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A Single-Subject Study on the Effectiveness of Applied Behavior Analysis for Managing Sitting Intolerance in Children with ADHD

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ABSTRACT

The purpose of the study is to apply methods of Applied Behavioral Analysis in an Educational setting. The study applied the technique of Differential Reinforcement of Alternative Behavior (DRA) to reduce and alter the behavior of Sitting Intolerance. The observation was recorded on the basis of Pre-Intervention Phase, Intervention Phase, Post-Intervention Post and Follow-Up Phase. After the Intervention Phase, there is a significant change in the subject's behavior which can be seen in the graphical representation of the results, Thus, the findings of the study indicated that Differential Reinforcement of Alternative Behavior (DRA) Is an effective technique to reduce and alter the behavior of Sitting Intolerance.

Keywords: *ADHD, Behavioral Analysis, Intolerance*

INTRODUCTION

Although research on the application of behavioral principle to help people change behavior (behavior modification) had been published since the late 1950s, (Miltenberger, 2015) [1], the term applied behavior analysis was introduced in 1986 in the first issue of journal of Applied Behavior Analysis (Fisher, Piazza, & Roane, 2011). [2]

Applied behavior analysis is the science in which the principles of the analysis of behavior are applied systematically to improve socially significant behavior and experimentation is used to identify the variables responsible for behavior change. (Cooper, Heron, and Heward, 2007) [3]

This definition contains six key components of ABA. These include:

1. ABA is guided by the attitudes and methods of scientific inquiry.
2. All procedures are described and implemented in a systematic, technological manner.
3. Not all means of changing behavior qualify as ABA; only those derived from the basic principles of behavior.
4. Focus on socially significant behavior.
5. Meaningful improvement in important behavior.
6. Analyze the factors responsible for improvement.

This definition of Applied Behavior Analysis is a holistic definition, explaining ABA discipline which focus on improving significant behavior by designing, implementing and evaluating interventions. Applied Behavior Analysis modifies the environment and monitors changed responses exhibit by the

individual / learner, to result in changed behavior or learning of life skills. It is imperative that programs and interventions focus on outcomes for the learners that will have socially significant consequences and that this change is to a meaning full degree.

A wide rand of research work on Behavior Modification techniques has been done in several settings (clinical, home, organization) suggesting effectiveness of such techniques.

Intervention programs have been used successfully to decrease and eliminate the problem behaviors and increase appropriate skills for individuals with Intellectual Disabilities (ID), Autism Spectrum Disorders (ASD), Attention Deficit Hyper Activity Disorder (ADHD) and related disorders (Davis & Kollins, 2012). [4]

Focusing on intellectual disability only, it is a disability characterized by significant limitations in **b**oth intellectual functioning and in adaptive behavior, which covers many everyday social and practical skills. This disability originates before the age of 18**.**

A study conducted in Norway were analyzed to evaluate early behavioral intervention for children with intellectual disabilities. And study suggested that the approximately 64% of the children in the behavioral intervention group met objective criteria for reliable change in IQ, whereas 14% in the eclectic comparison group did so. These results suggest that children with intellectual disability may profit from behavioral intervention typically provided for children with autism. (Eldevik, et al, 2010). [5]

A basic principle to modify behavior in ABA is that of Differential reinforcement. Differential reinforcement gives reinforcement to modify behavior, when a target behavior happens at the designated time and place, whereas no reinforcement is given when the behavior does not occur during the time or place that is designated (Wolery & Fleming, in Bailey & Wolery, 1992). DRA as techniques aids in increasing an appropriate behavior while decreasing the inappropriate behavior simultaneously. (Valdescu, Kodak, 2010). [6]

A comparison controlled study of 1 year showed that extensive behavior modification treatment is extremely successful to implement in school setting and can give favorable outcomes if applied systematically, on children of 4-7 years of age. (Eikeseth et al, 2002). [7]

Another research used applied behavioral to evaluate the graduated exposure and positive reinforcement in a compliance training intervention package with an adolescent female who had autistic disorder, intellectual disability, and long-standing avoidance of routine medical examination. Intervention consisted of slowly introducing her to a 12-step examination hierarchy and reinforcing compliant responding within a changing criterion experimental design. Reinforcement for appropriate alternative behavior and modelling were also components of intervention. A behavioral clinician first implemented procedure that were subsequently generalized to nurses. This study suggested the learning of tolerating a medical examination that she had resisted for nearly 2 years. (Cavalry, 2013) [8]

Keeping above researches in mind, a study was conducted in Karachi, Pakistan using differential reinforcement on an intellectual disable child.

Aim of the study:

The objective of this research was to bring about a decrease in maladaptive behavior of an intellectual disable subject through scientific means of behavior modification technique that is Differential Reinforcement of Alternative Behavior (DRA), with in the provided environment.

Target Behavior:

The target behavior of the child is to decrease the behavior of getting off from seat.

Operational definitaion:

The target behavior is defined as:

"whenever the child gets off his seat too often".

Demographic of the subject:

Name: ABC

Date of Birth: 11th -june-2010

Age: 7 years

Sex: Male

Occupation: Student

No. of Siblings: 1 Sister and 2 Brothers including him

Current Diagnosis: Intellectual Disability/Mental Retardation

Birth Order: last birth order

Father's Age: 43 years

Father's profession: work in Pak Navy

Father's Income: Not available

Mother's Age: 40 years

Mother's Profession: House Wife

Case History:

ABC, is a seven-year-old boy born on 11-06-2010, who belong to a Muslim, Punjabi speaking, middle class family and living in Karachi. His father and mother were cousins. His father is doing service in Navy and his mother is a house wife, His milestone was delayed, he starts walking at the age of 2 year and start speaking sounds at the age of 3 years he only makes sounds to communicate.

ABC has been diagnosed that he has very low IQ and is intellectually deficit in relation to the children of his age. Parents reported that due to the bleeding during pregnancy the child cause intellectual disability and child birth was premature. He is studying in Bahria Special School, he took vocational and speech therapy. He has two siblings elder than him one brother and one sister.

The client close to his father and not much close to his mother.

The client did not explore the environment and do not want to play with toys, his behavior with other class member is unpredictable and he suddenly get aggressive and hyper and tease the class fellows. He

has a sitting tolerance issue. The client does not sit one place more than a minute and he do not take part in any group activity.

The client has a appropriate height but has a weak physique. He wears appropriate clothing during school, he has a steady walk, he babbles modestly to communicate with the people in his environment and possesses a vocabulary of up to 7-9 words. The client is deficit not only in communication domain but also in other area of adaptive functioning as well. He likes to eat sweet things specially candies, juices and biscuits.

METHOD AND PROCEDURE:

Subject and Target Behavior:

ABC, a seven years old boy with intellectual disability was chosen as the subject for this study. As reported by the school administration, teacher and parents. The child would leave his seat whenever he got chance and the teacher was busy in any work. ABC's intolerance towards sitting was causing disruption for the class and other students during school hours and causing disruption in home also. After evaluating the behavior, it was concluded that the behavior was significant enough and application of behavior modification. Observation of target behavior and its impact were made during two hours. It was reported that the subject did not take interest in any activity when asked to sit on his seat and told to not roam around in the class did not comply. Therefore, it was chosen as the target behavior.

Parental Consent:

Permission to conduct the study was acquired from the school principal through a formal meeting, permission letter and consent form and from the parents through a phone call because the child's parents told that they cannot come to school. Principal and parents were informed of the risk-benefits ratio and all preventive measure undertaken to ensure the well-being of the child. A formal consent form was signed at the beginning of the study (APPENDIX)

Setting:

The research was carried out at Bahria School of Special Children. It was conducted during school hour starting from 9:00am-11:00pm. In order to control the effect of any intervening confounding variables, time as a variable was kept constant throughout the study. The researcher followed and observed the subject throughout the said time period. In an effort to prevent any error in readings, the researcher played a passive role during the pre-intervention and post intervention phase to determine accurate result, without influencing the target behavior.

Phases of the Study:

The study was divided into three phases: Pre-intervention, Intervention and Post-Intervention, each phase was distributed into 10 days of data collection. After the end of post intervention phase, a follow-up after two days was carried out. For data collection" Event Recording" method was used.

Pre-Intervention Phase:

Aim:

- Baseline formation
- Identification and measurement of responses

During the pre-intervention phase, a baseline of the target behavior was acquired to determine its level prior to the introduction of intervention required to modify behavior. For collecting baseline information, ten days, on a daily two-hour basis were assigned to this phase of the study. Along with that, an analysis of subject environment was done to detect variables that needed to be changed or altered.

The response measured during this phase was sitting intolerance. Sitting intolerance was considered to be whenever the child gets off his seat too often. Method used for data collection was "Event Recording". Charts were made by the researcher which were divided into slots of thirty minutes and a mark was made for the behavior. At the end of each session, the researcher added the number of all four slots. At the end of the pre-intervention phase the recording of all the days were added and mean value was calculated by dividing the total value by 10.

Total session time, 2 hours was kept constant throughout the study. A passive role was practiced by the therapist during the pre-intervention phase.

Intervention:

Aim:

- Introduction pf Reinforcement
- Introduction of Alternate Behavior

In the second phase of the study the role of the researches changed from passive observer to someone who intervened in the target behavior and tried to bring a change in behavior.

Introduction of Alternate Behavior:

The therapist employed Differential Reinforcement of Alternate Behavior as a technique to introduce the alternate behavior of compliance on verbal prompts to sit. Procedure of DRA was used to reduce the sitting intolerance behavior by providing reinforcement upon the alternate behavior. The alternate behavior was introduced through a combination of verbal and visual prompts. The alternate behavior was to engage the child in different activities like playing with balls, block games, coloring activities, playing with cars and the activity of identify the different animals and fruits etc. and the verbal prompts was "seat pay bethain" along with visual cues towards the seat. No physical prompting was used.

Reinforcement:

The reinforcement was selected on the basis of a questionnaire that were filled by the parents and teacher. The questionnaire was designed to help the researcher to find the reinforcement that was liked by the subject and improve the behavior. (APPENDEX D) The most effective reinforcement came about to be stickers of stars. Edible reinforcement like candies, biscuits, juice, cake etc. the verbal reinforcement like good boy, very good, Shabash and activity like taking out child to the ground for playing. However, during the intervention phase different type of reinforcement were used to avoid dependency towards a particular reinforcement. The reinforcements were given immediately after complying behavior, this was done to prevent any problem regarding delayed gratification.

Post-Intervention Phase:

The post intervention phase, continued for 10 days, two hours daily. The researcher's role switched back to passive. During this phase the observer recorded the total number when the child get off his seat by event recording method as practiced in the pre-intervention phase, observation was employed. In

this phase, it was intended to determine whether the alternate behavior achieved during intervention was being maintain after the termination of program or not.

Follow-Up Phase:

Two follow up session were conducted at the same designated time like that of previous phases (9:00am to11:00am) to determine whether the behavior is maintained after the discontinuation of treatment plan or not.

Functional Analysis:

Functional Analysis of behavior was conducted to identify important, controllable and causal functional relationship with the target behavior.

Functional Analysis of Behavior is a strategic tool that was utilized so as to assess the causes of the behavior, and to assist in deriving strategies in eliminating the inappropriate behavior.

For identify the causes of the behavior researchers took interviews from different teachers and from the one occupational therapist which take the session of the child. According to teachers the child does not exhibit any behavior for getting attention he just copies the behavior of other children. According to his class teacher the child easily attaches with any child and then start to copy the behavior of that particular child. Because the child gets easily influence by other children. Whatever the other child does the same behavior the child exhibited. And in the absence of the other child with which the child was too much attach the behavior and the frequency of the behavior like sitting intolerance was observed slightly low. And also, the teacher mentioned that the behavior frequency increased whenever the child gets bored and did not want to do any activity and got chance to get off from seat.

As it was observed during the pre-intervention Phase the behavior would occur when the child was bored and when the child was not engaged in any activity, or whenever other children started wondering in the class. Because child mostly copy the behavior of other children. The frequency was highest when there was external distracting factor for the child and also the behavior would occur whenever he got the chance to get off from seat. And the frequency of the behavior was lowest when the child would have engaged in any desirable activity and desired social contact.

Based on the observation and interview it is hypothesized that the behavior may be because of the avoidance, internal sensory positive reinforcement and external sensory positive reinforcement.

The result suggest that the behavior occur sometime because of the self-stimulating behavior (whenever the child got bored) or sometime because of the social consequences (copy the behavior of other child present in social environment and got chance to get off from seat). Antecedent could not be pin pointed as the behavior occurred without particular situation. Because sometime occur because of getting the chance to get off from seat, sometime occurred because of the copied the behavior of other children. Or sometime behavior occurred when the child was not doing any activity. And sometime when child got bored and did not want to do any activity.

RESULTS

The statistical analysis through graphs and Mean values shows that during the Pre-Intervention Phase the Mean Score was 40.2 (table-1) Whereas, during Intervention Phase it was 12.3 (table-2) and Post-Intervention Phase it was decreased to 29.3 (table-3)

Table 1: Pre-Intervention:

Days	Frequency of Behavior				
ss	**9:00-9:30**	**9:30-10:00**	**10:00-10:30**	**10:30-11:00**	**Total**
Day 1	**7**	**13**	**9**	**8**	**37**
Day 2	**10**	**10**	**8**	**11**	**39**
Day 3	**13**	**11**	**14**	**6**	**44**
Day 4	**3**	**7**	**6**	**9**	**25**
Day 5	**18**	**10**	**17**	**13**	**58**
Day 6	**7**	**8**	**6**	**10**	**31**
Day 7	**10**	**14**	**15**	**13**	**52**
Day 8	**8**	**9**	**6**	**11**	**34**
Day 9	**11**	**10**	**14**	**12**	**47**
Day 10	**8**	**12**	**10**	**5**	**35**
Total					**402**

Mean = ∑X/n

Mean = 402/10

Mean = 40.2

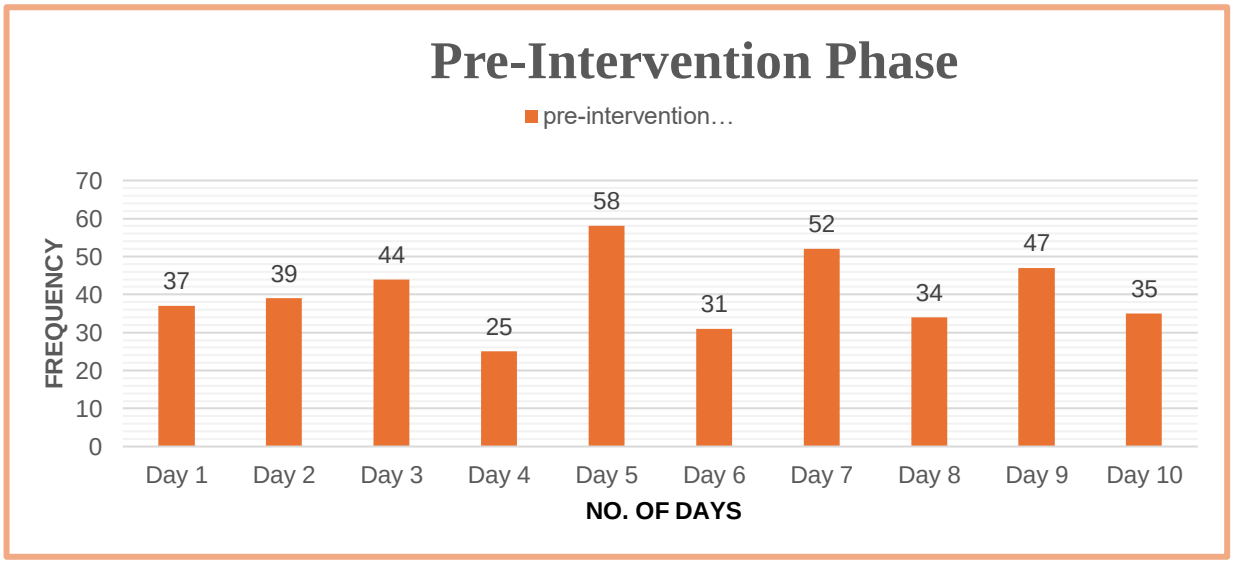

Figure-1: Pre-Intervention Phase

Table 2: Intervention Phase:

Days	Frequency of Behavior				Total
	9:00-9:30	**9:30-10:00**	**10:00-10:30**	**10:30-11:00**	
Day 1	**1-R(E)** **1-R(P)**	**1-R(S)** **1-R(E)** **1-R(S)** **1-R(P)**	**1-R(S)** **1-R(E)**	**1-R(E)** 1-R(S) **1-R(S)** **1-R(E)**	**12**
Day 2	**1-R(E)** **1-R(S)** **1-R(P)** **1-R(E)**	**1-R(E)** **1-R(S)** **1-R(S)** **1-R(P)** **1-R(E)**	**1-R(S)** **1-R(E)**	**1-R(S)** **1-R(E)** **1-R(S)**	**14**
Day 3	**1-R(P)** **1-R(S)** **1-R(S)** **1-R(E)** **1-R(E)**	**1-R(E)** **1-R(S)** **1-R(S)**	**1-R(S)** **1-R(E)** **1-R(A)** **1-R(P)**	**1-R(P)** **1-R(E)** **1-R(S)**	**15**
Day4	**1-R(S)** **1-R(P)** **1-R(E)** **1-R(S)**	**1-R(S)** **1-R(P)**	**1-R(S)**	**1-R(S)** **1-R(E)** **1-R(S)**	**10**
Day 5	**1-R(S)** **1-R(S)**	**1-R(E)** **1-R(S)** **1-R(S)** **1-R(P)** **1-R(E)**	**1-R(S)** **1-R(E)** **1-R(S)**	**1-R(E)** **1-R(S)**	**12**

Day 6	**1-R(S)** **1-R(S)** **1-R(E)**	**1-R(S)** **1-R(P)** **1-R(E)**	**1-R(E)** **1-R(S)**	**1-R(S)** **1-R(S)** **1-R(P)**	**11**
Day7	**1-R(S)** **1-R(S)** **1-R(E)** **1-R(S)** **1-R(S)**	**1-R(E)** **1-R(S)**	**1-R(S)** **1-R(P)**	**1-R(S)** **1-R(E)** **1-R(A)**	**12**
Day8	**1-R(S)** **1-R(S)**	**1-R(E)** **1-R(S)** **1-R(S)** **1-R(P)** **1-R(S)**	**1-R(E)** **1-R(S)** **1-R(S)**	**1-R(E)** **1-R(S)** **1-R(P)** **1-R(S)** **1-R(S)**	15
Day 9	**1-R(S)** **1-R(E)** **1-R(S)**	**1-R(P)** **1-R(S)**	**1-R(S)** **1-R(E)**	**1-R(S)** **1-R(P)**	**9**
Day 10	**1-R(S)** **1-R(S)** **1-R(E)** **1-R(S)**	**1-R(S)** **1-R(S)**	**1-R(S)** **1-R(S)** **1-R(E)**	**1-R(P)** **1-R(S)** **1-R(S)** **1-R(S)**	**13**
Total					**123**

KEY: (R: Reinforcement, A: Activity, P: Possessional, S: Social, E: Edible)

Mean = ∑X/n

Mean = 123/10

Mean = 12.3

Figure-2: Intervention Phase

Table 3: Post-Intervention Phase:

Days	Frequency of Behavior				Total
	9:00-9:30	**9:30-10:00**	**10:00-10:30**	**10:30-11:00**	
Day 1	**4**	**3**	**11**	**10**	**28**
Day 2	**8**	**7**	**9**	**8**	**32**
Day 3	**4**	**7**	**9**	**10**	**30**
Day4	**5**	**4**	**10**	**10**	**29**
Day 5	**6**	**7**	**13**	**8**	**34**
Day 6	**5**	**7**	**9**	**6**	**27**
Day7	**4**	**5**	**9**	**10**	**28**
Day8	**5**	**6**	**12**	**9**	**32**
Day 9	**3**	**5**	**9**	**11**	**28**
Day 10	**3**	**2**	**9**	**11**	**25**
Total					**293**

Mean = ∑X/n

Mean = 293/10

Mean = 29.3

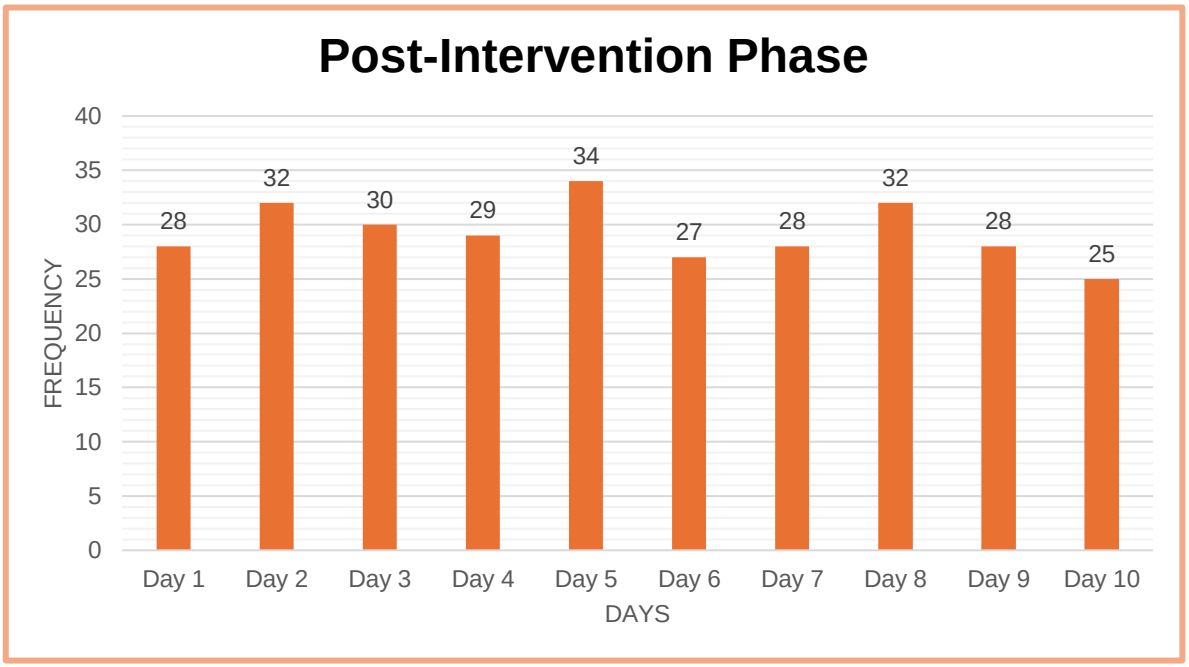

Figure-3: Post-Intervention Phase

Comparison of Phases:

Phases	**Mean of Frequencies**
Pre-Intervention Phase	40.2
Intervention Phase	12.3
Post-Intervention Phase	29.3

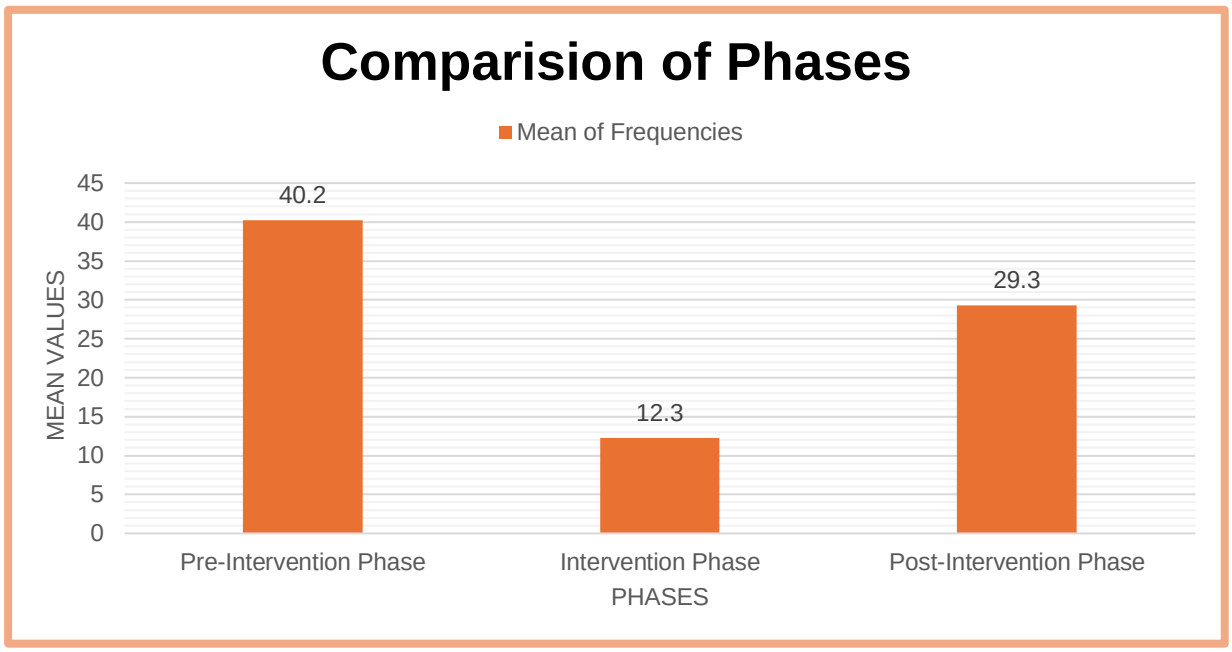

Figure-4: Comparison of Phases

Table 4: Follow-Up Phase:

Days	Frequency of Behavior				Total
	9:00-9:30	**9:30-10:00**	**10:00-10:30**	**10:30-11:00**	
Day 1	**4**	**3**	**13**	**11**	**31**
Day 2	**4**	**7**	**8**	**10**	**29**
Total					**60**

Mean = ∑X/n

Mean = 60/2

Mean = 30

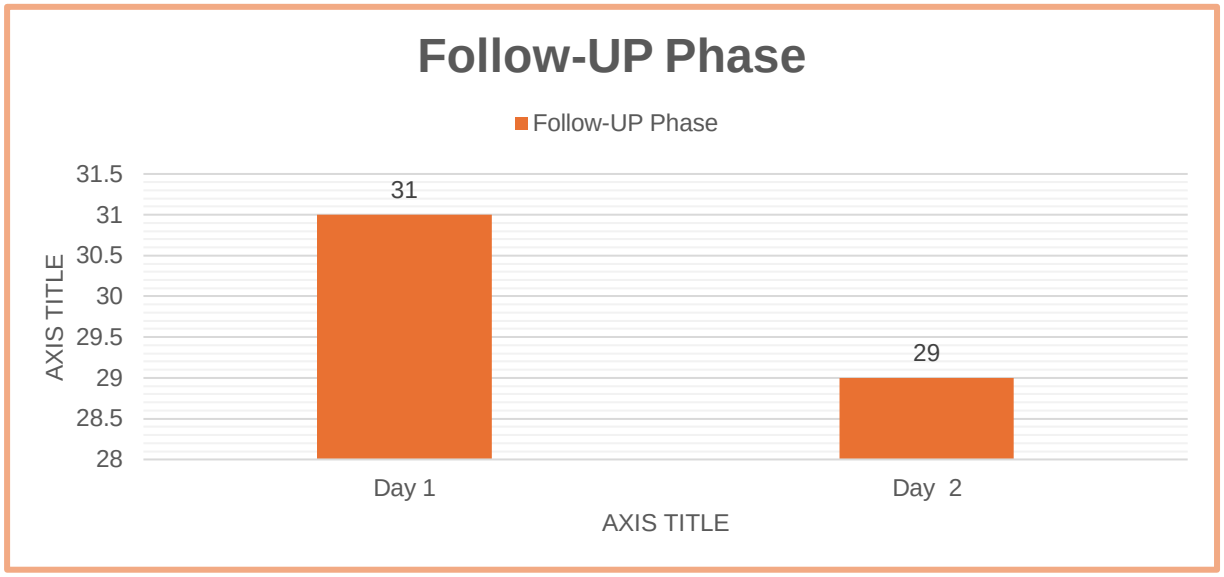

Figure-5: Follow-Up Phase

Comparison of Phases:

Phases	**Mean of Frequencies**
Pre-Intervention Phase	40.2
Intervention Phase	12.3
Post-Intervention Phase	29.3
Follow-Up Phase	30

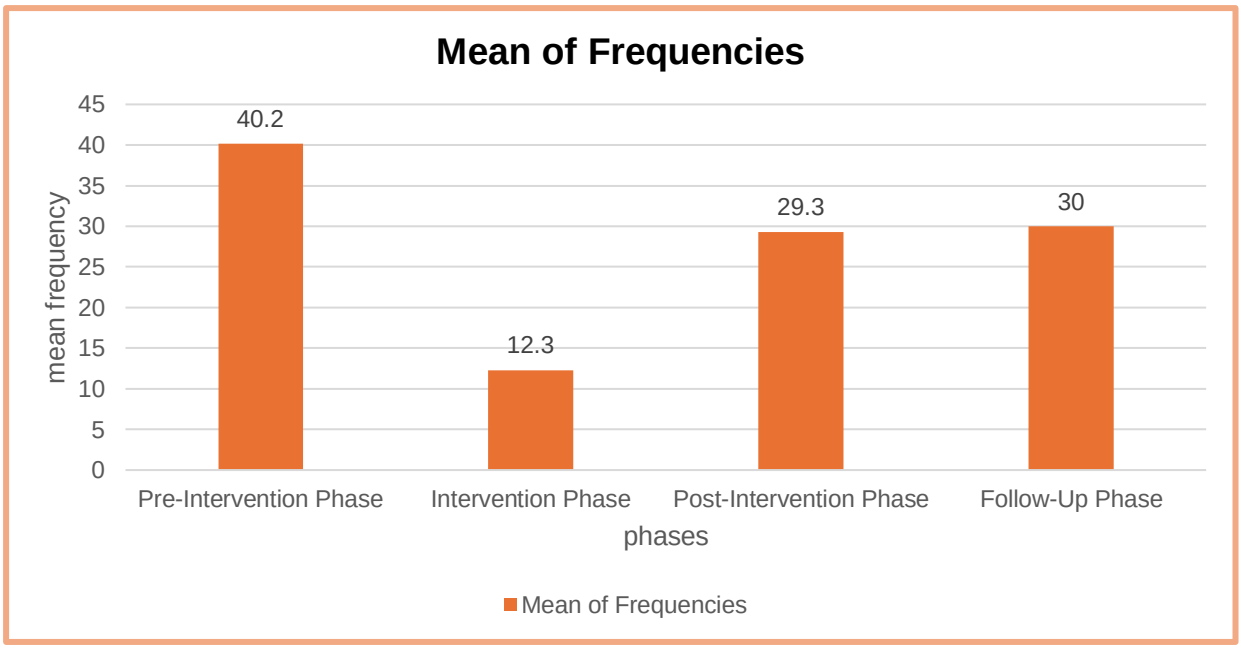

Figure-6: Comparison of Phases

DISCUSSION

The study was conducted on a 7 years-old boy. The purpose of the study was to analyze the efficiency of techniques used to decrease and excessive behavior, namely sitting intolerance base on Applied Behavioral Analysis (ABA) Methodology. At the completion of one-month long program, which help to reduce the target behavior, subject result's show that the behavior was successful.

A few observation sessions were conducted with the child and after that the Pre-Intervention Phase, Intervention Phase, Post-Intervention Phase and Follow-Up Phase were then conducted. In the same respective order.

Experimental measure for ABC showed that during Pre-Intervention Phase the child would get off from his seat on average of 40.2 times in two-hour time period (see table-1). As seen in the table-1 sitting intolerance was most on the fifth and seventh day when it reached 58 and 52 respectively as there were many distracting stimuli for child on that day. And lowest on the fourth day when it dropped to 25 because that day the child was not feeling well. The reason for getting very high frequency in the pre-intervention phase was that the child in the whole pre-intervention phase did not involve in any activity. instead of one or two times, because according to his teacher the child did not engaged in any activity.

After the Pre-Intervention Phase the technique that was I decided to do with the child was Differential Reinforcement of Incompatible Behavior by foot- painting but in the first day of intervention when I start to apply the intervention, the teacher informed me that the child had the foot appliance fit on his leg due to which he walk easily. So, without that appliance the child was felt difficulty to walk so, Differential Reinforcement of Incompatible Behavior by foot- painting will be unable to administered.

Due to the technique not working another intervention was applied- Differential Reinforcement of Alternative Behavior for the next ten days in which the Alternative behavior was introduce according to child interest. And the therapist also involved with the child to do that activities or alternative behaviors. The alternate behavior was introduced through a combination of verbal and visual prompts. The alternate behavior was to engage the child in different activities like playing with balls, block games, coloring activities, playing with cars and the activity of identify the different animals and fruits etc. and the verbal prompts was "seat pay bethain" along with visual cues towards the seat. No physical prompting was used.

The behavior of involving the alternative behavior was high on the third day when the therapist introduced the activity reinforcement (visit the school bus which was standing in the school) which was liked by the child so the frequency of involved in the alterative behavior was high. (see table-2) Reinforcement of Alternative Behavior, after applying the selected technique it was observed that behavior had decreased significantly

Another key element during the Intervention Phase which was taken much care of was the use of reinforcers. The child was reinforced whenever the child was involved in the Alternative Behavior.

Also, as the Intervention Phase the child was not made reward-dependent, so give the reinforcer like candies, juices, stars and gradually turned into the social reinforcer for example high-five or thumbs up. This yielded excellent result as the child eventually involved in any alternative Behavior thus, resulting in an intrinsic motivation to involve.

The post-Intervention Behavior shows an upward trend of behavior, Although the behavior had increased in frequency than what it was during the Intervention period it was Still significantly lower than its frequency of that of Pre-Intervention Phase. These results suggest that the technique used was successfully in decreasing the target behavior. The behavior did not shoot up as much because the teacher had learned to engage the child in the activities.

In the Post Intervention Phase the frequency of the behavior high in the 3rd (10:00-10:30am) and 4th slot (10:30 to 11:00am) as compare to 1st and 2nd slot (see table-3) because before the lunch break the teacher involved the child in the activates like coloring, matching the picture with same fruits or animal, poems, puzzles, playing with car and blocks etc. at 10:00 am the lunch break started and during this time period the child did not involve in any alternative behavior or activity or the teacher also did not involve the child so that time period the frequency of behavior (sitting intolerance) was high.

In Figure-6, a comparison of mean-values can be seen of the Pre-Intervention Phase, Intervention Phase Post-Intervention Phase and Follow-Up Phases. During the Pre-Intervention Phase, the child would get off from his seat on average of 40.2 times in two-hour time period (see table-1) However, in the Intervention Phase the child would get off from his seat on average of 12.3 times in two-hour time period (see table-2). The mean value again rose to 29.3 in Post -Intervention Phase and then turn to 30 which was slightly high in the follow-up Phase. (Figure-6). Thus, these results indicate that the technique used was successful in decreasing the target behavior.

CONCLUSION

The data representing the result of a one-month treatment program designed to decrease sitting intolerance using Differential Reinforcement of Alternative Behavior was analyzed and was concluded that the study has been successful in decreasing the target behavior.

RECOMMENDATIONS

Based on the findings of the study followings recommendations are made:

- The result as shown in this study describe an attempt to increase the frequency of getting off from his seat within educational setting, so it is recommended that there must be a greater choice in the activities for child as per there interests so the child involve in the activities and the frequency of the behavior (sitting intolerance) will decreases.

- The study shown that the child copies the behavior of other children and there are few students in the class who was very hyperactive due to that the learning of ABC child also effected. So, it is recommended that the child will shift in any other class where all the children do their work properly due to this child will copy and learn the good and appropriate behavior.

- It is recommended that teachers also use the reinforcement techniques for decreasing the inappropriate behavior.

- It is recommended that the teacher would be use the whiteboard or wall for the homework, so the child can stand. Because the child had sitting intolerance problem. Not only this help the child to do task in standing position also it exercises the shoulders, which improves stability for fine motor control, and decreases visual distortion, making the work easier to see.

- It is recommended that teacher start the child's day with physical exercise because exercise increases in attention span, on-task behavior, and level of correct responding.

- It is recommended that teacher use the group learning technique it is one of the most effective teaching strategies for students with intellectual disabilities. It is when you bring children together in a group to teach various skills. Children often do better when they are in a group. Behavior difficulties are less, and children motivate each other. The only difficulty in group learning is that you need enough hands to help children learn together.

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