitigate the effects of ACEs and poverty on mental health and well-being.
5. Executive function bolster academic and SEL competencies, predicting school and life success.
6. Multiple web-based and technology-enabled interventions to improve executive function and related behavioral and functional life outcomes have now met high evidentiary standards of effectiveness in school settings. These programs constitute primary prevention and early intervention programs to decrease the incidence, severity, and life-long personal and social costs of ACEs and low executive function.
7. Current school-based mental health and substance abuse interventions are not able to provide broad and early enough support to address the number of children affected by ACEs and poverty. These urgent problems can be addressed with low-cost, broad-scale, often technology-enabled, and neuroscience-informed preventive and early interventions programs. Without early and broad interventions, the mental health system will remain unable to address large numbers of individuals with mental health problems and associated consequences.

Endnotes

[i] Hansen, M., Mann Levesque, E., Valant, J., & Quintero, D. (2018). The 2018 Brown Center Report on American Education. Washington, DC; Brookings. Retrieved from https://www.brookings.edu/multi- chapter-report/the-2018-brown-center-report-on-american- education/

[ii] Anda, R., Butchart, A., Felitti, V., & Brown, D. (2010). Building a framework for global surveillance of the public health implications of Adverse Childhood Experiences. American Journal of Preventive Medicine, 39(1), 93-98. doi: 10.1016/j.amepre.2010.03.015

[iii] McCormack, H. O'Brien, C., Kennedy, P., Harbin, H., Carneal, J., & Alfred, L. (2015). Promoting Brain Health and Brain Fitness: A National Call for Action. Retrieved from https://chp-wp-uploads.s3.amazonaws.com/www.thekennedyforum.org/uploads/2017/06/ issue-brief-Brain_Fitness_160725.pdf

[iv] Whitney, D.G. & Peterson, M.D. (2019) US national and state-level prevalence of mental health disorders and disparities of mental health care use in children. JAMA Pediatrics, 173(4):389-391. doi:10.1001/jamapediatrics.2018.5399

[v] Twenge, J., Cooper, A., Joiner, T., Duffy, M., & Binau, S. (2019). Age, period, and cohort trends in mood disorder indicators and suicide-related outcomes in a nationally representative dataset, 2005–2017. Journal of Abnormal Psychology, 128(3), 185-199. doi: 10.1037/abn0000410

[vi] Pingault, J.B., Tremblay, R.E., Vitaro, F., Carbonneau, R., Genolini, C., Falissard, B., & Cote, S. (2011) Childhood trajectories of inattention and hyperactivity and prediction of educational attainment in early adulthood: a 16-year longitudinal population-based study. American Journal of Psychiatry, 168:1164–70.

[vii] Bridgett, D. J., Burt, N. M., Edwards, E. S., & Deater-Deckard, K. (2015). Intergenerational transmission of self-regulation: A multidisciplinary review and integrative conceptual framework. Psychological bulletin, 141(3), 602–654. doi:10.1037/a0038662

[viii] Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., … Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. Proceedings of the National Academy of Sciences of the United States of America, 108(7), 2693–2698. doi:10.1073/pnas.1010076108

[ix] MacQueen, G.M. & Memdovich, K.A. (2017) Cognitive dysfunction in major depression and bipolar disorder: Assessment and treatment options. Psychiatry and Clinical Neurosciences, 71(1): 18-27. doi: 10.1111/pcn.12463

[x] Alexopoulos, G.S. (2005) Depression in the elderly. Lancet, 365:1961–1970. doi: 10.1016/S0140-6736(05)66665

[xi] Murphy, C.F. & Alexopoulos, G.S. (2004). Longitudinal association of initiation/perseveration and severity of geriatric depression. American Journal of Geriatric Psychiatry, 12(1):50-6. doi: 10.1097/00019442-200108000-00011

[xii] Bora, E., Hidiroglu Ongun, C., Ozerdem, A., Kaçar, Ö., Sarısoy, G., Arslan, F… & Tumkaya, S. (2016). Executive dysfunction and cognitive subgroups in a large sample of euthymic patients with bipolar disorder. European Neuropsychopharmacology, 26. doi: 10.1016/j.euroneuro.2016.04.002

[xiii] Thai, M.L., Andreassen, A.K., & Bliksted, V. (2019). A meta-analysis of executive dysfunction in patients with schizophrenia: Different degree of impairment in the ecological subdomains of the Behavioural Assessment of the Dysexecutive Syndrome. Psychiatry Research, 272:230-236. doi: 10.1016/j.psychres.2018.12.088

[xiv] Gutiérrez-Colina, A.M., Eaton, C.K., Lee, J.L., Reed-Knight, B., Loiselle, K., Mee, L.L., LaMotte, J., Liverman, R., & Blount, R.L. (2016) Executive functioning, barriers to adherence, and nonadherence in adolescent and young adult transplant recipients. Journal of Pediatric Psychology, 41(7): 759–767. doi: 10.1093/jpepsy/jsv107

[xv] El-Missiry, A., Elbatrawy, A., El Missiry, M., Moneim, D.A., Ali, R., & Essawy, H. (2015) Comparing cognitive functions in medication adherent and non-adherent patients with schizophrenia. Journal of Psychiatric Research, 70:106–12. doi: 10.1016/j.jpsychires.2015.09.006

[xvi] Martinez-Aran, A, Scott, J, Colom, F, Torrent, C, Tabares-Seisdedos, R, Daban, C (2009). Treatment nonadherence and neurocognitive impairment in bipolar disorder. Journal of Clinical Psychiatry, 70, 1017-1023. doi: 10.4088/JCP.08m04408

[xvii] Hinkin, C.H., Castellon, S.A., Durvasula, R.S., Hardy, D.J., Lam, M.N., Mason, K.I., Thrasher, D., Goetz, M.B., & Stefaniak. M. (2002). Medication adherence among HIV+ adults. Neurology, 59(12):1944-1950. doi: 10.1212/01.WNL.0000038347.48137.67

[xviii] O'Boyle, E., & Harter, J. (May 13, 2014). Why Your Workplace Wellness Program Isn't Working. Washington, D.C.: Gallup. Retrieved from https://www.gallup.com/workplace/236531/why-workplace-wellness-program-isn-working.aspx

[xix] Beaton, T. (Dec 7, 2017). 61% of Employees Dissatisfied with Employer Wellness Programs. Retrieved from https://healthpayerintelligence.com/news/61-of-employees-dissatisfied-with-employer-wellness-programs

[xx] McCormack, H., O'Brien, C., Raines, L. & Alexander, K. (2019) Brain Fitness and Executive Function: Evidence-Based Interventions That Improve Student Outcomes. Available at https://www.brainfutures.org/brainfitnessinschools/

[xxi] Zelazo, P. D., Müller, U., Frye, D., & Marcovitch, S. (2003). The development of executive function in early childhood: VI. The development of executive function: Cognitive complexity and control--revised. Monographs of the Society for Research in Child Development, 68(3), 93-119. doi:10.1111/j.0037-976X.2003.00266.x

[xxii] Chen, E., Martin, A. D., & Matthews, K. A. (2006). Socioeconomic status and health: Do gradients differ within childhood and adolescence? Social Science & Medicine, 62, 2161–2170

[xxiii] Diamond, A., & Lee, K. (2011). Interventions shown to aid executive function development in children 4 to 12 years old. Science, 333(6045), 959–964. doi:10.1126/science.1204529

[xxiv] McCormack, H., O'Brien, C., Raines, L. & Alexander, K. (2019) Brain Fitness and Executive Function: Evidence-Based Interventions That Improve Student Outcomes. Available at https://www.brainfutures.org/brainfitnessinschools/

[xxv] McCormack, H. O'Brien, C., Kennedy, P., Harbin, H., Carneal, J., & Alfred, L. (2015). Promoting Brain Health and Brain Fitness: A National Call for Action. Retrieved from https://chp-wp-uploads.s3.amazonaws.com/www.thekennedyforum.org/uploads/2017/06/ issue-brief-Brain_Fitness_160725.pdf

[xxvi] McCormack, H., O'Brien, C., Raines, L. & Alexander, K. (2019) Brain Fitness and Executive Function: Evidence-Based Interventions That Improve Student Outcomes. Available at https://www.brainfutures.org/brainfitnessinschools/

[xxvii] McCormack, H., O'Brien, C., Raines, L. & Alexander, K. (2019) Brain Fitness and Executive Function: Evidence-Based Interventions That Improve Student Outcomes. Available at https://www.brainfutures.org/brainfitnessinschools/

[xxviii] Nelson, T., Nelson, J., James, T., Clark, C., Kidwell, K. & Espy, K. (2017). Executive control goes to school: Implications of preschool executive performance for observed elementary classroom learning engagement. Developmental Psycholology, 53, 836-44. doi: 10.1037/dev0000296

[xxix] Best, J. R., Miller, P. H., & Naglieri, J. A. (2011). Relations between Executive Function and Academic Achievement from Ages 5 to 17 in a Large, Representative National Sample. Learning and individual differences, 21(4), 327–336. https://doi.org/10.1016/j.lindif.2011.01.007

[xxx] Cantin, R., Gnaedinger, E., Gallaway, K., Hesson-McInnis, M. & Hund, A. (2016). Executive functioning predicts reading, mathematics, and theory of mind during the elementary years. Journal of Experimental Child Psychology, 146, 66-78. doi: 10.1016/j. jecp.2016.01.014

[xxxi] Christopher, M., Miyake, A., Keenan, J., Pennington, B., DeFries, J., Wadsworth, S., et al. (2012). Predicting word reading and comprehension with executive function and speed measures across development: a latent variable analysis. Journal of Experimental Psychology: General. 141:470. doi: 10.1037/ a0027375

[xxxii] Duckworth, A., Quinn, P., & Tsukayama, E. (2012). What No Child Left Behind Leaves Behind: The Roles of IQ and Self-Control in Predicting Standardized Achievement Test Scores and Report Card Grades. Journal of Educational Psychology, 104(2), 439–451. doi:10.1037/a002628

[xxxiii] Yeniad, N., Malda, M., Mesman, J., van IJzendoorn, M., & Pieper, S. (2013). Shifting ability predicts math and reading performance in children: A meta-analytical study. Learning and Individual Differences, 23, 1-9.doi: 10.1016/j.lindif.2012.10.004

[xxxiv] Pingault, J.B., Tremblay, R.E., Vitaro, F., Carbonneau, R., Genolini, C., Falissard, B., & Cote, S. (2011) Childhood trajectories of inattention and hyperactivity and prediction of educational attainment in early adulthood: a 16-year longitudinal population-based study. American Journal of Psychiatry, 168:1164–70.

[xxxv] McClelland, M. M., Acock, A. C., Piccinin, A., Rhea, S. A., & Stallings, M. C. (2013). Relations between Preschool Attention Span-Persistence and Age 25 Educational Outcomes. Early Childhood Research Quarterly, 28(2), 314–324. doi:10.1016/j.ecresq.2012.07.008

[xxxvi] Sacks, V., Moore, K., & Murphey, D. (2014). Adverse Childhood Experiences and the Well-Being of Adolescents. Research Brief. Child Trends publication number 2014-28. Retrieved from https://www.childtrends.org/wp-content/uploads/2014/07/Brief-adverse- childhood-experiences_FINAL.pdf

[xxxvii] Felitti MD, V., Anda MD, R., Nordenberg, D., Williamson, D., Sptiz, A., & Edwards, V. et al. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. American Journal of Preventive Medicine, 14(4), 245–258. doi: 10.1016/S0749-3797(98)00017-8

[xxxviii] Moffitt, T., Arseneault, L., Belsky, D., Dickson, N., Hancox, R., Harrington, H., & Caspi, A. (2011). A gradient of childhood self- control predicts health, wealth, and public safety. Proceedings of The National Academy of Sciences, 108(7), 2693-2698. doi: 10.1073/pnas.1010076108

[xxxix] MacQueen, G.M. & Memdovich, K.A. (2017) Cognitive dysfunction in major depression and bipolar disorder: Assessment and treatment options. Psychiatry and Clinical Neurosciences, 71(1): 18-27. doi: 10.1111/pcn.12463

[xl] Alexopoulos, G.S. (2005) Depression in the elderly. Lancet, 365:1961–1970. doi: 10.1016/S0140-6736(05)66665-2

[xli] Elderkin-Thompson, V., Kumar, A., Bilker, W., Dunkin, J., Mintz, J., Moberg, P., Mesholam, R. & Gur, R. (2003). Neuropsychological deficits among patients with late-onset minor and major depression. Archives of Clinical Neuropsychology, 18: 529-49. doi: 10.1016/S0887-6177(03)00022-2

[xlii] Alexopoulos, G.S. (2005) Depression in the elderly. Lancet, 365:1961–1970. doi: 10.1016/S0140-6736(05)66665-

[xliii] Murphy, C.F. & Alexopoulos, G.S. (2004). Longitudinal association of initiation/perseveration and severity of geriatric depression. American Journal of Geriatric Psychiatry, 12(1):50-6. doi: 10.1097/00019442-200108000-00011

[xliv] Bora, E., Hidiroglu Ongun, C., Ozerdem, A., Kaçar, Ö., Sarısoy, G., Arslan, F… & Tumkaya, S. (2016). Executive dysfunction and cognitive subgroups in a large sample of euthymic patients with bipolar disorder. European Neuropsychopharmacology, 26. doi: 10.1016/j.euroneuro.2016.04.002

[xlv] Thai, M.L., Andreassen, A.K., & Bliksted, V. (2019). A meta-analysis of executive dysfunction in patients with schizophrenia: Different degree of impairment in the ecological subdomains of the Behavioural Assessment of the Dysexecutive Syndrome. Psychiatry Research, 272:230-236. doi: 10.1016/j.psychres.2018.12.088

[xlvi] Black, 2011. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3195515/

[xlvii] Mendelson,T., Greenberg, M. T., Dariotis, J. K., Gould, L. F., Rhoades, B. L., & Leaf, P. J. (2010). Feasibility and preliminary outcomes of a school-based mindfulness intervention for urban youth. Journal of Abnormal Child Psychology. https://doi.org/10.1007/s10802-010-9418-x

[xlviii] McKee. M., Hull, J.W., & Smith, T.E. (1997 Feb 28). Cognitive and symptom correlates of participation in social skills training groups. Schizophrenia Research; 23(3):223-9. doi.org/10.1016/S0920-9964(96)00090-4

[xlix] Schonert-Reichel, K., Oberle, E., Lawlor, M., Abbott, D., Thomson, K., Oberlander, T., & Diamond, A. (2015). Enhancing cognitive and social-emotional development through a simple-to-administer mindfulness-based school program for elementary school children: a randomized controlled trial. Developmental Psychology, 51(1): 52-66. doi: 10.1037/a0038454

[l] Inner Explorer (2019). Inner Explorer – Changing the world, one student at a time… retrieved from https://innerexplorer.org

[li] Rosa, V.O., Franco, A.R., Salum, G.A., Moreora-Maia, C.R., Wagner, F., Simioni, A., Bassotto, C.F., Moritz, G.R., Aguzzoli, G.S., Buchweitz, A., Schnitz, M., Rubia, K., & Rhode, L.A.P. (2019). Effects of computerized cognitive training as add-on treatment to stimulants in ADHD: a pilot fMRI study. Brain Imaging and Behavior, 1-12, doi.org/10.1007/s11682-019-00137-0; 2.

[lii] Smith, S.D., Crowley, M.J., Ferrey, A., Ramsey, K., Wexler, B.E., Leckman, J.F., & Sukhodolsky, D.G. (2019) Effects of integrated brain, body and social (IBBS) intervention on ERP measures of attentional control in children with ADHD. Psychiatry Research, 248-257. doi: 10.1016/j.psychres.2019.06.021

[liii] Wexler, B.E., Vitulano, L.A., Moore, C., Katsovich, L., Smith, S.D., Rush, C., Grantz, H., Dong, J., & Leckman, J.F. An integrated program of computer-presented and physical cognitive training exercises for children with Attention-Deficit/Hyperactivity Disorder (Psychological Medicine, in press).

[liv] C8Sciences (2018). Data provided to C8Sciences by the school.