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Exploring Play Attention

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EXPLORING PLAY ATTENTION

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ABSTRACT

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The present study examined the Play Attention neurofeedback computer program to determine its efficacy in the classroom. A program that would increase students' ability to pay better attention in the classroom would vastly improve our entire educational system. The two areas that were used to determine the effectiveness of the program were improved task performance and the ability to follow directions the first time they are given. Daily progress reports of twenty different students were compared to each other over a six month period. There were ten students in the experimental group and ten students in the control group. There were no statistically significant differences between the group that used the Play Attention program and those in the control group. There were too many confounding factors in this study. A better set of dependent variables may help to indicate the true effectiveness and benefits of this program.

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Statement of the Problem

There are many people and especially children that struggle to focus their attention, stay on task and follow directions. The level of distractibility may vary between individuals, but the problems are all the same. When referring to children or students, this presents major issues in the classroom. Using a combination of neurosciences and developing strategies to help to improve some of these problems, would greatly improve their chances of success. The purpose of this study is to determine whether or not a computer-based program called Play Attention will help students improve attention and their ability to stay on task in the classroom. The hypothesis for this study is that through Play Attention, students will increase their ability to stay on task in the classroom and in real life situations.

Significance of the Study

Over the last couple decades there has been an abundant amount of research and progress when it comes to brain mapping, education, and neurofeedback. Neurofeedback research has really progressed since its origins. According to Robbins,

> "During the 1960's Dr. Joe Kamiya at the University of Chicago was studying consciousness by attempting to elicit "alpha wave" activity in the brain. This is

the type of wave the brain emits at a calm resting state. He found that some individuals could learn to identify when their brain was producing alpha waves and increase their production. They found the process to be relaxing. Using a simple reward system, and with his subjects' cooperation, he conducted the first ever EEG biofeedback training. Meanwhile, also during the 1960's Dr. Barry Sterman of UCLA and the Veteran's Administration Hospital in Sepulveda, California was studying brain activity during sleep. His subjects were cats, and he recognized that brain activity at a certain rate of speed was associated with relaxation in the cats. He experimented with rewarding the cats each time their brains would function at the speed associated with the relaxed state, and found that the cats responded by becoming more relaxed in general. Shortly after those findings he was contacted by NASA to research a problem with astronauts who were exposed to a particular rocket fuel. They had headaches, nausea, hyperventilation, hallucinations, and seizures. While performing experiments with this fuel (also on cats) Sterman found that the cats who had been rewarded for the brain activity in the relaxed state were resistant to seizures that often resulted from exposure to the rocket fuel."

It is now possible for science and technology to help people overcome deficits in cognitive abilities. "The medical community is also responding, and numerous physicians are either becoming trained as practitioners in neurofeedback or referring their patients for neurofeedback treatment. Research has increased and new methods and protocols are discovered with amazing speed." (http://neurofeedbacktoday.com) There is also a plethora of classifications for the people who are dealing with these issues. They may

have attention deficit disorder with hyperactivity, severe emotional disorders, or even a wide range of behavioral disorders. These classifications may also be combined with one or more of the others. Many of these people often have low cognitive ability to begin with, and that just makes it that much more difficult for them. They are easily distracted, talk excessively, tend to be disorganized and have difficulty completing tasks. These are concerns for students who are simply diagnosed with attention deficit disorder right on through to the most severe cases and those with multiple disorders. There must be a multidisciplinary approach to helping these individuals.

Need

There are many approaches to try and accommodate their disabilities and maximize their educational experience. There needs to be a level of metacognition, in an effort to improve concentration. Skills on how to concentrate need to be taught through various skill streaming strategies. The ultimate goal is to be able to increase their ability to concentrate, build their cognitive skills and help shape their behavior. Currently, educational institutions prefer to use data-driven, technologically advanced intervention strategies to help improve cognitive and behavioral deficiencies, to supplement other proven strategies. However, there are an ever increasing number of special education students being identified. Many times these students don't fully understand the habits they have formed and continue them throughout their lives. These habits often interfere with their ability to stay on task. In the future, this can also lead to an inability to keep a job. This is a problem that impacts our entire society. There are many possible factors that are contributing to this problem, but the heart of the issue is the inability to focus attention. NASA and the Air Force have developed a behavior bases system called Play

Attention that can help these students understand and control these negative habits that contribute to poor academic performance and reduce their impulsivity and disruptive behavior. Play Attention increases the ability to concentrate, helps to scaffold the cognitive skills necessary to be a good learner, and influences the behavior of students to enable them to manage their attention problems. (http://www.playattention.com/educators/)

Purpose of the Study

This study will examine the effectiveness of Play Attention on students with emotional, behavioral and cognitive disabilities. The hope is also that they will be able to generalize the skills they are attaining and transfer them over to other settings, such as the classroom and real life situations. The major purpose of this study is to determine whether or not the Play Attention program is an essential medium for helping students with deficits in attention, to stay more focused and become more successful in the classroom and beyond. Depending how focused they are, it will determine how well they do in the game. The Play Attention interface unit measures the area of the brain associated with focus and cognitive abilities. They control the video game solely by attention.

Research Questions

The hypothesis for this study is that through Play Attention, students will increase their ability to stay on task in the classroom and in real life situations. There are many behaviors that these students must gain control over before they are able to focus complete attention to the task at hand. Some of these behaviors include engaging in

nervous habits, such as, twisting hair, biting nails, and chewing on objects. They are often off task, either daydreaming or their eyes are wandering around the room. They are unable to adjust their behavior to the expectations of the situation. They call out, fidget, hum, cry, or become easily frustrated. They may be excitable, nervous, have an outburst, or engage in a verbal argument because they do not want to complete a task. They often do not follow verbal directions or need instructions repeated. Students must be made aware that there is correlation between these specific behaviors and their behavior and attention. It is important for the coach to point out the behaviors of the student while they are engaged in the Play Attention, so they realize the correlation between their behaviors and what happens in their game. Another essential aspect to one of the research questions are whether or not the students will be able to transfer the skills they are developing through the play attention program, into the classroom.

Operational Definitions

There are many terms that will be used throughout this study that need to be operationally defined. According to the DSM-IV the following is used to define ADHD:

I. Either A or B:

A. Six or more of the following symptoms of inattention have been present for at least 6 months to a point that is disruptive and inappropriate for developmental level:

Inattention

1. Often does not give close attention to details or makes careless mistakes in schoolwork, work, or other activities.

2. Often has trouble keeping attention on tasks or play activities.
3. Often does not seem to listen when spoken to directly.
4. Often does not follow instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions).
5. Often have trouble organizing activities.
6. Often avoids, dislikes, or doesn't want to do things that take a lot of mental effort for a long period of time (such as schoolwork or homework).

Often loses things needed for tasks and activities (e.g. toys, school assignments, pencils, books, or tools).

7. Is often easily distracted.
8. Is often forgetful in daily activities.

B. Six or more of the following symptoms of hyperactivity-impulsivity have been present for at least 6 months to an extent that is disruptive and inappropriate for developmental level:

Hyperactivity

1. Often fidgets with hands or feet or squirms in seat.
2. Often gets up from seat when remaining in seat is expected.
3. Often runs about or climbs when and where it is not appropriate (adolescents or adults may feel very restless).
4. Often has trouble playing or enjoying leisure activities quietly.
5. Is often "on the go" or often acts as if "driven by a motor".
6. Often talks excessively.

Impulsivity

1. Often blurts out answers before questions have been finished.
2. Often has trouble waiting one's turn.
3. Often interrupts or intrudes on others (e.g., butts into conversations or games).

II. Some symptoms that cause impairment were present before age 7 years.

III. Some impairment from the symptoms is present in two or more settings (e.g. at school/work and at home).

IV. There must be clear evidence of significant impairment in social, school, or work functioning.

V. The symptoms do not happen only during the course of a Pervasive Developmental Disorder, Schizophrenia, or other

> Psychotic Disorder. The symptoms are not better accounted for by another mental disorder (e.g. Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder).

Neurofeedback is a type of biofeedback. In biofeedback, information about some part of your body is fed back to you, and a person is able to gain control over them in a way previously unavailable. Lubar (1995) defines neurofeedback as:

> In neurofeedback the information fed back to you is EEG (electroencephalogram) data read by sensors placed on your head. Very tiny amounts of electric energy are read and processed by electronic and computer equipment to provide you with moment by moment information about your brain activity. This activity is shown to the neurofeedback therapist as wave patterns on a computer screen, and to clients as visual graphics--ranging from rocket ships racing one another to rapidly changing side by side thermometers. The goal is explained to the client (make one rocket ship go faster than the other), and the brain learns how to make that happen without the person knowing how they do it. A sound also beeps when the brain behaves as desired, which helps. Simply wanting to hear the beeps seems to be enough to get the brain to cooperate.

Academic Bridging is the method used in Play Attention to transfer and generalize skills learned in a Play Attention training session to an academic setting. There is a link on the Play Attention website, http://www.playattention.com/educators/, which gives this example to fully comprehend what is meant by academic bridging, "Students actually perform homework assignments while connected to the Play Attention

program. The program alerts them when they fail to pay enough attention to their homework. Play Attention teaches them to finish their homework on time."

Neuroplacsticity is another key term that needs to be defined. Finger (2001) discusses the idea of neuroplacticity in his book Origins of Neuroscience:

> "Scientists apply the term neuroplasticity to the action of brain growth and adaptation in response to challenge. Provided the correct challenge and environment, children and adults frequently compensate (shift brain function from one area to another) when a certain area of the brain cannot function correctly. It is documented in many medical and neurological journals that the brain will increase activity in another region to overcome loss of another region. UCLA pediatric neurologist Dr. Donald Shields states, "if there's a way to compensate, the developing brain will find it." There is no question that the brain can compensate even if it has problems focusing attention.

Play Attention is founded in educational cognitive psychology to provide the correct environment and challenge. Educational and behavioral objectives are two terms that need to be operationally defined. Educational objective and behavioral objectives are broad terms that are used in a variety of different ways throughout education and psychology. When used in conjunction with the Play Attention program there is a specific objective associated with each level of the game. The component that measures the participants' brainwaves is referred to as the Play Attention Interface Box. The Play attention Interface Box is a brainwave amplifier, which is also called model PA 1050. Fixed frequency filtering is utilized to measure only the brainwaves of interest, and there

are not adjustments or options available to the user. After the brainwaves have been measured a data report is produced every time the program is used. Play Attention allows you to store its skill-based cognitive and behavioral data from your students. Detailed reports and graphs are printed to demonstrate efficacy in an IEP and provide reinforcement of cognitive skills and behaviors. In an effort to determine the effectiveness of Play Attention and the students' ability to transfer the skills into the classroom, data from their daily progress report will be measured. The daily progress report is based on the school-wide behavior modification system. Behavior modification is an idea that has been explored for the past century, since it was first used by E.L. Thorndike. Pear and Martin indicate that there are seven characteristics to behavior modification. They are: There is a strong emphasis on defining problems in terms of behavior that can be measured in some way. The treatment techniques are ways of altering an individual's current environment to help that individual function more fully. The methods and rationales can be described precisely. The techniques are often applied in everyday life. The techniques are based largely on principles of learning. There is a strong emphasis on scientific demonstration that a particular technique was responsible for a particular behavior change. There is a strong emphasis on accountability for everyone involved in a behavior modification program.

These terms will be used throughout the study, so a solid understanding of their definitions is essential.

Assumptions and Limitations

There are some limitations to the study, mainly because of the many different variables involved. Some of the different variables that will present limitations in the study will be the types of medications the students are taking. Whether or not they have taken the medications they are supposed to take, will impact how they do while using Play Attention and their subsequent behavior in the classroom. The wide variety of classifications and diagnosis's of the students will also present limitations. Many students involved in the study are classified as multiply disabled, so it is difficult to determine which classification is affecting their ability to concentrate and remain on task. Their classroom behavior may also be impacted by another student's behavior. Another limitation may be their ability to transfer the skills developed using Play Attention into the classroom and other settings. A final limitation and quite possibly the most important, is whether or not the students involved in the study were using the Play Attention program consistently and correctly. These confounding factors could have had a significant impact on the results of the study.

Overview

The following chapter will be an exploration into the current research on neuroplasticity, neurofeedback and behavior modification techniques. Within these topics, research is developing exponentially as more is discovered about the brain. The combination of cutting edge technology and knowledge about the brain is leading to innovative ways of helping people overcome deficits in many areas in life. Chapter three will focus around the design of the study. It will look at the sample used for the study

and the measures being used. A testable hypothesis will be presented along with a detailed analysis and summary of the study.

Chapter Two: Literature Review

Introduction

The subject of neurofeedback or electroencephalogram (EEG) has been explored since the early twentieth century, so there is an enormous amount of research on the topic. Essentially, it is the measurement of electrical activity produced by the brain as recorded from electrodes placed on the scalp. The process, application and designated uses of neurofeedback have evolved in many ways over the last century and into the twenty-first century. Since its discovery, scientists, psychologists, and physicians have been trying to determine the many uses it may have and the efficacy of its use. Individuals are able to alter their patterns of brain waves through operant conditioning. Research has demonstrated there are several psychological and neurological disorders that show specific EEG patterns and neurofeedback can help change them. (Masterpasqua and Healey) Over the course of the last couple decades psychologists have felt that neurofeedback could be a benefit to people with Attention-Deficit/Hyperactivity Disorder. Behaviors that are typical of those with ADHD have been observed for a long time, but it was not included in the Diagnostic and Statistical Manual of Mental Disorders until 1980. Since that time EEG-based biofeedback has been used as an alternative treatment for reducing symptoms of ADHD. Despite being an alternative treatment, it is

often best to supplement it with other modalities of treatment to produce the most effective results.

Regardless of the fact the term Attention Deficit Disorder did not appear until the 1960's, many children just like them have been around since recorded history began. Many professionals have been observing specific characteristics related to those diagnosed with ADD for over a century and documenting them. A case study was done by G.F. Still in 1902 that documented impulsive and hyperactive symptoms. The person in this case study had a tendency to be destructive, mischievous, and lacking moral control. There was not much literature regarding children such as these for the next few decades. In 1937, Dr. Charles Bradley documented the first know pharmacological treatment for these types of individuals. He prescribed an amphetamine sulfate to several different children with attention problems and it produced positive results. Then in 1947 Strauss and Lehtinen developed a term coined as minimal brain dysfunction or MBD, which gave it a conceptualized definition. Strauss and Lehitnen (1947) stated children with MBD were impulsive and hyperactive and lowered their inhibition, resulting in negative behavior. The term Attention Deficit Disorder first appeared in the second addition of the Diagnostic and Statistical Manual of Mental Disorders back in 1968. Since that time the definition has gone through many different changes. In 1972, Douglas used the terms impulsive and inattention. The current definition from the DSM-IV, which was published in 1994, states the condition is now called Attention-Deficit/ Hyperactivity Disorder. There is an inattention component, a hyperactivity component and an impulsivity component. The definition is going to change again when the DSM-V comes out in 2010.

In the past the definition has always been based strictly on behavior. Professionals must use observable behavior that is viewed subjectively, to make an appropriate diagnosis. They observe them in natural settings, such as school, social situations and at home. There are no identified physical features or clinical tests that can help determine diagnostic criteria for assessing ADD. This makes an accurate diagnosis of ADD a difficult task. Some of the behavior-based criteria have been impulsiveness, inattention, poor organizational skills, hyperactivity, and distractibility. All children have the potential to exhibit these qualities occasionally. Many of these symptoms are also present in a plethora of other disorders. Comorbidity is extremely prevalent in many children diagnosed with ADHD, so it is often difficult to distinguish which diagnosis is responsible for which behaviors. According to Othmer, Othmer, and Marks (1991), over fifty percent of children with ADHD are comorbid for other disorders. This can make it extremely difficult to accurately diagnose and many people believe that, especially in the United States, ADD is over diagnosed.

History of Neurofeedback

The initial movement towards utilizing neurofeedback as a means of changing behavior can be traced back to its origins, but the evolution of it and the potential benefits in the future are inconceivable. Electroencephalography was a term first coined by Hans Berger in 1929 when he discovered that different frequencies of brain waves are measurable from the scalp. During the 1940's and 1950's most of the research done was done in a laboratory setting by researches from many areas of expertise. They were testing the ability of biofeedback to modify psycho physiological functions in animals and humans. There were several researches that made significant contributions to

neurofeedback research during the 1960's. Dr. Kamiya's research at the University of Chicago and Sterman and Friar's work with seizure patients helped pave the way for its use for people with ADHD. After Neal Miller's publications in 1969, demonstrating that autonomic functions can be used for operant conditioning, it had an unimaginable influence on psychologists. They realized that animals and humans could be conditioned to control their brain waves through contingent feedback (Robbins, 2001). During the 1970's neurofeedback was disregarded as a legitimate therapeutic intervention because it became associated with the psychedelic and altered states of consciousness movement, which had a negative connotation within the scientific community (Budzynski, 1999).

It wouldn't take very long before neurofeedback would become widely accepted by healthcare workers, scientists and mental health workers. Sterman is really responsible for bringing neurofeedback back in favor with the scientific community by proving the clear connection between the mind and physiology and making the benefits abundantly clear (Robbins 2001). Around this same time, psychologists, psychiatrists, and other medical doctors were forming a more accurate diagnosis of what is now referred to as ADHD. Some doctors were already looking at the potential benefits that EEG could have on those people. Grunewald-Zuberbier, Grunewald and Raske published a report in 1975 stating that children, who have a tendency to be hyper, actually have higher alpha and beta amplitudes when they are not being over-stimulated. Their study showed they have more alpha waves and fewer beta waves, which they interpreted as a lower state of EEG arousal. In the late 1980's Dr. E. Roy John was working at New York University Medical Center and published an important document about computer assisted differential diagnosis of brain dysfunction (John, Firdman &

Easton, 1988). Researchers have built on his work through the use QEEG and computer analysis.

Quantitative Electroencephalography (QEEG) is the measurement, using digital technology, of electrical patterns at the surface of the scalp which primarily reflect cortical activity or "brainwaves". A multi-electrode recording of brain wave activity is recorded and converted into numbers by a computer. These numbers are then statistically analyzed and are converted into a color map of brain functioning. Digital EEG techniques have grown rapidly in both technology and popularity since the early 1980's for recording, reviewing, and storing EEG data. One of the pioneers of QEEG is Dr. Frank H. Duffy of Harvard Medical School. In 1994, he wrote an extremely important paper for the American Medical EEG Association. After publishing this paper the QEEG movement really started to gain momentum. Other scientists, doctors and researchers began defining clearly the physiological effects that EEG analysis has. "We now know clearly that the relevant EEG rhythmic patterns reflect the unique properties of cortical circuits, that these EEG patterns are topographically localized in relation to nervous system organization, and that the interaction between specific and nonspecific sensory and cortical influences determines their frequency and cortical expression" (Sterman, 1996, p.4). It is also important to differentiate between QEEG and clinical EEG. Clinical EEG is what is used strictly by medical doctors to determine if there are serious medical conditions. These tests would include computerized axial tomography or a CAT scan, an x-ray, and magnetic resonance imaging or MRI. These tests would be used to diagnose a tumor, epilepsy, or some type of problem with brain structure.

The use of QEEG is used to measure brain function and the physiology of the brain. Any type of EEG essentially is the measuring of brain wave activity. They are measuring the electrical impulses that are produced when a bunch of neurons are released in the brain. The different patterns of activity really depend on a number of different circumstances all based on the individual who is being assessed. The brain activity will fluctuate depending on whether or not the person is asleep or awake, scared, tired, or involved in a cognitive task. Through current research and many different clinical studies it has been determined that the level of brain activity is related to the individuals' cognition and emotion, in addition to the level of arousal. The neurons function in the initiation and conduction of electrical impulses in the nervous system. Anything that exhibits a response, either psychological or physical, will produce an electrical impulse. The impulse then moves along the axon, which is covered with a myelin sheath that acts as an electrical insulator. The myelin sheath guides the impulse quickly down the axon until it reaches the next neuron at a synapse. The receiving branches are called dendrites. The space where the axon of one nerve cell connects with the dendrite of the next nerve cell is called the synapse, or synaptic gap. Neurotransmitters, which are released from the dendrites, help the nerve signals travel along the synaptic gap. They help carry messages from neuron to neuron. Neurotransmitter chemicals excite or inhibit a response depending on which chemicals are released into the synaptic gap. It also depends on the stimulus. Some of the chemicals that are released include dopamine, serotonin, and norepinephrine. QEEG measures electrical patterns on the surface of the scalp. The digital technology measures the brain wave activity of the individual. The speeds of the frequencies vary greatly. Some of the names of the bands are alpha, delta, theta, beta,

and sensory motor rhythm or SMR. They are identified according to their frequencies, which are measured in hertz.

Brain waves are grouped into clinical bands. They are usually grouped from the slowest to the fastest. Linden, Habib, and Radojevic did extensive studies on brain waves and were able to determine the clinical bands that are commonly used and when they are most and least frequent. Delta brain waves tend to be the slowest and highest amplitude brainwaves. They range from 1-3 Hz. They are the brain waves that are present when a person is sleeping or in an emphatic state. When there is an over abundant amount of delta activity, it usually means there is some kind of dysfunction. Theta waves range from 4-8 Hz and are present when a person is daydreaming or fantasizing. In the lower range of theta waves between 4-5 Hz, intellectual activity is not present. When there is a high range of theta waves between 6-8 Hz, there is a state of intense inward focus and concentration. This is also the level people enter when there are under hypnosis or in a meditative state. Alpha waves range from 8-11 Hz and tend to be slower and larger. They are associated with a state of relaxation and waiting to respond when necessary. When a person closes their eyes and imagines peaceful, serene images, their alpha waves increase. Sensory motor rhythm waves range from 12-15 Hz and are associated with being mentally alert. The smallest and fastest waves are beta waves. They range from 16 Hz and above. Beta waves are associated with being mentally and intellectually active. They are present when a person is in deep thought, using problem solving skills, or processing information. Despite the differences in brain waves and their activity, people often produce a mix of multiple brain wave frequencies in various parts of the brain simultaneously (Lubar, 1995).

Benefits of Neurofeedback

The benefits of QEEG in combination with behavior modification can no longer be denied. There is currently an abundance of literature to suggest and confirm that QEEG is not only a way to change behavior, but may also have uses in other areas. Dr. John Hughes and Dr. E. Roy John published an article in The Journal of Neuropsychiatry and Clinical Neurosciences in 1999 that reviewed all of the scientific literature related to QEEG. They looked at five hundred scholarly papers published in the previous decade and relate specific patterns of abnormality to specific diagnoses. Brain wave analysis gives psychologists, psychiatrists and other mental health workers an objective way to look at and assess mental health. "Evidence has unequivocally established that mental illness definitely correlates with brain dysfunction. QEEG promises to have greater expanded use as psychiatrists become more familiar with its applications." (Hughes & John, 1999) The additional benefits of neurofeedback include the ability to help regulate medications, confirm a diagnosis already given or help to properly diagnose. Knowing what is functionally wrong with the individuals brain can help to figure out what may be the cause of the symptoms. It is now starting to be used as a pretreatment to help assist the pharmacological treatment. Sterman (1996) proposed the integration neurology, physiology, clinical research and learning theories. Brain wave analysis, which was originally scrutinized by most of the medical community, is now widely accepted as a diagnostic tool used for clinical applications. The United States Federal Drug Administration regulates the methods and medical devices used. Many health care providers will even pay for the procedure. The future of QEEG appears to be promising and has potential benefits for the entire society.

There are currently many different methods for treating ADHD, although medication seems to be the most common. Many times psycho stimulant drugs, such as Ritalin, Adderall and Cylert, are used to help remediate the symptoms of ADHD. Drug treatments have been effective, but there are also harmful effects associated with them. Drugs are only effective while they being used and do not really help the individual in the long run. Lubar (1991) found there are serious potential ramifications over time that includes stunted growth, drug dependence, and an inability to function normally without the drug. Behavior modification is a method for treating ADHD that has a more positive view. When parents, teachers and other people directly involved in the child's life work together to help modify behavior, there can be great success. Neurofeedback is now a viable alternative to helping treat individuals with ADHD. It is especially effective when all three modalities are used in combination with each other. There is plenty of scientific literature that demonstrates that neurofeedback can be effective in reducing symptoms of ADD (Kaiser, Othmer & Othmer, 2000).

Future of Neurofeedback

The more we are discovering about specific patterns of EEG, the more optimistic the scientific and medical community is about the success of neurofeedback. Many studies have discovered there is a localized excess of 4-8 Hz theta activity in the prefrontal, frontal, and sensorimotor cortex of individuals with ADHD (Barabasz & Barabasz, 1996). Another characteristic of EEG patterns in individuals with ADHD is there is a generalized excess of theta or slowed alpha activity in all cortical areas during all test states, which are exaggerated when the individual is engaged in a task (Chabot & Serfonstein, 1996). People with ADHD tend to have excess slow waves, usually delta,

slow theta and excess alpha. When there is excess slow wave activity in the frontal part of the brain, it is difficult to control behavior, attention, and emotions. They have difficulty with concentration, controlling impulses and hyperactivity. The major assumption of this research is that every change in a physiological state is represented by an appropriate change in mental state (Linkenhoker, 1983). In 1995, Rossiter and LaVaque compared neurofeedback to drug therapies. They found that both treatment modalities produced significant improvements in performance and behavior. In 1996, Linden, Habib and Radojevic compared 18 randomly assigned patients to either a neurofeedback treatment or a control group. The treatment group was able to suppress their theta waves and enhance their beta waves. The group that received the neurofeedback took part in 40 sessions and was able to decrease inattentive behaviors and increase their scores on an intelligence test. They performed significantly better than those in the control group. In 2002, Monastra, Monastra & George compared the effects of drug treatment, neurofeedback and parenting styles. They gave them a pre and post test assessment using the Attention Deficit Disorders Evaluation Scales (ADDES) and the Tests of Variables of Attention (TOVA). All of the subjects received Ritalin, parent counseling and in school support, but only half of the participants received additional neurofeedback treatment on a weekly basis. They found that only the children who received neurofeedback made gains on both the ADDES and the TOVA. In 2003, Fuchs, Birbaumer, Lutzenberger, Gruzelier and Kaiser assigned children to either a neurofeedback treatment or a drug treatment using methylphenidate. They were also given the TOVA and both groups showed significant improvements from pre to post treatment tests. All of these studies demonstrate that both neurofeedback and drug

treatments are effective in treating individuals with ADHD. There are much less risks involved with neurofeedback treatment and by changing patterns in the brain, QEEG could be a long term solution, as opposed to a short term one.

QEEG seems to be the diagnostic tool that will dictate the future of the mental health profession. Technology and brain research are both developing exponentially and will only become more precise. In the future, QEEG will not only benefit those with ADHD, but will help people to overcome deficits in cognitive ability, personality disorders, depression, and many other disorders.

Chapter Three: Design of the Study

Sample

The participants in this research study were all from the same elementary school and were between first and eighth grade. The school is a private school for students with severe emotional and behavioral disabilities. They represent several different school districts and come from a wide variety of cultural and socioeconomic backgrounds. All of the students involved in the study have been removed from their local district school because they were too disruptive and the schools did not have a program to accommodate them. This research study is exploring the efficacy of neurofeedback as a means of increasing on task behavior and attentiveness. All of the students participating in the study were given a consent form before any data was used. The total sample size used in the study was twenty students, who are classified with a wide variety of disabilities. The comorbidity rate is about 85%, as many are classified as multiply disabled.

Measures

The measures that were established for this study were a combination of data. The school has a detailed behavior modification system that breaks down their scores into separate categories. Two of the categories that the students can earn points in are on task behavior and following directions the first time. Both of these areas correlate with being

attentive and exhibiting positive behavior. The students in the experimental group were participating in the Play Attention program twice per week. The students in the control group did not participate in the Play Attention program, but still received daily progress reports.

Procedure

The researcher obtained permission from the school superintendent to conduct the researcher. The superintendent suggested that the researcher also obtain parental consent for all the students involved in the study. Each student was given a consent letter, which was signed before any data was collected. The parents were also informed that they would be able to view the results of the research upon completion of the study. The data was collected beginning in the month of September and ending in the month of February on a daily basis. The students in the experimental group began using the Play Attention program during the month of October. The students in the control group were chosen because they had similar disabilities to those in the experimental group. The data was compared over a six month period.

Hypothesis

It was hypothesized that the longer the students in the experimental group used the neurofeedback program, the more their ability to remain on task and follow directions the first time would increase. Additionally, it was hypothesized that the control groups' ability to stay on task and follow directions the first time would either remain stagnant or decreases throughout the six month period. For the two way mixed anova, it was

hypothesized that the experimental group will experience higher gains in on task behavior and ability to follow directions, than that of the control group.

Design

This study will utilize a two way mixed anova between and within subjects in an effort to prove the hypothesis. There should be a correlation between the use of neurofeedback as an intervention and improvement in the area of on task behavior and ability to follow directions the first time. The independent variable is the neurofeedback program called Play Attention. The two dependent variables will be on task points and following directions the first time points.

Summary

The focus of the study is to determine whether or not Play Attention enables students to alter their behaviors and habits by recognizing those behaviors. The research conducted in this study will be valuable to the school because it will determine if the neurofeedback equipment that the school purchased was cost effective. If it does increase the attention of the students, then it would be beneficial to encourage more students to participate in the program. The next chapters will include a detailed analysis of the results and the conclusion drawn from the study.

Chapter Four: Analysis of Results

Introduction

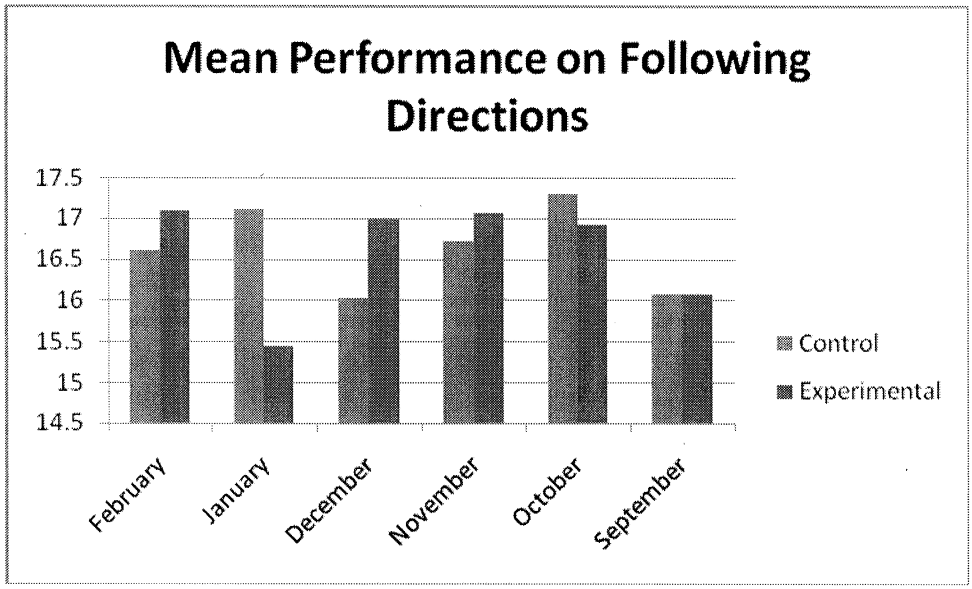
The purpose of this study was to determine the Play Attention neurofeedback computer program to determine its efficacy in the classroom. A program that would increase students' ability to pay better attention in the classroom would vastly improve our entire educational system. The two areas that were used to determine the effectiveness of the program were improved task performance and the ability to follow directions the first time they are given. Daily progress reports of twenty different students were compared to each other over a six month period. There were ten students in the experimental group and ten students in the control group. The hypothesis of this study was the longer students have been using the Play Attention program, their scores in on task performance and following direction the first time would improve.

Results

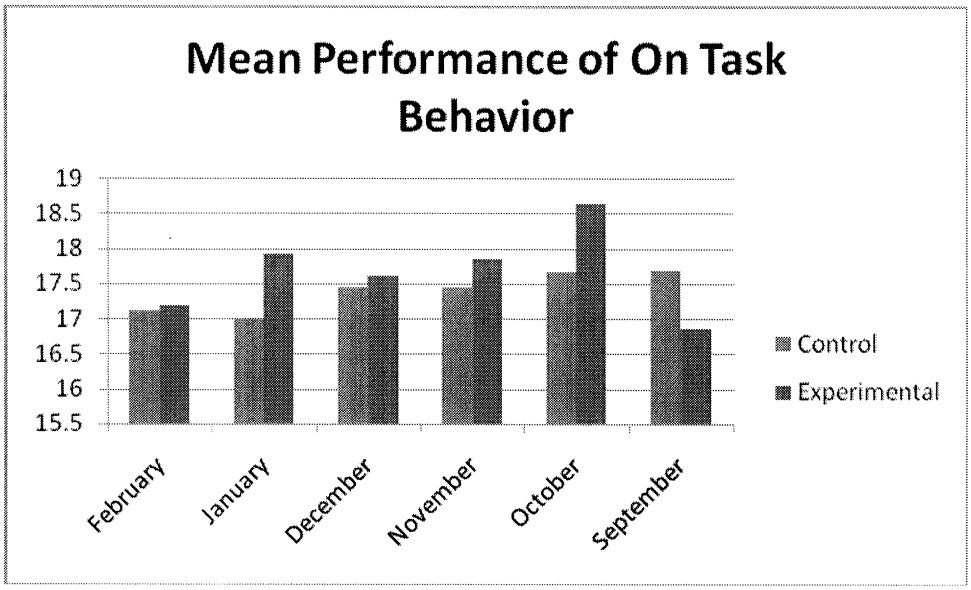
A two way mixed anova was conducted to test the hypothesis. These values were all less than .05, which means there is no significant difference. There were no statistically significant differences between the group that used the Play Attention program and those in the control group. Graph 4.1 and 4.2 refer to the average of the different daily points earned by both the control group and the experimental group. The average point total of the entire control group and the entire experimental group were represented in these bar graphs over a period of six months. Graph 4.1 refers to the

points earned for following directions. Graph 4.2 refers to the points earned for remaining on task. The graphs represent the inconsistencies between the control group and the experimental group and the overall ineffectiveness of the Play Attention Program in this experiment. There were too many additional confounding factors in this study that had serious implications on the results. The small sample size may also be a contributing factor.

Graph 4.1



Graph 4.2



Summary

The hypothesis that after the six months students in the experimental group would improve their on task and following directions scores in comparison to students in the control group was not proven to hold true. The null hypothesis, which stated there would be no difference between the control group and experimental group was found to be true. The implications of these findings will be discussed in the following chapter. The limitations of the study, as well as the need for further research, will also be discussed in the next chapter.

Chapter Five: Discussion and Conclusions

Introduction

The major purpose of this study is to determine if the Play Attention program could be used as an effective tool for helping students with deficits in attention, to stay more focused and become better students. The hypothesis was that as the student continued to utilize the Play Attention program, their ability to remain on task and follow directions the first time would improve.

Chapter two discussed a literature review in great detail about the topic of EEG and neurofeedback. There have been previous studies involving the use of neurofeedback as a useful aide for improving concentration. Many doctors, psychologists and other researchers have built on the work of Dr. E. Roy John at New York University Medical Center during the 1980's.

Chapter three laid out the design of the study. There were ten students in the experimental group, who were using Play Attention. There were ten students in the control group, who had similar disabilities as those in the experimental group. The data that was used came from the students' daily progress reports over a period of six months. The two specific categories that were used were on task behavior and following directions the first time.

Chapter four was an exhibition of the results of the research. A two way mixed anova was administered to compare the data between the experimental group and the control group.

Chapter five will include a summary and conclusions about the study. An interpretation of the results will be given in this chapter. There will also be discussion and implications for future research.

Limitations

There were several limitations within this study. One of the major limitations of this study was the frequency with which the students in the experimental group actually used the Play Attention program. The students in the experimental group were supposed to be using Play Attention two times per week for forty-five minutes each session. There were about five or six different one-on-one aides and classrooms assistants who were trained on how to administer the program. The students were not consistently using Play Attention for a variety of different reasons. The daily schedule changes frequently, other academic subjects may have taken priority, and classroom incidents that are extremely disruptive may have occurred. All of these reasons may have prevented the students in the experimental group from using the scheduled time for Play Attention.

Despite using Play Attention consistently, the results could have also been skewed for many other reasons. The scores that were used in the comparison were on task behavior and following directions on the first time. These scores could have been affected, regardless of the usage of the Play Attention program or not. The students' on task scores could be affected by a lack of medication, another student being extremely

disruptive, lack of interest, or the student could have been experiencing emotional issues at that moment. It would have been beneficial if there had been a larger sample, as well.

Conclusion

The initial purpose behind this study was to determine whether or not Play Attention was going to improve students' ability to concentrate. The study set out to figure out if it was ultimately going to be a benefit to the students who were using it. There may have been a more effective method of determining how beneficial Play Attention actually is, but according to the research conducted in this study it appears that Play Attention did not help to improve the concentration of the students who were utilizing it. There were entirely too many limitations within this study and probably could have produced more reliable results if the research could have been conducted in a more controlled setting.

Implications for Further Study

This study itself is not really indicative of the potential results that Play Attention and other neurofeedback programs have to offer. The sample size should be increased to a much larger number of students. This would actually create a more diverse sample size and potentially include students who are in regular education, as well as special education. When evaluating the students to determine whether or not Play Attention has helped increase their concentration skills, it may be a better indicator if they were isolated from their peers. Sometimes it is not the individual students' lack of focus, but their peers' disruptive behavior that is preventing them from sustaining their attention. Subsequently, they become deterred from remaining on task or following directions,

which causes them to not earn their points. This particular study is not necessarily the most accurate indication of the true efficiency of Play Attention.

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