

PROPOSAL FOR MONTREAT COLLEGE IRB

Green Play: Restorative Neurobehavioral Effects on ADHD children

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Section II:

Purpose of the Study

Using Attention Restoration Theory (ART) (Kaplan & Kaplan; 1989) as a theoretical framework, this study will seek to explore the neurobehavioral benefits of green outdoor play environments on EEG vigilance regulation and sustained-attention in ADHD children. Children diagnosed with ADHD struggle with hypervigilance, or hyperactivity. Symptoms of hyperactivity are fidgeting, over-talking, wiggling, and moving from one stimulus to another quickly (Lahey, Pelham, et al. 1988; Montague & Warger, 1997). ADHD children also struggle with sustained-attention tasks. Instead, of being able to concentrate on any or all tasks given to them, they often have attentional bias and choose to only focus on tasks that they deem engaging (Montague & Warger, 1997). ART has shown to aid in restoring attention in non-ADHD adults and also children (Kaplan & Kaplan, 1989; Kaplan, 2001, Cole & Hall, 2010). As well, preliminary studies have used ART to aid in understanding attention restoration through green play environments with ADD & ADHD children (Faber Taylor & Kuo, 2009). However, neither Faber Taylor & Kuo's 2001 or 2004 study used a neurobehavioral measure to aid in quantifying vigilance regulation.

One abiotic factor, solar intensity (SI) has also been an area of study in neuroscience and ADHD adults. Research suggests that increased SI through early morning-bright light adds in EEG vigilance regulation and sustained-attention (Ryback et. al., 2006). Therefore, SI will be an environmental abiotic factor that will also be measured during the study.

Section III:

Subjects. ADHD children ages 7-12 years, diagnosed using the DSM-IV or DSM-V, will be chosen for this study. Parents in the community will notified several ways about the study. 1) Letters from the local elementary school's 504 plan & IEP coordinator, will be sent to parents who have students that are identified with ADHD. 2) Social media networks such a homeschool forums will have a post notifying parents about the study. 3) Two local counseling offices/neurofeedback offices will have notices posted. The notices in all three situations will explain that a study is being conducted to

help aid educators, and parents in furthering their understanding of the role that green play environments have on prevention of ADHD symptoms. Parents will sign consent forms (appendix A) that detail the methods of the study, the use of the data, and confidentiality of the experiment. At least twelve students with parental permission will be needed for the study.

The treatment day will be a Saturday morning, in order to not disturb student's school schedule. On the day of the treatment children will not take their morning pharmacological interventions, but will instead take it following the green outdoor play treatment. Pharmacological administration will be the role of the parent(s). Children will be scheduled to arrive at one hour intervals throughout the morning. With four children participating in the study at a time.

Once arriving at the location, parents will be given a confidential background survey that will aid in knowing how the child was diagnosed, their normal dosage of pharmacological interventions or lack there of, and their age. Parents will stay on site until the child has completed the study which will take approximately 2 hours.

The first four children in Group 1 (G1) will each be given electroencephalography (EEG) scans for beta/theta in order to measure their EEG vigilance regulation ability. EEG scans simply measure the electrical impulses along the child's scalp. The ratio of theta/beta waves present in a child at a given time aid in determining their EEG vigilance regulation ability. Scans will be operated simultaneously by four trained EEG operators in four separate rooms. Using two source electrode locations, children's eyes will remain open while staring at a white wall. This pre-scan will be compared to a post-scan following the green outdoor play intervention. Group 1 will begin their scans at 8:00am, and subsequent groups will begin their scans at 1 hour, intervals (*Figure 1. 5*).

	Group 1		Group 2
7:50 am	Scan (<i>leader A, B, C, D</i>)	8:50 am	Scan (<i>leader A, B, C, D</i>)
8:00am	Walk (<i>leader E</i>)	9:00am	Walk (<i>leader E</i>)
8:31am	Scan (<i>leader A, B, C, D</i>)	9:31am	Scan (<i>leader A, B, C, D</i>)

8:40 am	CCPT & PRCS-Cii (leader F, G, H, I)	9:40 am	CCPT & PRCS-Cii (leader F, G, H, I)
9:00am	Group 1 leaves	10:00am	Group 2 leaves

	Group 3		Group 4
9:50 am	Scan (leader A, B, C, D)	10:50 am	Scan (leader A, B, C, D)
10:00am	Walk (leader E)	11:00am	Walk (leader E)
10:31am	Scan (leader A, B, C, D)	11:31am	Scan (leader A, B, C, D)
10:40 am	CCPT & PRCS-Cii (leader F, G, H, I)	11:40 am	CCPT & PRCS-Cii (leader F, G, H, I)
11:00am	Group 3 leaves	12:00pm	Group 4 leaves

	Group 5
11:50 am	Scan (leader A, B, C, D)
12:00pm	Walk (leader E)
12:31pm	Scan (leader A, B, C, D)
12:40 pm	CCPT & PRCS-Cii (leader F, G, H, I)
1:00pm	Group 5 leaves

Figure 1. 5 : Schedule of children's groups

Environmental settings. The green outdoor play environment chosen for the study is the Montreat College & the Black Mountain/Montreat Greenway which is a pathway that traverses Flat Creek, and has ample vegetation. As well, the pathway crosses the Black Mountain Primary Schools facility which is where the majority of the children attend school. Children will be lead on a moderate walk by a leader for 30 minutes. Talking will be kept to a minimum. (Faber Taylor & Kuo, 2004). An assistant will record the SI, using the Pyle PLMT56 Light Meter to aid in documenting lux at 30 second intervals during the walk. The SI will later be aggregated using a weighted mean. Documenting the SI will allow us to consider if lumen intensity effects EEG vigilance regulation or sustained-attention.

Post tests. Following the treatment children will return to their rooms for a post-EEG theta/beta scan. This scan will be operated by the same trained operator from their pre-scan, and will mimic the methods of the pre-scan. This scan will be used to determine if there has been a significant change in the child's EEG vigilance regulation from their pre-EEG theta/beta scan to the post-EEG theta/beta scan. Decreases in EEG theta/beta ratios will support the hypothesis that following a green play environment ADHD children have greater ability to regulate their vigilance. This heightened vigilance regulation aids in decreasing hyperarousal or hyperactive behaviors. Increases in the EEG theta/beta ratio will determine that green play does not have a significant effect on vigilance regulation, and that other treatments should be pursued.

After the post-scan children will participate in a visual Conjunction CPT (CCPT) developed by Tsai, Shalev, & Mevorach (2005) in order to measure pure sustained attention ability. High CCPT ability will support the idea that green play also increases a child's sustained-attention ability. Low CCPT ability will determine that green play has no effect on sustained-attention ability.

The children will next be asked orally about their perceptions of the green play environment using the Perceived Restorative Components Scale for Children (PRCS-Cii) (Bagot, 2004; Bagot, Kuo, & Allen 2007). The PRCS-Cii uses ART as a theoretical framework and aids in quantifying the student's perceptions of the environment using Kaplan's four criteria of restoration: being away, fascination, extent, and compatibility (2001). By having the children rate the environment with the PRCS-Cii we will gauge their perception of the environment, thus aiding in further understanding an environment's ability to aid in restoring sustained-attention and EEG vigilance regulation. If students do not deem the environment restorative, and we find an increase in sustained-attention and EEG vigilance following the treatment, we can begin to consider that there are variables at play concerning sustained-attention and EEG vigilance outside of Kaplan's model. One of these variables could potentially be solar intensity.

Data analysis. Pre and post EEG scans will be compared using a paired t-test of a repeated measures ANOVA. Correlations between the post-scan and CCPT will be completed using an

ANOVA. SI will also be considered and will be compared with the post-scans using an ANOVA. PRCS-Cii will aid in understanding children's view of the environment and its restorative ability. If children deem the environment restorative according to the PRCS-Cii, then an ANOVA will also be used to compare the PRCS-Cii results with the CCPT and with the EEG scans. This comparison will support the idea, that restorative environments aid in EEG vigilance regulation and sustained-attention ability.

Risks & Benefits. The FDA (Food and Drug Administration) has determined that this type of EEG test for ADHD children is safe (FDA, 2013). During the EEG, the bike helmet like apparatus, can sometimes feel funny or tight on the child's head, however, there is no pain involved. If the child feels any discomfort they will be instructed to tell the researcher right away. As well, on the walk the pace will be moderate and it will not be a run. However, whenever you children walk on a trail or a path there is the risk of twisting an ankle. Children will be instructed to listen carefully to their leaders, and to let them know of any discomfort as they walk.

The benefits which may reasonably be expected to result from this study is that the child will aid in helping ADHD children in the future by finding ways for them to concentrate and better manage their ADHD symptoms. As well, following the study they will receive the results of their tests. Because the tests will be coded to guard anonymity, when registering their children parents will fill out a self addressed envelope with their "code" rather than name. This will aid in returning their results while keeping confidentiality. The EEG scan will help children and parents to determine if walking in a green play area aids you in controlling your ADHD symptoms. If their results are positive, it would be a good idea to make outside play a regular part of their daily life. We cannot and do not guarantee or promise that you will receive any benefits from this study. There will be no compensation for participants.

Records. Because the project involves children's personal data, their forms and data will be coded, to ensure anonymity. The files will be kept in Dr. Daniel's office, and the researcher, Dr. Daniel, and Dr. Faircloth alone will obtain this information. Electronic files will also be kept on a database that is password protected on Dr. Daniel or Dr. Faircloth's laptop. Parents and children will be informed of that their forms, results from EEG scans, and post-tests will be evaluated. Results will be evaluated by the researcher. The data will hopefully be presented at several conferences as well as published in journals.

Discussion

While nature is composed of various biotic and abiotic factors, this study seeks to explore the effects green play environment's effect on ADHD children and the role that SI might play. Other individual variables such as temperature, air quality, cardiovascular exertion, vegetation, aesthetics and so on are not being tested. These individual factors are important to explore, however in additional studies. Likewise, the longevity of the treatment will not be tested as a part of this study.

APPENDIX A

Parental Consent Form

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