the Neuroconnection News

November - December 2017 Edition 4, Volume 2

The Benefits of Connectivity-Guided Neurofeedback
In-School Therapy

The Neuroconnection, in addition to providing state of the art neurofeedback in our clinic is now in-school!

In this month's special edition, we bring you research and our latest results of in-school neurofeedback training. An overview of how Connectivity-Guided Neurofeedback addresses the connectivity abnormalities in the EEG and improves the functional deficits that interfere with learning and attention will be detailed. Evidence-based research is also provided to further illustrate the efficacy of neurofeedback training for treatment in a school setting. To conclude this issue, we discuss our collaboration with Harvest Christian Academy and the progress participating students have made within the past year.

Upon reading this newsletter, if you have any questions or would like to request additional information, please feel free to contact us at (630) 858-5105.

In This Issue:

What is Connectivity-Guided Neurofeedback?

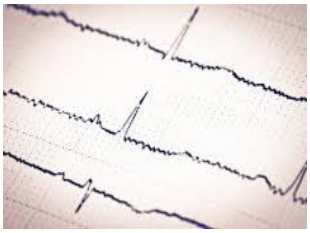
Connectivity-Guided Neurofeedback (CGNFB) is an advanced form of Neurofeedback (NFB) that allows the brain to make changes in brain wave patterns, across cortical regions, in order to develop more functional neuropathways. CGNFB is more accurate than traditional NFB because it measures the neuronal network activity in three dimensions across regions, unlike traditional NFB which only trains specific sites. This allows for improved communication within the brain and in turn, decreases neurologically rooted symptoms.

Learning disabilities, ADHD, Autism, and other problems impacting school success have specific patterns that are shown in the connectivites in QEEG Brain Maps that improve with CGNFB training. Typical functional improvements include: improved focus, attention, and cognitive abilities, improved mood and behavior, increased learning capacity and academic performance, and better sleep regulation. Because CGNFB creates new neurons/networks, changes in the brain are lasting, with none of the adverse side effects that may be experienced with medications.

WHO CAN BENEFIT?

In relation to in-school therapy, training the brain with neurofeedback has resulted in **dramatic** and lasting improvements for the following conditions:

- ✓ Attention Deficit Disorders
- ✓ Autism Spectrum Disorders
- ✓ Learning Disabilities
- ✓ Mood Disorders
- ✓ Obsessive Compulsive Disorders
- ✓ Seizure Disorders
- ✓ Traumatic Brain Injuries



Improvements from CGNFB for these conditions are often notable in the areas listed below:

- Attention
- Shifting attention
- Processing speed
- Executive functioning
- Following directions
- Organization
- Sensory sensitivity
- Mood
- Anxiety
- Behavior
- Obsessive thinking
- Sleep
- Social skills
- Motor skills
- Phonetics and semantic language
- Reading comprehension
- Word fluency
- Speech and language ability
- Grammar and writing ability
- Handwriting
- Spelling
- Math ability
- Test performance

Our goal at The Neuroconnection is to assist educators in having the best opportunity to teach their students by addressing the underlying impediments that some students enter the classroom with.

Therefore, we value and appreciate the cooperation and communication that teachers provide us with throughout a student's training. It is through this **collaborative effort** with educators that we are able to assist in learning through the use of CGNFB, thereby increasing student's ability to perform academically, while also improving emotional functioning.

The Neuronal Network: *A Closer Look inside the Brain*

Before we can begin training the brain to correct for a given condition or set of symptoms, we must first have a functional understanding of the brain itself.

The Reading Network

Investigations in MRI studies have confirmed the structural components of the brain responsible for reading create a ***pathway along the left cortical hemisphere***.

In a "typical" brain we should expect to find ***asymmetric activation across the left and right hemispheres within these frontal-temporal regions*** (see Figure 1). Such information also helps to facilitate more definitive diagnoses for reading disorders, such as ***dyslexia***, when ***identifying a lack of this asymmetry***.

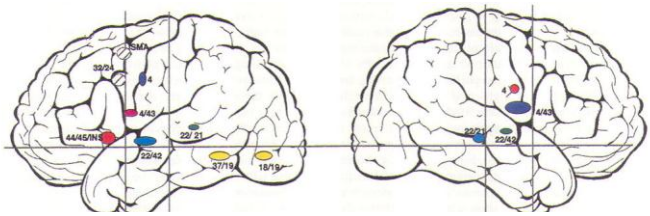


FIGURE 1 - Depiction of left to right asymmetric activation. Diagram summarizes data obtained in normal adults with PET activation during reading. Each oval is centered on the mean focus of maximal activation across nine studies (modified, Fiez and Petersen, 1998).

Within this network there are three distinct regions that must work together to enable proficient reading (see Figure 2).

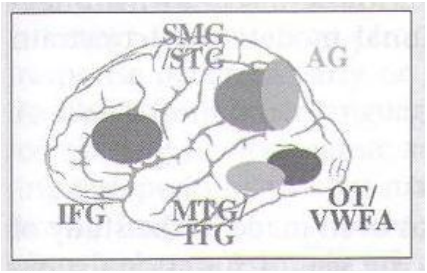


FIGURE 2 - Schematic representation of subregions thought to be associated with different components of reading.

1. The **Inferior Frontal Gyrus (IFG)** is responsible for **phonological processing**.

   The IFG facilitates our ability to turn letters into sounds. Children who lack phonemic awareness are unable to distinguish or manipulate sounds within words or syllables – making it impossible to read. This is considered the #1 problem causing failure among children learning to read.

2. The **Angular Gyrus (AG)** is responsible for **semantics, or the meaning of words in context.**

3. The **Inferior Temporal gyrus (ITG)** is responsible for **recognition of visual words**

Attentional and Affective Circuits in ADHD

In 2013, continued fMRI analysis was directed at Columbia University to identify possible outliers in the neuronal circuits of ADHD compared to healthy controls. The study ultimately established two distinguishable regions of reduced connectivity (communication) underlying both executive attention and emotional regulation.

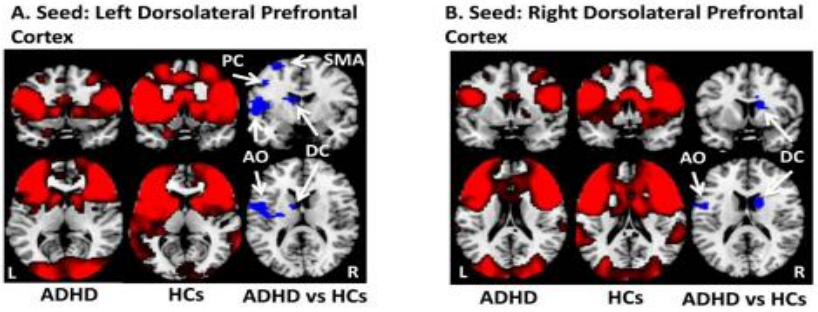


FIGURE A: Compared to healthy controls, children with ADHD had weaker functional connections between the left dorsolateral prefrontal cortex and the left anterior operculum (AO), left supplemental motor area (SMA), left dorsal caudate (DC), and left precentral gyrus (PC). (Emotional Motor Regulation)
Figure B: Compared to healthy controls, children with ADHD also had weaker functional connections between right dorsolateral prefrontal cortex and the left anterior operculum (AO), and right dorsal caudate (DC). (Executive Attention).

For more information pertaining to the findings noted above, please review the references below:

Fiez, J. A., & Petersen, S. E. (1998). Neuroimaging studies of word reading. *Proceedings of the National Academy of Sciences*, *95*(3), 914-921.

Posner, J., Rauh, V., Gruber, A., Gat, I., Wang, Z., & Peterson, B. S. (2013). Dissociable attentional and affective circuits in medication-naive children with attention-deficit/hyperactivity disorder. *Psychiatry Research: Neuroimaging*, *213*(1), 24-30.

Evidence-based Research: *Neurofeedback and Cognitive Attention Training for Children with Attention-Deficit Hyperactivity Disorder in Schools*

With these neurological patterns for reading networks and attention-deficit established from previous studies, more recent investigations have been able to explore treatment options that can directly target and regulate presenting abnormalities in the brain.

METHODS

One study recently evaluated the effectiveness of computer-modulated training in a randomized, controlled trial, which implemented *Neurofeedback (NFB) training within a school setting* (Steiner et al., 2014). Using students from second and fourth grade with an ADHD diagnosis, participants were assigned to NFB or control groups. Changes from pre-post intervention were assessed using parent and teacher feedback on the Connors 3-Parent, Behavior Rating Inventory of Executive Function rating scale (BRIEF), teacher reports, Connors 3-Teacher, and Behavioral Observation of Students in Schools. NFB groups received three 45-minute intervention sessions per week, for a total of 40 sessions over a 5-month period. All sessions were conducted throughout the school day by trained research assistants (RAs), at times that best accommodated each student's academic schedule. The NFB system incorporated in this study aimed to train a student's brain to increase beta waves and suppress theta waves, thereby decreasing the theta-to-beta ratio associated with effective focusing. Standardized checklists were completed by an RA at each session to monitor the intended accuracy and reliability.

RESULTS

Upon analysis of parent-reported measures, students assigned to NFB training showed significant improvements over time compared to the control condition on the Connors 3-Parent for inattention and executive functioning, study-targeted subscales, the Global Index, and 3 of the remaining general subscales. These students also showed significant improvements on the BRIEF Behavior Regulation, Metacognition, and Global Executive Composite summary scales, and on 5 of the 8 subscales.

CONCLUSION

Researchers concluded that *students assigned to the NFB condition were more likely to display improving symptoms due to the fact that neurofeedback training helps the brain to become more efficient by altering brainwave activity through cortical self-regulation*. In this case, implementing NFB in schools may be beneficial given that attention deficit symptoms are frequently recognized in the academic setting. Such interventions allow students to have access to treatment on an ongoing basis, as needed. In-school training could also facilitate more frequent and reliable feedback since teachers spend a great deal of time with their students and may offer valuable observations as to whether a student has benefitted from NFB treatment.

For more information pertaining to the findings noted above, please review the references below:
Steiner, N. J., Frenette, E. C., Rene, K. M., Brennan, R. T., & Perrin, E. C. (2014). Neurofeedback and cognitive attention training for children with attention-deficit hyperactivity disorder in schools. *Journal of Developmental & Behavioral Pediatrics*, *35*(1), 18-27.

The Neuroconnection at Harvest Christian Academy

For the past year, in addition to providing quality, personalized care to our clients in-office, The Neuroconnection has also been providing state of the art neurofeedback training in a school. Students participate in individual training throughout the course of the day, twice per week. Pre-and post-training outcome measures are provided by the school in the form of standardized tests, given at the beginning and end of the school year. This, along with our own objective testing, allows us to determine if and how well Connectivity-Guided Neurofeedback (CGNFB) is improving the academic performance of students trained with CGNFB. The following are outcome Measures of Academic Progress (MAP) scores of 8 individual students trained, along with overall improvement averages of those trained at Harvest Christian Academy (HCA) with CGNFB during the 2016-2017 school year (SEE FIGURES 3-7).

Reading Improvements on Standardized MAP testing scores:

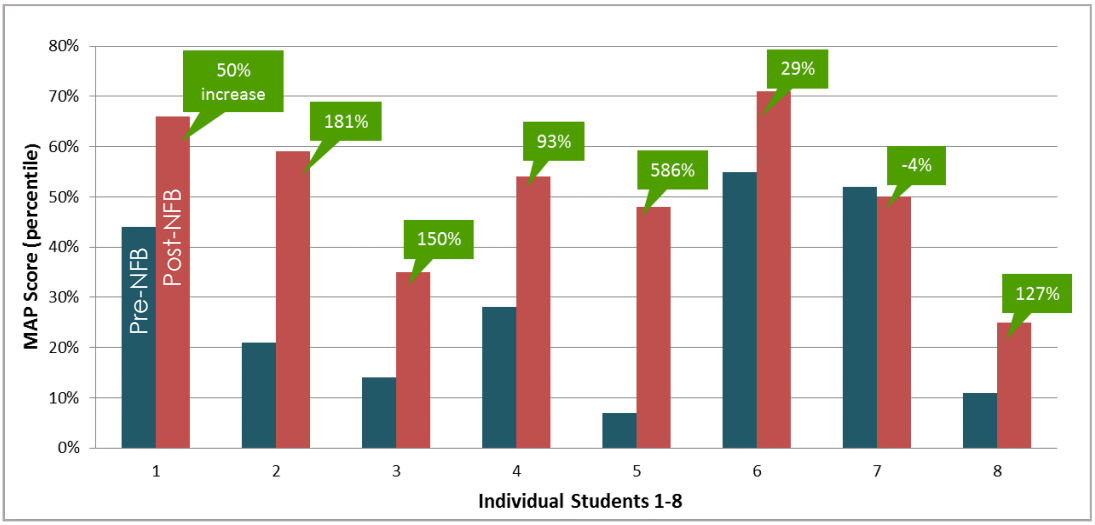


FIGURE 3 – Reading improvements for HCA students completing at least 1 protocol between pre-and-post MAP Scores who presented with below grade level academic performance in reading and/or language.

Language Improvements on Standardized MAP testing scores:

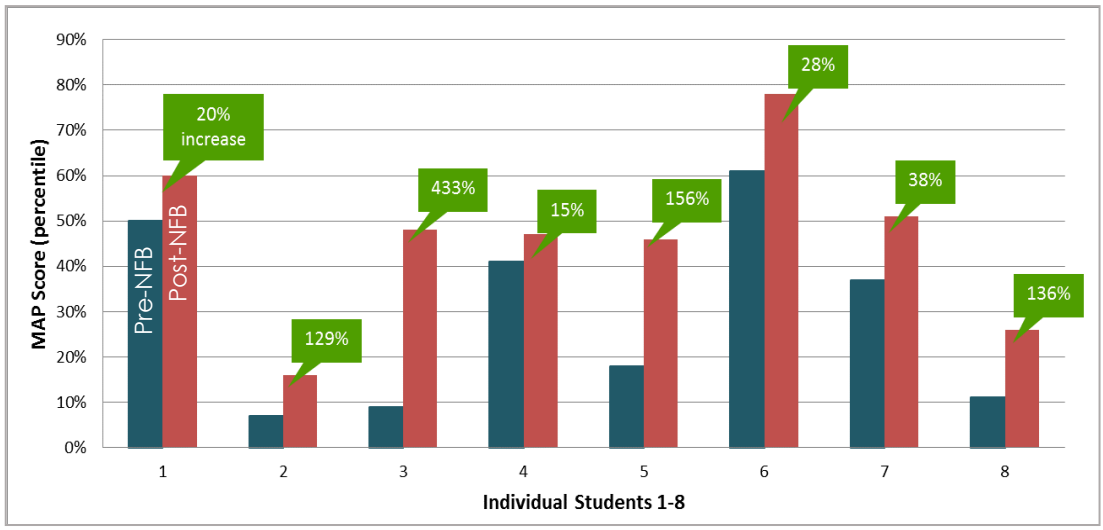


FIGURE 4 – Language improvements for HCA students completing at least 1 protocol between pre-and-post MAP Scores who presented with below grade level academic performance in reading and/or language.

The Neuroconnection at Harvest Christian Academy

Math Improvements on Standardized MAP testing scores:

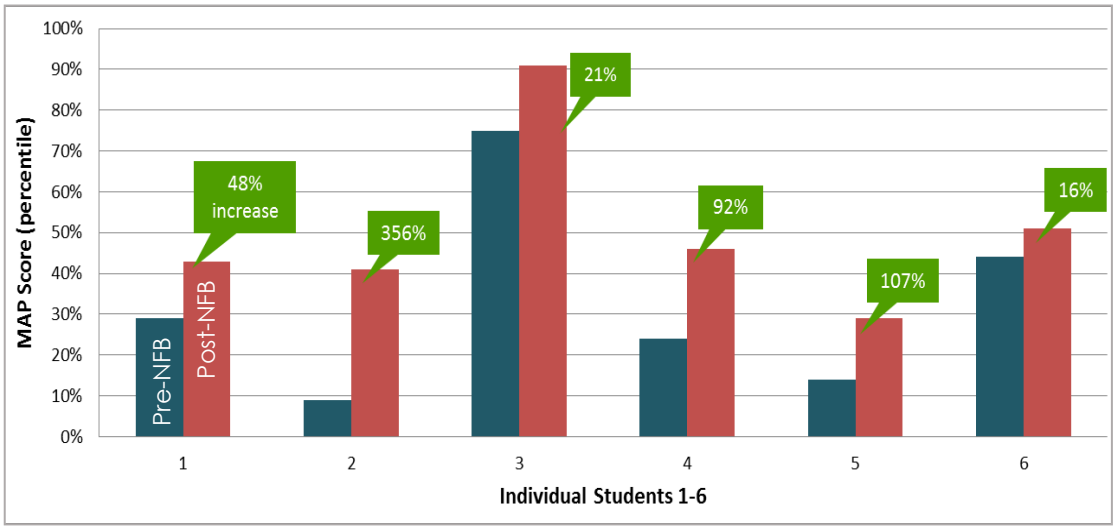


FIGURE 5 – Math improvements for HCA students completing at least 1 protocol between pre-and-post MAP Scores who presented with ADHD, ADD, or no formal diagnosis.

Symptom Checklist Improvements

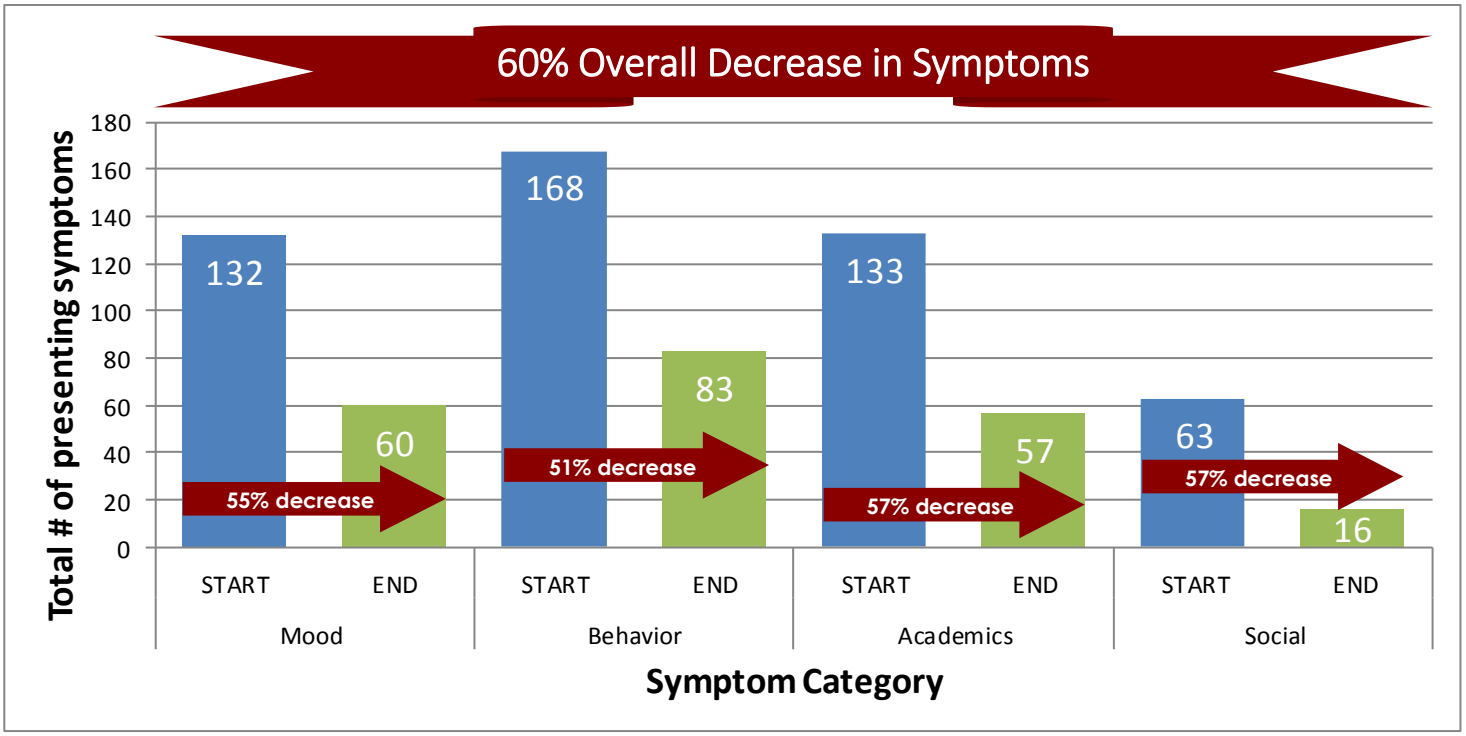


FIGURE 6 – Total number of presenting symptoms totaled for all HCA students (n=26) who completed at least 1 protocol and provided a follow-up symptom checklist upon final session. Symptoms were tallied into 4 categories of mood, behavior, academics, and social measures.

The Neuroconnection at Harvest Christian Academy: *Progress Summary*

Thanks to the devoted efforts of The Neuroconnection and Harvest Christian Academy, students, parents, and faculty of HCA have experienced the benefits of in-school therapy with CGNFB firsthand. After a successful year of collaboration, *all* HCA students completing one or more protocols upon discharge from training saw improvements in MAP testing scores for math, reading, and/or language use (SEE FIGURE 7).

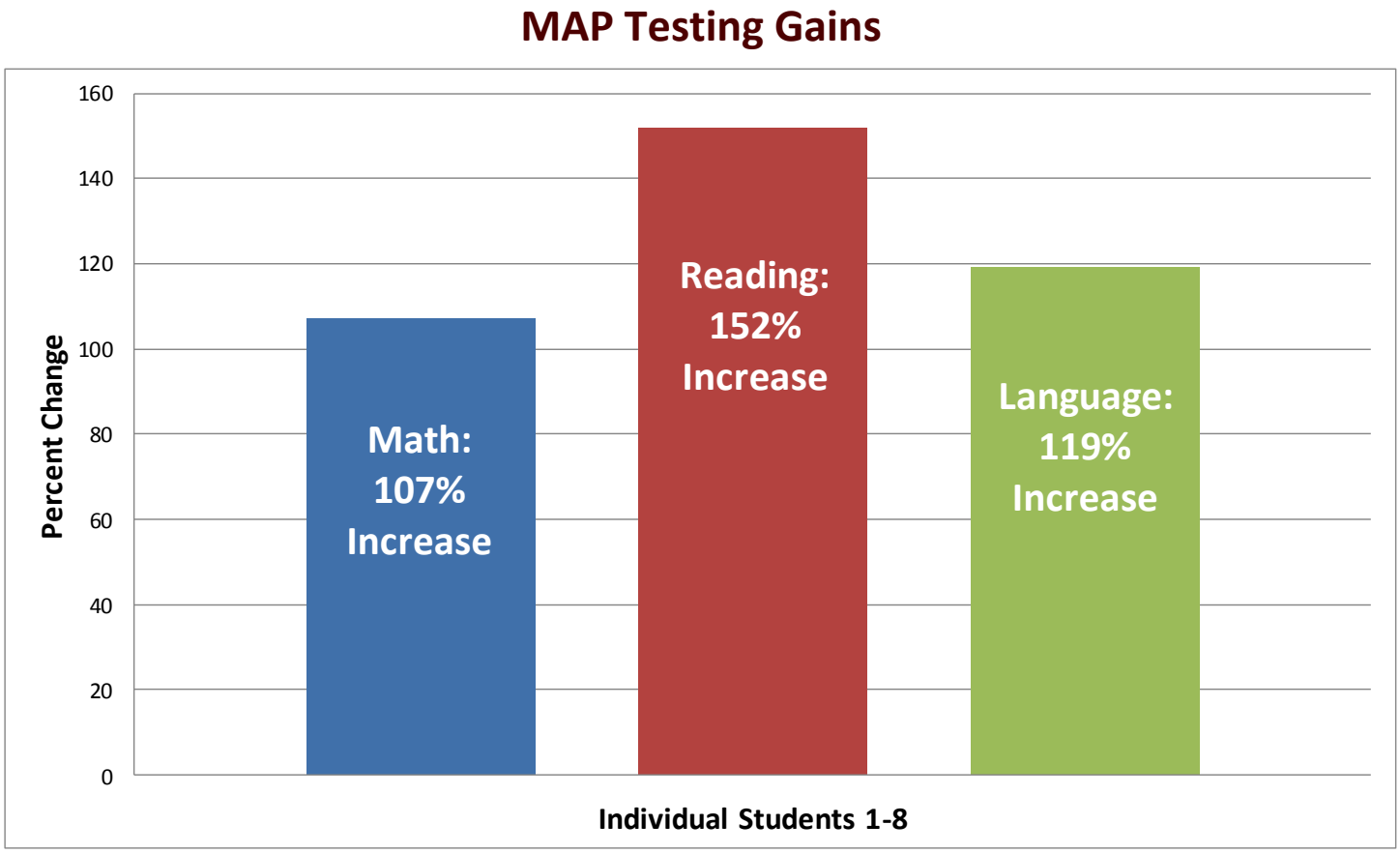


FIGURE 7 – Average percent change in percentile rankings on MAP testing after completion of at least one protocol of neurofeedback training (n=26 students). *Percentile rankings calculated from MAP testing scores in subjects of math, reading, and language use.*

"In my opinion, if any medication had demonstrated such a wide spectrum of efficacy it would be universally accepted and widely used. It is a field to be taken seriously by all."

(Frank Duffy, MD, PhD, Harvard Medical School)

The Neuroconnection Case Study

One particularly successful case for in-school training involves Grace, a second-grader enrolled at HCA. Grace's parents were initially referred to The Neuroconnection in hopes of addressing their daughter's ongoing cognitive difficulties in school with Connectivity-Guided Neurofeedback (CGNFB) training. Prior to training, it was determined Grace qualified with slow processing speed, below grade-level reading comprehension, and low performance on math calculations, all which were keeping her from performing optimally in her academic work. Considering a family history of dyslexia, indications of Grace's cognitive delays were detected as early as kindergarten when her parents noticed she struggled to write with pencils and crayons, and frequently wrote numbers and letters backwards when she did. In comparison to her peers, Grace consistently scored low in all three areas of mathematics, reading, and language usage, placing her far below grade level in the 9th, 10th, and 17th percentile ranges, respectively.

Beginning the CGNFB process at TNC, Grace was first administered a QEEG to identify any neurological irregularities (in connectivity *and* power) that could be contributing to her cognitive delays. Analysis of her QEEG data revealed mild left hemisphere connectivity deficiencies (also known as hypocoherence), as well as posterior slowing and excess frontal beta activity. Such results correlated with deficits in areas associated with visual processing, language, selective attention, and reading comprehension specific to decoding language, visual/auditory memory and sequencing.

To address these abnormalities, Grace was assigned a left-sided training protocol individualized to her connectivity and power needs. Following just three sessions of CGNFB, Grace showed notable improvements in her ability to complete multi-step tasks, comprehend what she was reading, and attend to her assignments and responsibilities. At the end of her first 10 sessions, Grace demonstrated such substantial gains that not only her parents, but her teachers also commended progress. One reported, *"She wrote a story and her handwriting was so neat. Almost all her words were spelled correctly. I was shocked and asked her if someone helped her with her spelling and she said, 'No, I wrote it all by myself!'"*. Grace's remap QEEG further confirmed these positive observations, revealing improved connectivity along the left hemisphere, as well as normalized beta amplitudes. Her parents were pleased with the success CGNFB had facilitated for Grace thus far and were eager to continue her in-school training.

By the end of her third protocol (total of 30 sessions), Grace reported she was thinking more clearly. She now demonstrated an ability to recognize when she was making spelling or computational errors and no longer struggled with improper writing or reversing of letters or numbers. Over the next few months, the developments Grace continued to make helped her to gain the self-confidence to override anxiety she had previously held from mistakes in her schoolwork. In the spring following her training, school-wide MAP evaluations confirmed the progress noted with Grace's percentile scores raised to the 41st, 22nd, and 38th percentile ranges for math, reading, and language use respectively (SEE FIGURE 8).

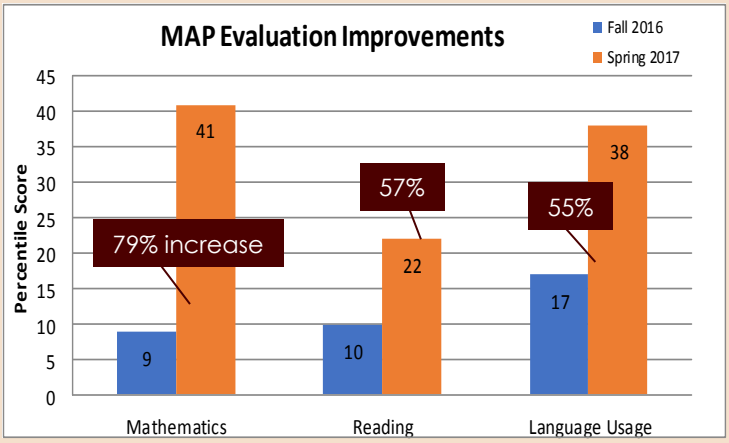


FIGURE 8 – Grace's MAP scores in math, reading, and language use before and after completing three protocols of in-school neurofeedback training.

*****Names and dates have been changed to maintain confidentiality*

In-School Training with The Neuroconnection

1 Referrals made from parents or resource teachers to TNC

2. Intake and QEEG brain map done at TNC – Results given to parents

3. Connectivity-Guided Neurofeedback training at HCA 2 times per week for 5 consecutive weeks

4. Formal communication from parents needed after every 3rd session – either by email or hard copy format sent with child to school

5. After completion of 10 sessions, parent(s) and child return to TNC for QEEG remap

The Neuroconnection CGNFB at Harvest Christian Academy

Interested in our training program?

Given the opportunity, The Neuroconnection would be delighted to come to your school to present more information to your faculty and staff members, tailored to your particular interests.

Please feel free to reach us at:

(630) 858-5105

More on The Neuroconnection:

The Neuroconnection @ Home Training brings Connectivity-Guided Neurofeedback to the convenience of your home.

Upon seeing such excellent results in the past 9 years with Connectivity-Guided Neurofeedback (CGNFB), our professionals aimed to extend access to training for those outside of our geographic area or inflexible schedules. As a result, The Neuroconnection designed an @ Home Training program to offer CGNFB sessions in the convenience of your home. For five years, we have been able to provide our expertise and therapeutic treatment to families across the world. The opportunity for daily neurofeedback training at home has brought successful results for clients living as far as Russia and India.

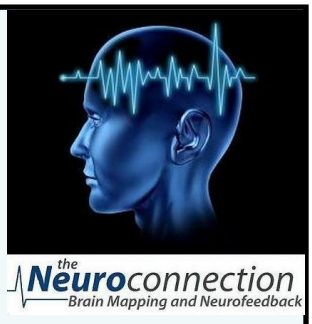
Meet Our Director

Ann L. Rigby, MSW, LCSW, BCN has over 30 years of experience in the mental health field. Ms. Rigby has been providing Neurofeedback services since 2001. She founded "The Neuroconnection", a Brain Mapping and Neurofeedback clinic that provides an advanced, research-based form of Neurofeedback known as Connectivity-Guided Neurofeedback.

Ms. Rigby is the Past Board Chair for the Autism Society of Illinois. She is a fellow and Board Certified member of The Biofeedback Certification International Alliance. She is also a field placement instructor for graduate students at Benedictine University and holds memberships with the International Society of Neurofeedback and Research (ISNR), the Biofeedback Certification Institute of America (BCIA), and the National Association of Social Workers (NASW). Ms. Rigby is a frequent speaker and exhibitor at many national and regional conferences throughout the year on topics related to the benefits of Connectivity-Guided Neurofeedback.

To learn more about up and coming speaking engagements, go to our website www.theneuroconnection.com and visit our Resources tab.

The Neuroconnection
1847 West Jefferson Ave, Suite B.
Naperville, IL 60540



Phone: (630) 858-5105
E-mail: arigby@theneuroconnection.com

Request more information from The Neuroconnection website!

www.theneuroconnection.com

