# Pilot Research Studies

## *Notable Findings*

## Workplace Wellness

This study comprised 23 corporate employees and educators who participated in the general study outline of completing the Daily Challenge 5 days per week for 6 weeks.

Copenhagen Burnout Inventory:

- 19.79% decrease in personal burnout ($p$ <.05)
- 21.03% decrease in work-related burnout ($p$ <.05)
- 20.38% decrease in overall burnout ($p$ <.05)

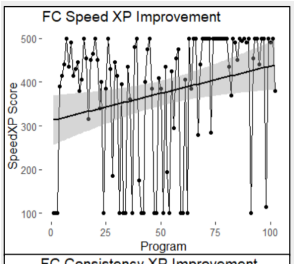
WHO Well-being Index:

- 18% increase in wellbeing ($p$ <.05)

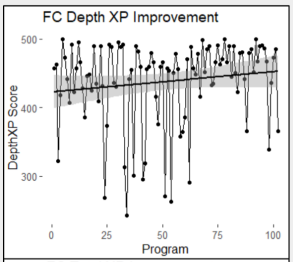
State-Trait Anxiety Inventory for Adults:

- 13% decrease in trait anxiety ($p$ <.05)

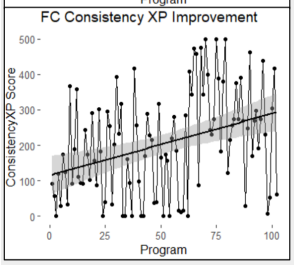
A sample of one of the educator's charts of XP Growth can be seen below.



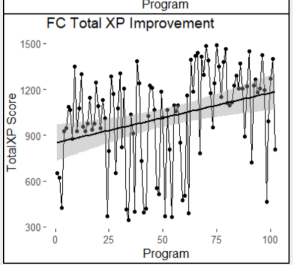

*Correlation: r = 0.25*
$R^2$ = 0.06
F(1, 100) = 6.58
p = .01




*Correlation: r = 0.14*
$R^2$ = 0.02
F(1, 100) = 2.05
p = .15




*Correlation: r = 0.36*
$R^2$ = 0.13
F(1, 100) = 14.45
p = .00002



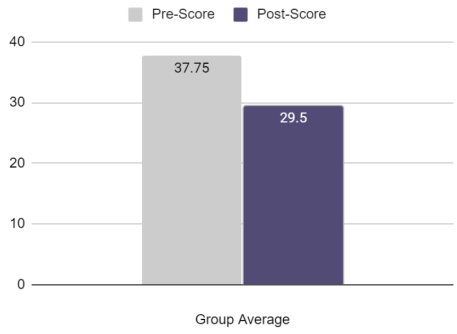

*Correlation: r = 0.3*
$R^2$ = 0.09
F(1, 100) = 10.48
p = .002

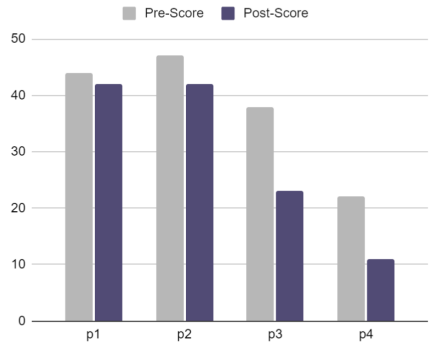
## Medical Professionals

This is an ongoing study with 10 nurses and 1 doctor from some of the best hospitals in New York, New Jersey, and California. Out of the 11 medical professionals, 4 of them completed the study so far with the following results:

| | |
|---|---|
| Emotional Exhaustion | *22% decrease (p = .004**)* |
| Depersonalization | 9% decrease |
| Personal Achievement | 5% decrease |
| WHO Wellbeing | 29% increase |
| STAI - Trait Anxiety | 14% decrease |

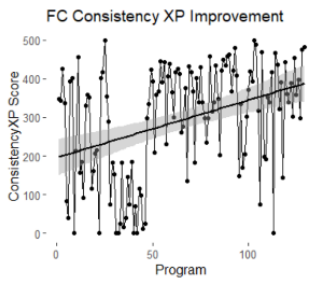
Below is a graph demonstrating the group and individual differences in Emotional Exhaustion:



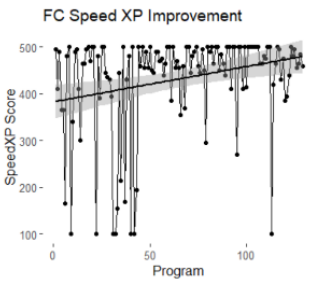




Below is a sample of the XP score improvement of the nurse who had the most usage.

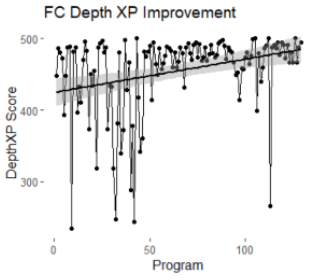
Player 1 - 129 programs



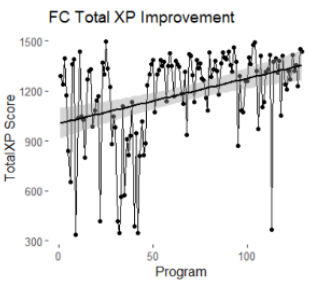

Correlation: r = .38
Regression: $R^2$ = .14
F(1, 127) = 21.48
p < .00001




Correlation: r = .26
Regression: $R^2$ = .07
F(1, 127) = 9.45
p = .003




Correlation: r = .31
Regression: $R^2$ = .10
F(1, 127) = 13.48
p = .0004

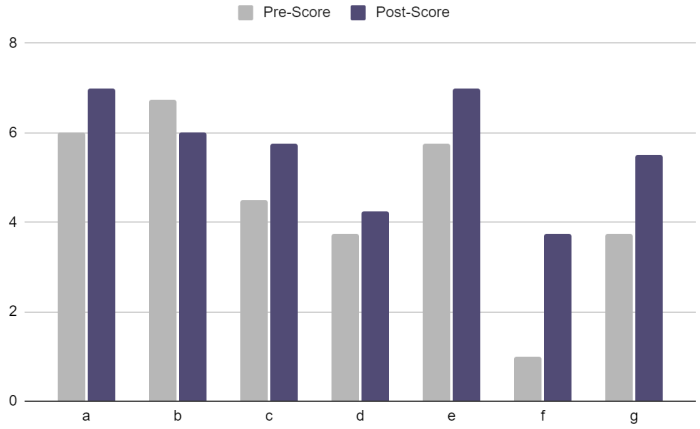



Correlation: r = .37
Regression: $R^2$ = .14
F(1, 127) = 19.75
p < .0001

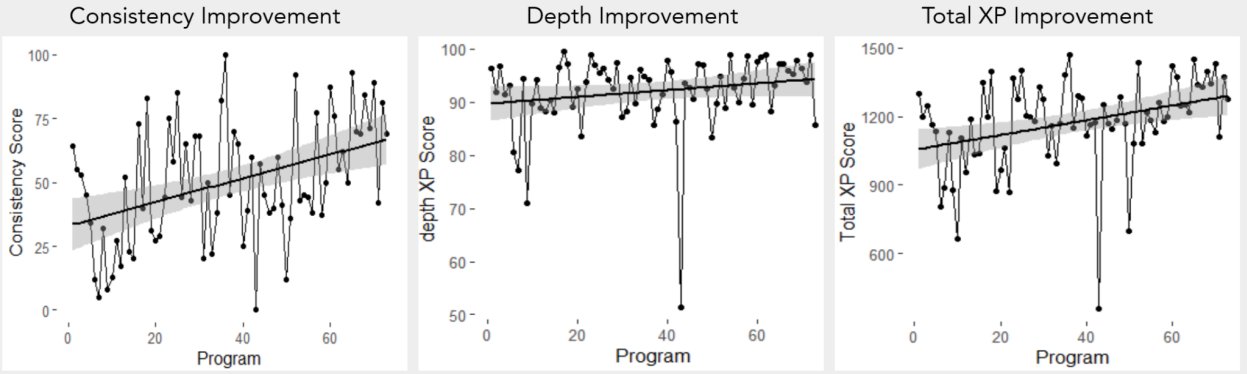
## MLB Rehabilitation Athletes

This study comprised 15 players in physical therapy for injuries in Major League Baseball. Out of the 15 players in the study, 7 players hit the benchmark of 20 days of usage. There was a 24.6% increase in the average Cognitive Specific Athletic Injury Imagery score of the 7 participants who completed 20 days of FC usage ($p$ <.05). Their individual score differences can be seen below.

Athletic Injury Imagery Questionnaire (AAIQ) - Cognitive Specific Imagery:




A sample of one of the pitcher's charts of XP Growth can be seen below.




*Correlation: r = 0.41*

$R^2$ = 0.17, F(1, 71) = 14.76, p < .0003

*Significant relationship*

*Correlation: r = 0.19*

$R^2$ = 0.04, F(1, 71) = 2.61, p = .11

*Correlation: r = 0.35*

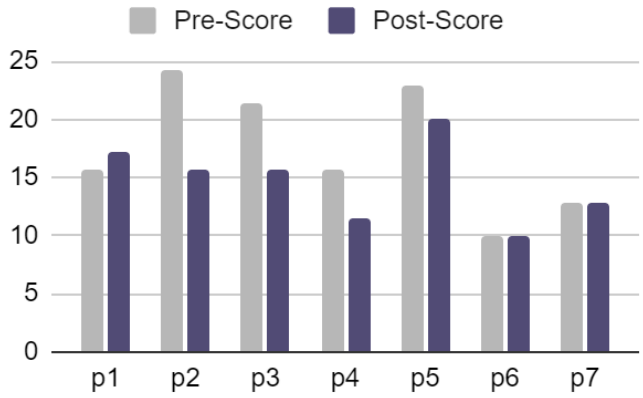
$R^2$ = 0.121, F(1, 71) = 9.73 , p = .003

*Significant relationship*

## Esports Athletes

This study comprised 10 athletes from a League of Legends esports team. They were asked to complete the Daily Challenge, or any other program if they preferred, 5 days per week before a training session. There was a 16% decrease in the somatic anxiety of the players who completed at least 20 programs ($p$ <.05). Their individual score differences can be seen below.

Competitive State Anxiety Inventory (CASI-2R) - Somatic Anxiety:



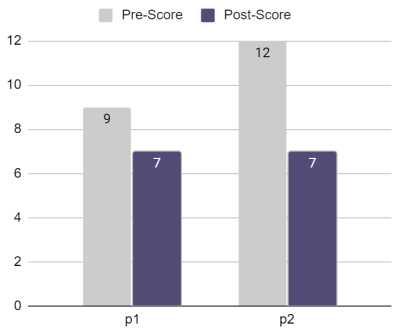

## Wheelchair Basketball Athletes

This is an ongoing study with 6 college-level wheelchair basketball athletes. Out of the 6 players, 2 of them completed the study so far, and their results are as follows:

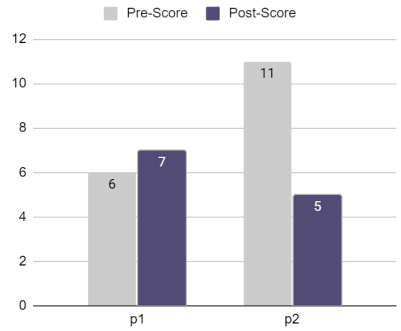
| | |
|---|---|
| Somatic Anxiety | 33% decrease |
| Cognitive Anxiety | 29% decrease |
| Self-confidence | 15% increase |
| WHO Well-being | 28% increase |
| Mental Toughness | 13% increase |

Their individual score differences can be seen below.

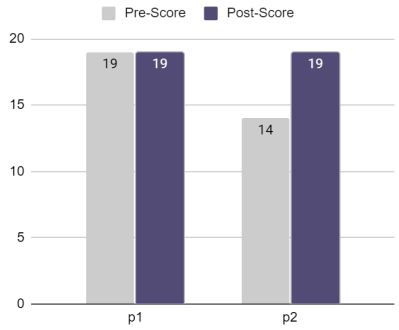
Somatic Anxiety



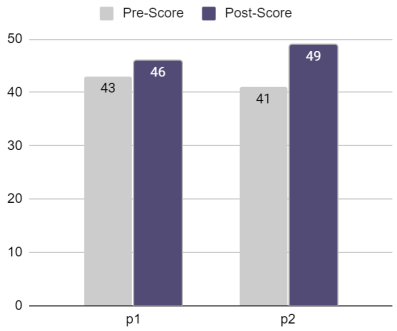

Cognitive Anxiety



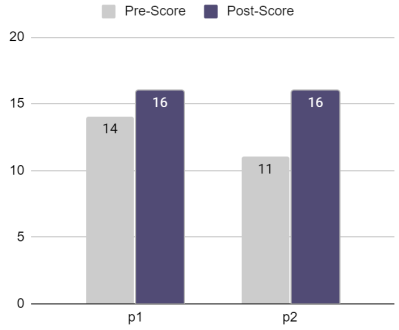
Self-Confidence




Mental Toughness

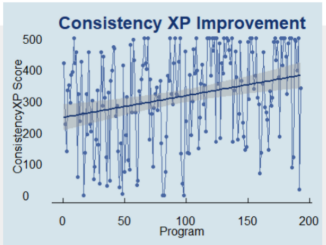



Well-being

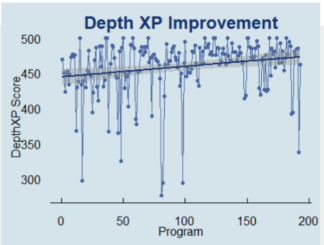



## Paralympic Athletes

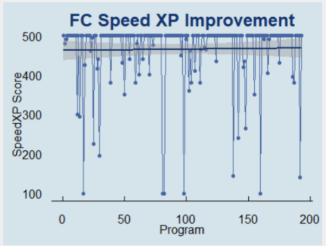
This is an ongoing study where 2 athletes have completed their training so far. Survey variables were recorded independently by the committee, but we were able to collect their data through XP scores and plot one of the athlete's growth over time, as seen below.



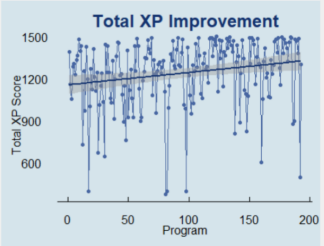

Correlation: r = .26
Regression: $R^2$ = .07
F(1, 191) = 14.04
p < .001




Correlation: r = .21
Regression: $R^2$ = .04
F(1, 191) = 8.56
p < .01




Correlation: r = .02
Regression: $R^2$ = .0004
F(1, 191) = .08
p = .77




Correlation: r = .21
Regression: $R^2$ = .04
F(1, 191) = 8.4
p < .01

# ADHD/ADD

We performed a research study where 18 children diagnosed with ADHD or ADD between the ages of 10-17 years participated in 25 FocusCalm training sessions over 5 weeks.

Significant training effects were noted for ADHD Combined (Conners Comprehensive Behavior Rating Scale) indicating that ADHD symptoms have reduced over the 5 weeks of the BrainCo training program [$t(18)=-4.6837$, $p<0.001$]. Significant improvements and effects of the training were also noted on the ADHD-Inattentive and ADHD-Hyperactive-Impulsive sub-scales. The effect size is reported as Cohen's d using the pooled standard deviation. See Table 1.

| Measure | Mean Baseline | Mean Change Δ | T-test score (p-value) | Effect Size |
|---|---|---|---|---|
| **CBRS-Parents** | | | | |
| ADHD Combined | 153.89 | -22.83 | -4.68 (0.0011) | -1.2 |
| ADHD-Inattentive | 78.22 | -9.78 | -4.21 (0.00029) | -0.72 |
| ADHD-Hyperactive-Impulsive | 75.67 | -13.06 | -4.03 (0.00043) | -1.0 |

**Table 1.** Pre-training and post-training comparisons of ADHD-Inattentive, ADHD-Hyperactive-Impulsive, and ADHD Combined (primary outcome measure) in CBRS-Parents Report T-score changes (n= 18).

*Note: Change scores are post-training minus pre-training; Improvements in CBRS scores are indicated with negative changes. P-values and effect size are rounded to 2 significant figures, all other values are rounded to 2 decimal places.*

The effect size of the results are comparable to that of other studies on treating ADHD in literature. Table 2 contains a list of neurofeedback and medication studies on children and adolescents with ADHD and their respective effect sizes. The primary outcome measure, ADHD Combined, had an effect size of -1.2, which is comparable to those found in medication studies.

| Neurofeedback Study | Treatment, Subjects | Effect Size |
|---|---|---|
| BrainCo Pilot Study (25 20-min sessions) [4] | Neurofeedback (n=18), children and adolescents | 1.2 |
| DeBeus, Roger J., and Kaiser, David A., 2011 (40 30-min sessions) | Neurofeedback (n=50), children and adolescents | 0.5 |
| Duric et al., 2012 (30 40-min sessions) [6] | Neurofeedback (n=91), children and adolescents | 2.25 |
| Lansberg et al., 2011 (30 20-min sessions [7] | Neurofeedback (n=8), children and adolescents | 0.78* |
| Duric et al., 2014 (30 45-min sessions) [8] | Neurofeedback (n=80), children and adolescents | 0.74* |

**

| Medication Study | Treatment, Subjects | Effect Size |
|---|---|---|
| Biederman et al., 2003 (2 weeks) | Extended-Release Methylphenidate (n=65), children | 0.9 |
| Faraone and Schreckengost, 2007 (4 weeks) | Lisdexamfetamine (n=218), children | 1.4 (30mg and 50mg doses); 1.7 (70mg dose) |
| Faraone et al., 2002 (meta analysis of 4 studies) | Immediate-Release Mixed Amphetamine Salts (n=108), children and adolescents | 0.25 |
| Kelsey et al., 2004 (8 weeks) | Atomoxetine (n=133), children | 0.7 |
| McGough et al., 2006 (1 week) | Transdermal Methylphenidate (n=79), children | 0.9 |
| Michelson et al., 2002 (6 weeks) | Atomoxetine (n=85), children and adolescents | 0.7 |
| Pelham et al., 2001 (7 days) | Osmotic-Release Oral System Methylphenidate (n=68), children | 2 |
| Spencer et al., 2002 (12 weeks) | Atomoxetine (n=129), children | 0.7 |
| Swanson et al., 2003 (7 days) | Osmotic-Release Oral System Methylphenidate (OROS-MPH) and Immediate-Release Methylphenidate (IR-MPH) [n=64], children | 1.7 (OROS-MPH); 1.6 (IR-MPH) |
| Wigal et al., 2005 (3 weeks) | Extended-Release Mixed Amphetamine Salts (XR-MAS) [n=102] and Atomoxetine (n=101), children | 1.1 (XR-MAS); 0.20 (Atomoxetine) |
| Wolraich et al., 2001 (1-4 weeks) | Osmotic-Release Oral System Methylphenidate (OROS-MPH) [n=95] and Immediate-Release Methylphenidate (IR-MPH) [n-97], children | 1.1 (OROS-MPH); 1.0 (IR-MPH) |

**Table 2.** Studies on Neurofeedback and medication treatments for children and adolescents with ADHD found in literature, and their effect sizes. Effect sizes taken from studies are of primary ADHD outcome measures, unless stated otherwise.

* Effect size calculated by taking mean of ADHD-Inattentive and ADHD-Hyperactive effect sizes.
** Medication Study table information taken from McGough and Faraone study [9].

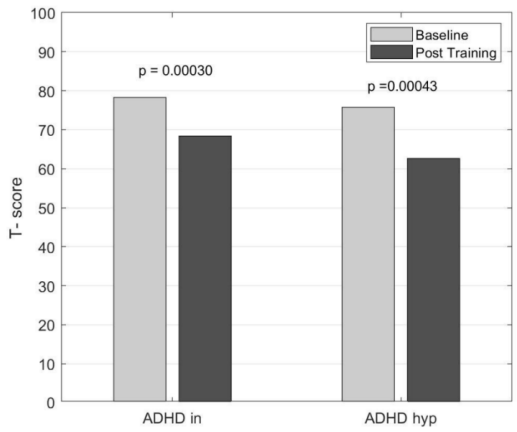



**Figure 1**. Baseline CBRS-P ADHD scales of participants compared to and post training ADHD scales. P is for parent ratings and ratings on the Conners' DSM-V ADHD rating scales (mean= 50, SD = 10): ADHDin = Inattentive, ADHDhyp = Hyperactive/Impulsive

When investigating the secondary outcomes from the Conners CBRS-P we saw significant improvements in other DSM-V symptoms of ADHD. Parents reported significant changes ($p<0.05$) in Generalized Anxiety Disorder, Social Anxiety Disorder (Social Phobia), Oppositional Defiant Disorder, Major Depressive Episode, Manic Episode, Defiant/Aggressive Behaviors, and Separation Anxiety Disorder. These secondary outcomes are also noteworthy considering children with ADHD report more symptoms of depression and anxiety than children without ADHD, and up to 25% of children with anxiety disorder meet diagnostic criteria for ADHD.

The IVA-2 assessment also indicated significant improvement in the Auditory Response Control Quotient of the participants [$t(18)=2.119$, $p<0.05$], which is quite relevant as children with ADHD have been shown to have significantly lower auditory response control than children of typical development.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