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Effectiveness of Individualized Use of a Multisensory Environment on Engagement in Preschool Children Attention Deficit Hyper Activity Disorder

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Abstract: ***Objective: In keeping with client-centered practice in support of occupational performance, we examined the use of a multisensory environment (MSE) on engagement in preschool children with Attention deficit hyper activity disorder (ADHD), comparing two different methods: an individualized approach and a protocol-driven approach. Method: Fifteen children, ages four to seven years, participated. A randomized, counterbalanced design was used to measure engagement in the protocol-driven condition and the individualized condition. In the protocol-driven sessions, the equipment was turned on in a slow, sequential manner. In the individualized sessions, participants were free to play and engage the MSE as desired. Engagement was measured across four variables: 1) The number of requests/initiations, 2). The duration of engagement /play, 3) Affect, and desired and undesired behaviors identified by the parents. Sensory processing patterns were determined through the Sensory Profile (Dunn, 1997). Parents were asked for their opinion of the use of the MSE under the two conditions. Results: Results were not significant in terms of increased engagement in an MSE in the individualized approach. However, most parents valued the use of the MSE with their children. Conclusion: This study provides a picture of engagement within MSEs for preschool children with ADHD. Given the results, occupational therapists should select between the individualized and protocol-driven approaches according to their own clinical judgment. Further research is needed to guide best practice use of MSEs.***

Keywords: ADHD, Multisensory environment, protocol and individualized driven condition approach

1. Introduction

Multi-Sensory Environments are used in all stages of development, from infants to the elderly. They benefit people with cognitive impairments and developmental disabilities resulting from Autism, Cerebral Palsy, Profound Multiple Disabilities, Developmental Disabilities, Chronic Pain Syndrome, Hearing Impairment, ADHD (Attention Deficit Hyperactivity Disorder), Pervasive Developmental Delays, Mental Dysfunction, Traumatic Brain Injury, Stroke, Coma, Alzheimer's and Dementia

Multi-Sensory Environments are used in nurseries to promote infant and child development. Individuals with traumatic brain injury and those with ontological impairments also benefit, as do agitated patients and those in need of pain management. The environment in which the sensory stimuli are delivered is important in the therapeutic process (Slavik& Chew, 1990; Walker, 1991). Dr. Ayres delivered her sensory integration therapy in a playroom with specific characteristics, including the presence of an occupational therapist or trained professional, a calm and safe environment, and occupational forms that provided significant sensory opportunities utilizing a variety of modalities to engage the senses (Ayres, 1971; Ayres 1979 as cited in Parham et al., 2007), such as suspension equipment, therapy balls, ramps, and climbing structures. In contemporary practice, therapeutic interventions often take place in dedicated spaces called Multisensory Environments (MSEs). Although MSEs do not utilize all of the specific characteristics of sensory integration treatment spaces, the underlying sensory integration theory lends support to the use of MSEs to provide sensory input. MSEs are designed to create a comfortable, welcoming environment that promotes relaxation and offers opportunities for an adaptive response (Messbauer, 2012). Linda Messbauer, an occupational therapist, is credited for bringing the first MSE to the United States from Europe, where it has been widely utilized in therapy for some time. In 1979, occupational therapists Ad Verheul and Jan Hulsegge at The Hardenberg Institute in Holland produced the first MSEs for utilization in therapy with people with intellectual disabilities to "find a balance between relaxation and activity within . . . a safe, adapted environment, supported by a facilitator," (Lotan& Gold, 2009, p. 207). The MSEs were carefully designed spaces created to engage sensory systems, eliciting neurophysiological changes by using innovative technology: moving images, soft music, tactile input, colorful lighting, fiber optic cables, bubble tubes, and a multitude of other sensory experiences (Hulsegge&Verheul, 1987). The equipment in the MSE.

Later became trademarked products marketed under the name Snoezelen, registered by the UK- based company Rompa. The MSE was predominantly utilized as a therapeutic intervention for older adults in hospital settings and mental health facilities, but Messbauer (2012) notes that the use of the MSE appears to be gaining popularity as a therapeutic intervention for children with disabilities. She notes that use of moving visual stimuli elicits head movements (to visually track the stimuli), thereby stimulating the vestibular system, even in the absence of

traditional suspension equipment. Proposed benefits of using MSEs include brain arousal, neuroplasticity, and vestibular stimulation, according to Messbauer (2012).

Multisensory Information

Most species, including humans, are equipped with various highly specialized sensory systems that give them access to numerous types of information on the surrounding environment. Each sensory modality gives us a unique outlook on the world: Color, for instance, can only be perceived through sight, sound through hearing and temperature feel through the somatosensory system. However, our surroundings never cease to present us with situations that stimulate several senses at once. In day-to-day life, events are rarely unimodal; they are multisensory experiences, deriving from a combination of information acquired through several sensory modalities. The brain integrates this multisensory information to provide a complete and coherent representation of what is being perceived and consequently for appropriate behavioural responses to be generated.

MSI and Attention Deficit Disorder with or without Hyperactivity (ADD/ADHD)

ADHD occurs in most cultures in about 3% to 5% of children [107,160] and accounts for approximately half of all paediatric referrals to mental health services in the United States. ADD/ADHD is a neurodevelopmental disorder characterized by impairing levels of inattention, disorganization, and/or hyperactivity-impulsivity that interferes with functioning or development. Inattention and disorganization entail inability to stay on task, to give close attention to details, to listen when spoken to, to follow through on instructions, to be easily distracted by extraneous stimuli and to have difficulty organizing tasks and activities, at levels that are inconsistent with age or developmental level . Hyperactivity refers to excessive motor activity when it is not appropriate or excessive fidgeting or tapping hands or feet when seated, difficulty to remain seated in situations where it is expected, over activity, talking excessively, at levels that are inconsistent with age or developmental level. Impulsivity implies a desire for immediate rewards or an inability to delay gratification which can manifest into behaviours such as a difficulty to wait for her/his turn, interrupting or intruding into other people's activities and making important decisions without consideration of long-term consequences, at levels that are inconsistent with age or developmental level [107]. According to the DSM-V, ADHD symptoms must be present in at least two settings, impact directly on social and academic activities and must be present before the age of 12-years-old [107]. While the predominantly inattentive type (ADHD-I) is the most common subtype in the population (38%–57% of all individuals with ADHD), individuals with the combined inattention-hyperactivity type (ADHD-C) (22%–26%) are more likely to be referred for clinical services. Additionally to attention problems, ADHD are often accompanied by deficits other than those subsumed under the ADHD diagnosis. In terms of cognitive profile, children with ADHD often have difficulty with executive functions (e.g., planning, set shifting, organization, inhibition and regulation Brain. Sci. 2015, 5 43 of behaviour) as well as processing speed and working memory. A high percentage of children with attention disorders also have sensory processing problems, exemplified by behavioural evidence of difficulty modulating sensory responses. It has been reported that boys with ADHD aged between 6- and 10-year-old have more sensory processing difficulties than neurotypical boys. It has also been suggested that these children may not be perceiving and processing sensory information properly as well as having difficulty producing appropriate responses at school, at home and in the community. Compared with children without neurodevelopmental disorders, children with ADHD exhibit greater difficulties in the sensorimotor domain such as the vestibular and balance control systems. For instance, in contrast to neurotypical children, Hassan and Assam (2012) showed that children with ADHD-C aged between 8- and 10-year-old had lower somatosensory, visual and vestibular ratios by 1%, 9%, and 18%, respectively. According to Guskiewicz and Perrin (1996), this could be the result of a lack of adequate interaction among the three sensory inputs that provide orientation information to the postural control system. Furthermore, children with ADHD also have more difficulties to process tactile [186], visual and auditory stimuli. More precisely, while Herne and Han (1992) found that 6- and 12-year-old children with ADHD-C exhibit more soft signs than the normal group on a prototype sensorimotor soft sign battery. Ghanizadeh (2010) demonstrated that children with ADHD give poorer performances on visual acuity and visual field. In the audition realm, a number of studies reported auditory processing problems in children with ADHD.

Aim and Objectives

To find the effect of individualized use of a multisensory environment on engagement in preschool children attention deficit hyper activity disorder

Objectives

- To screen ADHD children by using Vanderbilt ADHD diagnostic teacher rating scale.
- To assess multisensory environment on engagement in preschool children ADHD.
- To compare the multisensory environment between protocol-driven condition and individualized condition participation groups.

Hypothesis

Alternative Hypothesis

- Individualized approach and a protocol-driven approach will have significant effect on multisensory environment of preschool children ADHD
- There will be a difference between protocol-driven condition and individualized condition participation groups.

Null Hypothesis

- There will not difference between protocol-driven condition and individualized condition participation groups.
- There will not be a difference between protocol-driven condition and individualized condition participation groups.

2. Review of Literature

Leonardo fava a, b, Kristin strauss c et.al…, (2009)
The objective of the study is the Multi-sensory rooms: Comparing effects of the Snoezelen and the Stimulus Preference environment on the behaviour of adults with profound mental retardation. This paper considers my read of possibilities for actioners considering using multi-sensory environment in distributive behaviour. Results showed that Snoezelen intervention decreased disruptive behaviours only in individuals with autism, while Stimulus Preference increased pro-social behaviours only in participants with profound mental retardation with co-occurring poor motor and linguistic abilities

Vitoria T. Shimizu, Orlando F. A. Bueno, and Monica C. Miranda .et.al…, 2014)
The objective of the study is assess and compare the sensory processing abilities of children with Attention Deficit/Hyperactivity Disorder (ADHD) and children without disabilities, and to analyse the relationship between sensory processing difficulties and behavioural symptoms presented by children with ADHD. Thirty-seven children with ADHD were compared with thirty-seven controls using a translated and adapted version of the "Sensory Profile" answered by the parents/caregivers. For the ADHD group, Sensory Profile scores were correlated to behavioural symptoms assessed using the Child Behaviour Check List (CBCL) and the Behavioural Teacher Rating Scale (EACI-P).. Results Children with ADHD showed significant impairments compared to the control group in sensory processing and modulation, as well as in behavioural and emotional responses as observed in 11 out of 14 sections and 6 out of 9 factors. Differences in all Sensory Profile response patterns were also observed between the two groups of children. Sensory Profile scores showed a moderately negative correlation with CBCL and EACI-P scores in the ADHD group.

Meir Lotan& Christian Gold et.al.., (2009)
He conducted of the study "Meta-analysis of the effectiveness of individual intervention in the controlled multisensory environment (Snoezelen) for individuals with intellectual disability". To evaluate the therapeutic influence of the Snoezelen® approach. Twenty-eight relevant articles relating to individual (one-to-one) Snoezelen® intervention with individuals with intellectual and developmental disabilities (IDD) were reviewed. Results The primary finding was that the Snoezelen® approach, when applied as an individual intervention for individuals with IDD, enabled significant and large effect size in adaptive behaviours, with generalisation to the participants' daily life.

Ana Sofia Pinto Lopes, Janine Vanessa Martins Araújo, Marco Paulo Vieira Ferreira, Jaime Emanuel Moreira Ribeiro et.al.., (2015)
The conducted of the study "effectiveness of Snoezelen in reducing stereotyping in adults with intellectual disabilities: a case study of Occupational Therapy intervention in multisensory stimulation rooms" Data collection was completed by semi-structured interviews with the formal caregivers of the subject and by the participant and non.-participant direct observation with audio-visuals recording sessions These results converge with the theory that stereotypical behaviours provide sensory self-stimulation, given that such behaviours are to be found at a lower frequency on equipment that offer less sensory input.

Janine van der Linde, Denise Franzsen, Paula Barnard-Ashton et al.., (2013)
The conducted of the study "The sensory profile: comparative analysis of children with specific language impairment, adhd and autism" The Sensory Profile is useful in assisting with diagnosis of certain conditions which present with unique sensory processing patterns. The purpose of this study was to compare the Sensory Profile for children with Specific Language Impairment (SLI) (n=22) to a typical pattern, as well as the reported profiles of samples with autism and Attention Deficit/Hyperactive Disorder (ADHD). The Sensory Profile for both the autism and ADHD samples differed significantly from that of the SLI sample for H. Modulation Related to Body Position and Movement and Factor 6: Poor Registration.

Natasha Smet et.al..., (May 2014)
She conducted of the study "Effect of individualized use of a multisensory environment on engagement in preschool children with autism spectrum disorders "Method Fifteen children, ages four to seven years, participated. A randomized, counterbalanced design was used to measure engagement in the protocol-driven condition and the individualized Condition. In the protocol-driven sessions, the equipment was turned on in a slow, sequential manner. Results were not significant in terms of increased engagement in an MSE in the Individualized approach. However, most parents valued the use of the MSE with their children.

David Coghill and Sarah Seth et.al.., 2015)
The conducted of the study "Effective management of attention-deficit/hyperactivity disorder (ADHD) through structured re-assessment: the Dundee ADHD Clinical Care Pathway". This paper considers read of possibilities for actioners considering using The Dundee ADHD Clinical Care Pathway (DACCP) uses standard protocols for assessment, titration and routine monitoring of clinical care and treatment outcomes, with much of the clinical work being nurse led. The DACCP uses staff skills and time effectively via a structured core pathway to provide a consistent, up-to-date, evidence-based approach to the treatment and management of children and adolescents with ADHD.

3. Methodology

Research design:
Present study was conducted into two groups, pre-test and post test quasi
Experimental design (pre-post study).

Protocol driven condition =
Pre-test - multisensory environment ⟶ Post test

Individualized driven condition =
pre-test multisensory environment ⟶ post test

Study setting:
Annai Therapy Clinic, Tiruchirappalli, Tamil Nadu 620018

Sampling method:
Convenient sampling technique was adopted.

Sample size:
Total numbers of consecutive samples of 30 subjects have taken this study. The subjects were divided into two groups as protocol and individualized approach group. The protocol group consist of 15subjects, and individualized group consist of 15 subjects.

Study duration:
Total duration of the study is 6 month

Intervention period:
Participants attended seven sessions (one introductory session and six MSE sessions). Sessions were scheduled at the convenience of parents and were completed in a three-month span. Sessions were conducted at approximately the same time of day in an effort to control for individual differences across time of day.

Selection Criteria:

Inclusion criteria:
- Participants were children with ADHD between ages 3 to 4 years.
- Children with multisensory environment between protocol-driven condition and individualized condition participation groups.
- Both males and females

Exclusion criteria:
- Age should not be more than 4years one month or less than 3 years.
- Children with neurologic problems like as cp.
- Retts, Asperger syndrome, mental retardation and other associated conditions are excluded.

Variables
Independent Variables
Multisensory environment

Depentent Variables
Protocol-driven condition and individualized of ADHD.

Measurement Tools/Materials Required:
Vanderbilt ADHD Diagnostic Teacher Rating Scale
Sensory profile-2
Hollingshead's Four Factor Index of Social Status

4. Procedure

Participants attended seven sessions (one introductory session and six MSE sessions). Sessions were scheduled at the convenience of parents and were completed in a three-month span. Sessions were conducted at approximately the same time of day in an effort to control for individual differences across time of day.

In the first session, the research personnel obtained informed consent from the parents and assent from the participants. The child participant and parent were oriented to the study protocol (including the email procedure to schedule sessions and to arrive with their child rested, fed, and toileted or changed, as appropriate). The parents completed the demographics questionnaire and the Sensory Profile-2 (Winnie Dunn) while the research personnel conducted the Vanderbilt ADHD Diagnostic Teacher Rating Scale (VADRS) with the child participant in an adjacent room. The VADRS assessment was videotaped using a Panasonic high definition video recorder with audio capabilities for later offline analysis. A stuffed bear named Lucy was used to demonstrate donning and doffing of the devices during the first session.

Upon arrival for the six subsequent MSE sessions (three in the protocol-driven condition and three in the individualized condition), the parents were asked to assist the research personnel in applying the physiological measurement devices when needed. Child participants remained seated on a child-sized chair next to the door while the physiological measurement devices were prepared to activate and stream/record. The child participant was then led to the MSE to engage in a 30-minute session.

Parents had the option to inconspicuously observe the sessions via the two wall-mounted cameras or to accompany the child. Research personnel remained with the participants in the MSE to ensure their safety and take field notes. Research personnel only interacted with the

Participant if the participant initiated the interaction. When participants engaged in behaviours that were unsafe or destructive, research personnel redirected them. If unsafe or destructive behaviours persisted after three attempts to redirect, the parent was asked to intervene. If the parent intervention was unsuccessful, the session was terminated.

After completion of all MSE sessions, parents were asked to observe videotaped sessions and count incidents of desired and undesired behaviours (as they defined them). Parents were also asked to complete a reflective questionnaire about their child's experience in the MSE.

Measurement

Engagement. Each session was videotaped for offline analysis from five different camera angles (one faced the bubble tubes, one was located in the loft area, one faced the ball pit, and two were wall-mounted, belonging to the facility). Engagement was used as the primary outcome measure. Engagement was measured across four variables. The first variable was the number of requests or initiations for an MSE item to be turned on or off in the individualized condition. Requests and initiations were defined as such: pointing toward an item or piece of equipment, positive vocalizations, smiling, laughing or immediately engaging/ playing with an item. The second variable was the duration of engagement/ play within the MSE, measured in minute: second increments. The third variable was Quadrants, measured by identifying Quadrants, neutral, and positive. The Quadrants signs could range from extreme distress to

extreme excitement. Negative include Quadrants signs of distress, ranging from frowns, grimacing, whining, inconsolable crying and negative verbalizations. Neutral includes being summer-autumn during MSE engagement/play and flat Quadrants . Positive Quadrants includes smiling, laughing, and positive vocalizations. Quadrants was quantified by tallying the number of minutes spent displaying negative, Neutral and positive for Quadrants each session. The fourth variable was occurrence of the top three desired and undesired behaviours identified by the parents (see Appendix B). The number of desired and undesired behaviours was tallied for each session.

5. Data Analysis and Result

Table 1: unpaired t test

Group	Test	Mean	S.D	't' value	'p' value
Protocol	Pre	44.15	13.49		
Individualized	Pre	44.23	13.56	0.0145	0.9886

Comparison between pre-test values of protocol and individualized

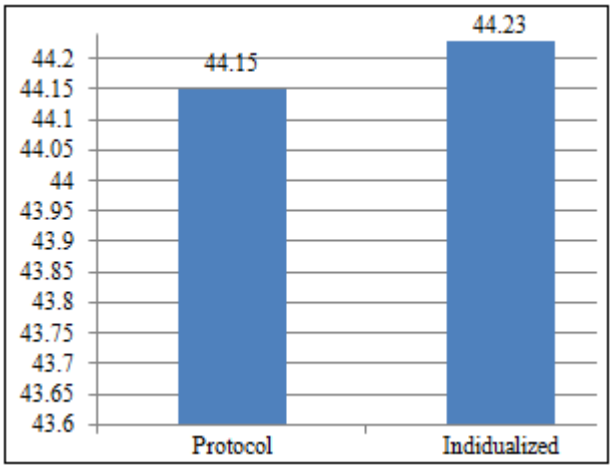


Table 1, Graph 1 shows comparison between pre-test values of protocol group and individualized group, and mean values are 44.15 and 44.23; t value is 0.0145 and p value is 0.9886. It shows there is no significant difference in pre-test values between individualized group and protocol group.

Table 2: unpaired t test

Group	Test	Mean	S.D	't' value	'p' value
protocol	Post	44.00	12.99		
Individualized	Post	39.62	13.30	0.8504	0.4035

Comparison between post test values of protocol and individualized

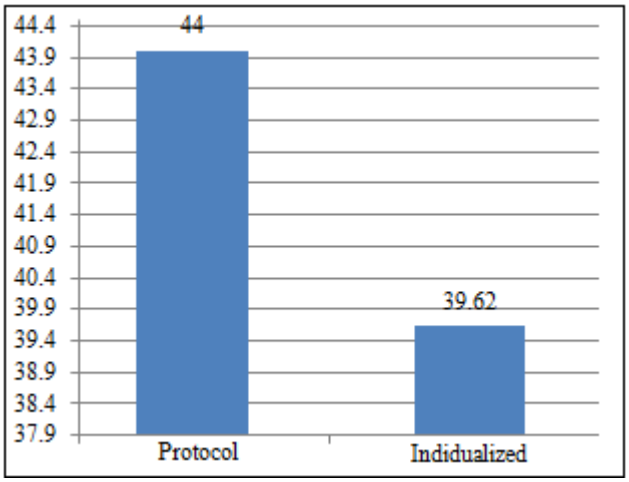


Table 2, Graph 2 shows comparison between post-test values of protocol group and individualized group, and mean values are 44.00 and 39.62; t value is 0.7659 and p value is 0.4515. It shows there is no significant difference in post-test values between individualized group and protocol group.

Table 3: paired t test

Group	Test	Mean	S.D	't' value	'p' value
protocol	Pre	44.15	13.49		
protocol	Post	44.00	12.99	0.2782	0.7856

Comparison between pre and post test values of protocol group

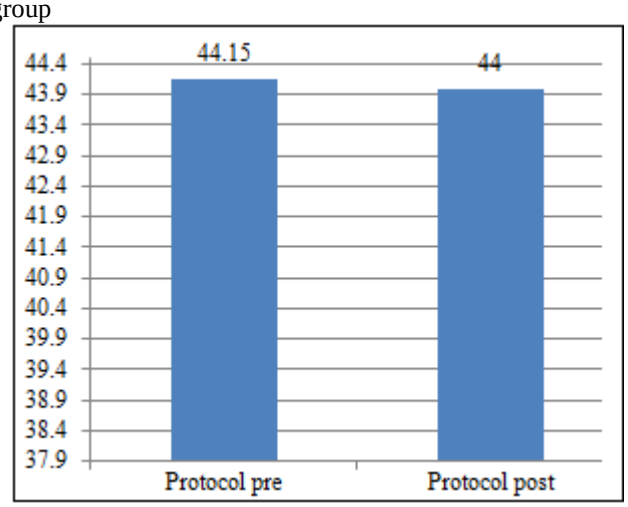


Table 3, Graph 3 shows comparison between pre-test & post test values of protocol group , and mean values are 44.15 and 44.00; t value is 0.2782and p value is 0.7856. It shows there is no significant difference in post-test values between protocol group.

Table 4: Paired t test
Comparison between pre and post test values of individualized group

GROUP	TEST	MEAN	S.D	't' value	'p' value
protocol	Pre	44.23	13.56		
protocol	Post	39.62	13.30	8.4017	0.0001

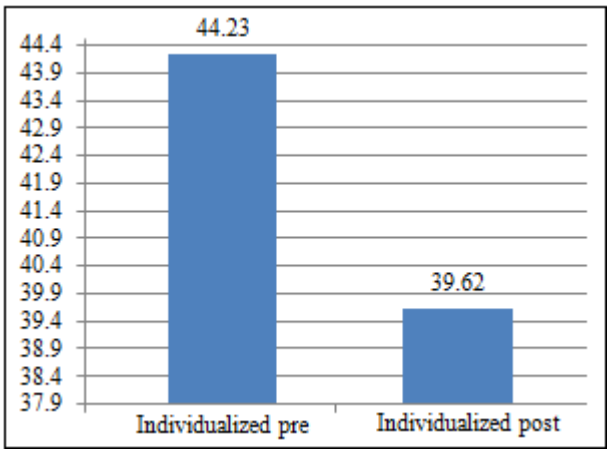
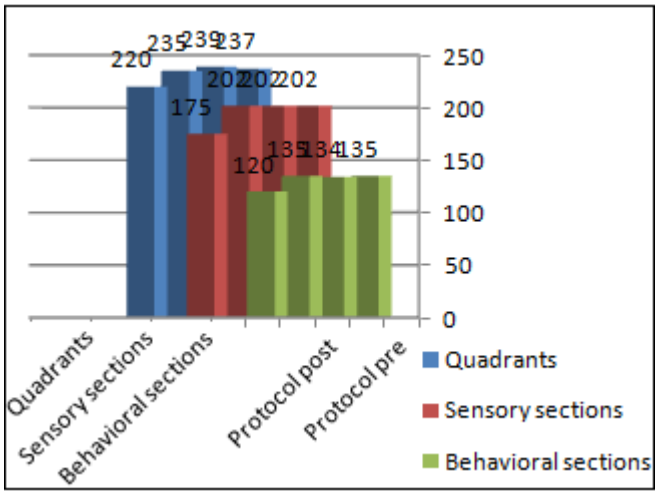


Table 4, Graph 4 shows the comparison of pre and post test values of individualized group, mean values are 44.23 and 39.62; t value is 8.4017 and p value is 0.0001 which shows there is significant difference between pre test and post test values of individualized group.



Graph 5: Shows the comparison between pre and post test values of protocol and individualized group
Sensory profile 2 –summary scores

6. Discussion

The purpose of the study is to determine effectiveness of individualized use of a multisensory environment on engagement in preschool children attention deficit hyper activity disorder

Sensory profile-2 for is the pre-test and post test measurement tool this scale is used to evaluate the level of quadrants, sensory sections, behavioural sections (protocol/individualized) among adhd preschool children. Initially ADHD preschool children were selected based on the inclusion criteria were assessed using the sensory profile-2. This study sought to evaluate whether engagement within the MSE would be greater using an individualized approach compared to a protocol-driven approach; this hypothesis was not supported by data analysis. One possible explanation for the lack of difference between the two is the potential for a ceiling effect. The research sample was largely comprised of children with attention to impulsivity ADHD, many of whom were or had been receiving various therapies. In our study there was no difference in the number of requests/initiations made by the participants in the two conditions; there were 23-26 requests in the 30-minute sessions.

Participants attended seven sessions (one introductory session and six MSE sessions). Sessions were scheduled at the convenience of parents and were completed in a three-month span. Sessions were conducted at approximately the same time of day in an effort to control for individual differences across time of day.

TABLE 1, GRAPH 1 shows comparison between pre-test values of protocol group and individualized group, and mean values are 44.15 and 44.23; t value is 0.0145 and p value is 0.9886. It shows there is no significant difference in pre-test values between individualized group and protocol group. TABLE 2, GRAPH 2 shows comparison between post-test values of protocol group and individualized group, and mean values are 44.00 and 39.62; t value is 0.7659 and p value is 0.4515. It shows there is no significant difference in post-test values between individualized group and protocol group.

These results are supported by the study done by this examined 13 outcomes **Natasha Smet et.al..., (May 2014)**She conducted of the study "Effect of individualized use of a multisensory environment on engagement in preschool children with autism spectrum disorders "Method Fifteen children, ages four to seven years, participated. A randomized, counterbalanced design was used to measure engagement in the protocol-driven condition and the individualized Condition. In the protocol-driven sessions, the equipment was turned on in a slow, sequential manner. Results were not significant in terms of increased engagement in an MSE in the Individualized approach. However, most parents valued the use of the MSE with their children. **Janine van der Linde, Denise Franzsen, Paula Barnard-Ashton et al.., (2013)**The conducted of the study "The sensory profile: comparative analysis of children with specific language impairment, adhd and autism" The Sensory Profile is useful in assisting with diagnosis of certain conditions which present with unique sensory processing patterns. The purpose of this study was to compare the Sensory Profile for children with Specific Language Impairment (SLI) (n=22) to a typical pattern, as well as the reported profiles of samples with autism and Attention Deficit/Hyperactive Disorder (ADHD). The Sensory Profile for both the autism and ADHD samples differed significantly from that of the SLI sample for H. Modulation Related to Body Position and Movement and Factor 6: Poor Registration.

TABLE 3, GRAPH 3 shows comparison between pre-test & post test values of protocol group , and mean values are 44.15 and 44.00; t value is 0.2782and p value is 0.7856. It shows there is no significant difference in post-test values between protocol group. TABLE 4, GRAPH 4 shows the comparison of pre and post test values of individualized group, mean values are 44.23 and 39.62 ; t value is 8.4017 and p value is 0.0001 which shows there is significant difference between pre test and post test values of individualized group. This result are supported by the study is the multi sensory environment in occupational therapy **Leonardo fava a, b, Kristin strauss c et.al…, (2009)**The

objective of the study is the Multi-sensory rooms: Comparing effects of the Snoezelen and the Stimulus Preference environment on the behaviour of adults with profound mental retardation. This paper considers my read of possibilities for actioners considering using multi-sensory environment in distributive behaviour. Results showed that Snoezelen intervention decreased disruptive behaviours only in individuals with autism, while Stimulus Preference increased pro-social behaviours only in participants with profound mental retardation with co-occurring poor motor and linguistic abilities

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7. Conclusion

The protocol driven approach group and individualized driven approach group participation in multi-sensory environment shows better engagement and reduce sensory behavioural issues among preschool with ADHD.

8. Limitations and Recommendations

Limitations

- Small sample size
- Included only the age group of 3 - 4 years
- Study was conducted only for shorter duration

Recommendation

The study can be repeated on a large sample size.
Study can be done with extended age limit.
Study can be repeated with comparison on the other treatment techniques.
Male and female comparison can be included in further studies

9. Acknowledgement

I express my sincere thanks to Annai therapy clinic managing director Dr.Egambaram MOT (Paediatric) and also Dr. Sathish Kumar MOT (Mental health) for this expert and efficient support Dr.Mahendran BOT, Mr.Dhanapal, statistician for his guidance in statistical analysis and I also thank my family and lovely friends.

Place of Study
Annai Therapy Clinic, Trichy.

Period of Study
6 months duration

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