Report to the CBH Clinical Committee
Springtime for South Philly Students with Neurofeedback

by Gary Ames, BATP
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Introduction:
This report presents the outcomes of a Spring 2022 neurofeedback training program conducted on a group of non-IBHS students within 2 South Philly schools. These schools were within the Behavior Analysis & Therapy Partners (BATP) cluster with permission of each Principal and parent. This neurofeedback program was funded by BATP.

Neurofeedback is a behavioral intervention training that has been gaining attention as an intervention for various neurological and psychological conditions. The greatest growth in research is currently in Europe and other developed nations.

Medicaid in the State of Nevada is now funding Neurotherapy for 46 ICD codes within 8 categories: Attention, Anxiety, Depressive, Bipolar, OCD, ODD/Reactive Attachment, PTSD, Schizophrenia.
https://dhcfp.nv.gov/uploadedFiles/dhcfpnvgov/content/Resources/AdminSupport/Manuals/MSM/C400/MSM_400_09_28_22.pdf page 39

This report will focus on four participants who completed 30 sessions by training on most school days March-May, 2022. The aim of this report is to provide the clinical committee with an overview of the training, including methodology, results, and a suggestion for a future practice and access to the EPIC process.

Methods:
Participants: A total of 13 children began training in the neurofeedback program aged 10 to 17 years. Most often 1 Technician worked with up to 6 students after school on 3 BrainPaint laptop systems. The children at GAMP were self-selected. The students at Palumbo were referred by a counselor but only given 3 days a week. All students selected 2-4 growth area targets within categories such as: attention, anxiety, depression, sleep, behavior, OCD, social concerns, etc. There were further defined by current frequency, intensity or duration of behavior.

Sessions occurred up to 5 times per week. We ran 15 sessions of the eyes-open protocol. Then we moved to 15 sessions of the alpha-theta protocol which included 10 minutes of the eyes-open fast protocol and 24 minutes of continuous eyes-closed alpha-theta training. East session set up, training, and clean up took between 35 to 50 minutes.

Training Protocol: The neurofeedback training protocol was based on EEG results obtained during a performance game. This allowed an artificial intelligence program (AI) to determined which bands of brainwave to train up or down to best regulate neural arousal. Training began at

TC3-TC4 over the temporal-central lobe about 3" above each ear. Each eyes-open training protocol is in this form.

- Inhibit: 1.47-11.69 Hz
- Reinforce: 11.69-18.55 Hz
- Inhibit: 18.55-27.68 Hz
- Cross Frequency Coupling (Coherence): 40.38-54.03 Hz

Neurofeedback is quite safe. The AI suggests adjustments in activation if there are unwanted effects such as headache or sleep problems. No student required changes.

We started with 15 eyes-open sessions with 24 minutes of training. There were also 15 sessions devoted to eyes-closed Alpha-Theta training that reinforced slower brainwaves.

The training protocols were designed to modify specific brainwave patterns in order to promote self-regulation and improved cognitive, emotional and behavioral functioning. The AI has learned from calculating progress on behavioral goals of over 100,000 BrainPaint clients.

The main part of our rationale to assert that neurofeedback is a form of Applied Behavior Analysis is the following.
Neurofeedback is real-time monitoring and correcting participants' brainwave behavior patterns using electroencephalography (EEG) technology. Students saw on their laptop computers morphing fractal images generated by their brainwaves that were more or less interesting. They heard sounds that were more or less pleasant in order to reinforce preferred brainwave behavior. Dozens of times per second the rich audio-visual feedback guided brainwaves towards and away from ten protocol-generated target ranges contingent on their brainwave activity.

Outcomes Assessment:
This was not a scientific experiment. To evaluate the effectiveness of the neurofeedback training, ongoing assessments were conducted using baseline behavioral goals that specified observable behavior.

Four students completed 30 sessions. The other students completed fewer sessions because they could not participate most every day. They generally had results less robust as expected with a lower dose. One such student was no longer mute. There were no adverse effects reported and there were no treatment failures for students who completed at least 5 sessions.

Student reports of progress on a daily form and parental feedback via interview were also collected. Parents were interviewed by phone near the end of training in May 2022 and parents or students were interviewed in April and May 2023.

Results:
The following section highlights the self-reported outcomes in 2022 for the four children from GAMP who completed 30 neurofeedback training sessions:

1. Student CR 14 F

Behavior: Transitioning from thing like homework, play, bed, and outings create yelling conflicts at least 4 times per week.
95% Resolved.
Attention: Currently takes 2 hours to complete 30 minutes of homework.
89% Resolved.
Attention: At least 2 times per week I find myself having to explain to people my mistakes.
99% Resolved
Attention: People express frustration with me at least 4 times per week when I overlook responsibilities.
91% Resolved.

2022 Parent interview
She is making own decisions with no help from Mom. More self-confident. More conversations, engaging. More focused. Getting homework done at school. Introspective … asking how not to appear self-absorbed. Taking care of herself. On time-improved. Enjoys biofeedback, into it. No complaints.

2023 Parent interview
Getting straight "A"s now. Focus is not a problem anymore. Independently starts studying when needed. She became diligent. Sleep is no longer an issue. She says she understands what people are saying. She had a **maturity growth spurt.**

2. Student CM 10 M

Anxiety: I wake with negative emotions most morning and this lasts at least 1 hour. Bashful in public settings.
100% Resolved.
Behavior: Improve frustration tolerance. Mini tantrum when separated from screen for 20 minutes.
59% Resolved.
Emotion Regulation Skill: Makes critical comments to sister. Raise voice for 5 minutes or parental intervention 3-5 times a day.
41% Resolved.
Attention: Currently takes 2 hours to complete 30 minutes of homework or projects. Takes 40-60 minutes to do 15 minutes of violin practice with minimal effort and much frustration.
75% Resolved.

2022 Parent Interview.
More confidence. Enthusiasm for performing. Fighting with sister is nearly gone. Progress across the board. Not fretting about reduced screen time. Everything in positive territory.

2023 Parent Interview.
Wowed by biofeedback. More confidence. Enthusiasm for performing. Doing great.

Thoughtful and calm. Content. More vocal and verbal about his feelings and boundaries. Can establish good relations that way.

A little perfectionistic and afraid of messing up. Showing his own interests and less perfectionistic. Less on the sidelines. Sister conflicts still happens, but less. But more really good times together. They get along well.

Instrument. He will practice when asked instead of arguing for 45 minutes. Now moving to bass.

Overall impression. Settling into a nice routine of what is expected and coping with non-preferred activities. Transitions easier now such as getting electronics out of his hands. "Maturity growth spurt." Mom would enthusiastically endorse that phrase.

The student says: "The most fun I've ever had in my life."

3. Student: EC 16 M

Sleep: It takes me 30 minutes to fall asleep most nights.
0% Resolved.
Anxiety: Haunted by social regrets. Minor once a day. Major events 2 times a month.
0% Resolved.
Attention: Usually fidgets with hands or feet or squirms in seat about 45-50 minutes out of each hour. Limited tolerance for continuous subjects.
0% Resolved.
Obsessionality: Rule following. Correct is not good enough.
0% Resolved.

2022 Parent interview
Definite improvements. Sleeping more. Falling asleep easier, staying asleep easier.

More open and talkative. Self-motivated. Does his homework. More agreeable less likely to talk back.

Loved that he was interested in observing his physiology. He enjoyed that. Fascinated by mood rings. Fascinated by them. Comfortable with body.

Most practical to observe is when time to do non-preferred tasks. Takes less effort. Less emotional outcry. He only verbalizes discontent. No tantrums, less opposition.

2023 Student interview
This student denied any benefit to his neurofeedback sessions in any category in May 2002. I suspect his attitude changed over the year, rather than a surge of benefits.

Sleep: It takes me 30 minutes to fall asleep most nights.
100% Resolved. "Not a problem anymore."
Anxiety: Haunted by social regrets. Minor once a day. Major events 2 times a month.

70% Resolved.

Attention: Usually fidgets with hands or feet or squirms in seat about 45-50 minutes out of each hour. Limited tolerance for continuous subjects.

0% Resolved.

Obsessionality: Rule following. Correct is not good enough.

35% Resolved.

It was good, I think it should be available to other students.

4. Student: JM 14 F

Attention: Usually fidgets with hands or feet or squirms in seat about 30 minutes each hour.

26% Resolved.

Anxiety: My whole body feels over stimulated for no reason at least 4 times a week.

69% Resolved.

Attention: I can't read a page without my mind wandering at least once.

40% Resolved.

Mood Swings: About 4 times per week, I get overly stimulated. I speak fast or am almost overwhelmed with ideas.

44% Resolved.

Parent and student interview 2023

Mom says: I see a change. More comfortable. Making friends. She's fine right now. Has helped her. Confidence.

Student says: Some improvements have stuck with me: confident, speaking and communicating. Not much improvement with fidgeting.

Mood swings. More control. Less persuaded by emotions.

Feeling over-stimulated / under-simulated. Not much change.

Attention. Reading. Still a little difficulty but improved.

Good for communication more smoothly. Hard to get motivated for anything including homework. Still getting A and B grades.

More confident with music.

Discussion:

The results from the four participants who completed 30 neurofeedback training sessions demonstrate enduring positive outcomes in terms of improved cognitive functioning, reduced symptoms, and better self-regulation of thinking, feeling and behaving.

The improvements were across a broad spectrum of psychological, behavioral and physical symptoms. These included those observed by the student and parents. These findings are

consistent with the research from 1970-2018 found at https://isnr.org/isnr-comprehensive-bibliography as well as in books and BrainPaint specific findings.

Conclusion:
The findings from this neurofeedback training program suggest that this intervention is broadly and highly effective-with durable results. I hope these local results provide useful information for the clinical committee to consider in the development and implementation of future neurofeedback training programs.

While members of the Committee suggested that BATP open an outpatient clinic to continue neurofeedback, this is not in our strategic plan and we do not have a psychiatrist on staff. Thus, **BATP has no way to enter the EPIC process to continue neurofeedback on any population.**

The only way BATP can provide these services is through IBHS or as a stand-alone evidence-based practice. We could also partner with the schools through the Special Ed department to conduct a neurofeedback program with the assistance of CBH, particularly in South Philly High School.