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Rate and Frequency of Demands on Children with Autism

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Abstract

Applied Behavior Analytic (ABA) intervention seeks to improve deficits in children with autism by providing multiple planned opportunities for learners to develop and practice skills that are useful to them, and are effective alternatives to less acceptable behaviors. Throughout a given day, teachers give instruction to children. While the rate and frequency of these instructions occur in high numbers, there is little literature on just how often they occur. This project sought to find out the frequency of demands in one-hour increments for ten children in a behavior analytic school setting, and to test for differences between male and female students. Demands were tallied for any directive that was presented to the individual in which evokes a response. Results implicated that students averaged 173.47 demands per hour. These results indicate that a high number of demands are needed to keep the students engaged and maximize their learning opportunities.

Keywords: Autism, Discrete Trials Training, Children, Demands

Introduction

Autism is a pathological mental disorder characterized by the presence of considerably abnormal or impaired development in social interaction and communication and a markedly restricted repertoire of activity and interests. Autism is typically characterized by three main behaviors; qualitative impairment in social interaction, problems with verbal and nonverbal communication, and restricted repetitive and stereotyped patterns of behaviors or obsessive interests, (DSM-IV-TR, 2000). There are many treatments being used to help individuals with autism throughout the world, but the treatment option that has become most effective, and therefore most often preferred, is Applied Behavior Analysis.

In the Behavior-Analytic view, autism is a syndrome of behavioral deficits and excesses that have a biological basis but are nonetheless capable of changing through carefully orchestrated, constructive interactions with the physical and social environment. Behavior Analytic intervention seeks to improve those deficits by providing multiple planned opportunities for the learner to develop and practice skills that are useful in a variety of situations, and are effective alternatives to less socially acceptable behaviors such as tantrums, stereotypy (repetitive, ritualistic movements), and destructive behaviors (Green, 2001).

Learning opportunities are typically repeated many times until the learner performs the target response readily and fluently, without prompting. The learner's responses are recorded frequently according to specific objective criteria. Those data are summarized and graphed to provide pictures of the learner's progress and to enable frequent

adjustments in instructional procedures when the data show that the learner is not making the desired gains. As the learner becomes consistent in their ability to perform a certain skill under these conditions, then the conditions are altered to help the learner perform the same skill in different scenarios (Green, 2001). The timing and pacing of teaching sessions, practice opportunities, and consequence delivery are determined precisely for each learner and each skill (Anderson & Romanczyk, 1999).

This literature review will explore Discrete Trials Training, which is a specific technique used within ABA. Furthermore, it will describe some of the explanations as to why ABA seems to be so effective. The study to follow will explore a possible explanation for ABA's effectiveness that has not been looked into very deeply in the past.

Discrete Trials Training

A Discrete Trial is a small unit of instruction implemented by a teacher who works one to one with a child in a distraction-free setting. It is a method for simplifying and individualizing instruction to enhance children's learning. For children with autism, it is especially useful for teaching new forms of behavior, (Smith, 2001).

The essence of Discrete Trials training is control over the teaching situation. What this means is that the learner is given limited opportunities to respond, and that those opportunities are managed entirely by the teacher in terms of what happens before, during, and after the learner responds in a learning task. In the prototype example with a young learner with autism (Lovaas & Buch, 1997; Ghezzi, 2007), the teacher starts a discrete trial by giving one instruction ("sit down") to which the learner makes one response (he or she sits down). Then, depending

upon how accurate or appropriate the learner's response was to the teacher's instruction, the teacher either provides a positive consequence (an M&M or other edible treat) or withholds a positive consequence (withdraws attention).

Another aspect in which Discrete Trials Training exerts control is that the response given by the learner can be supplied by providing a response prompt. Given autistic children's high rate of escape and avoidance behaviors, methods that increase motivation to respond may be essential to positive long-term outcomes, (Carbone, Morgenstern, Zecchin-Tirri, & Kolberg, 2010). In the prototype case of teaching a learner to sit down on a chair when instructed to "sit down," the teacher may gently but firmly lead the learner to a seated position in a chair and then provide a positive consequence for attending to and complying with the instruction. The advantage here is that the learner is immediately successful in following the teacher's instruction and that a positive consequence follows the learner's response, thereby enhancing the likelihood of it occurring again (Ghezzi, Berens, & Fox, 2007).

Effectiveness

Each child differs when it comes to the effectiveness of Discrete Trials Training. Whatever the child needs improvement on can be a focus of the trials. Typically, DTT focuses on things such as teaching new forms of behavior and reducing escape and avoidance behavior, (Carbone, Morgenstern, Zecchin-Tirri, & Kolberg, 2010). Many children with autism have difficulty making the sounds necessary to form speech, but in studies incorporating a scientifically sound design, DTT is the only approach with documented effectiveness for teaching these children to add new speech sounds to their repertoires and combine those sounds into words, syllables, and phrases, (Smith, 2001).

Other skills that Discrete Trials Training often help children with include making new discriminations between objects that formerly could not make. Also, many children with autism have little to no imitation skills, like clapping hands together after the teacher claps hands. DTT is the only teaching method that has been clearly shown to assist such children to imitate actions, (Smith, 2001).

Discrete Trials Training also focuses largely on Receptive and Expressive Language. Receptive language refers to a child performing an action in response to a verbal cue, like say "touch the toy." Expressive language refers to the child actually giving a verbal cue in response to a visual cue, like saying "toy" when the teacher holds up a toy. DTT

also focuses on elements of basic conversation, such as sentence structure, grammar and syntax. DTT is the only approach with data-based evidence of effectiveness for helping children learn new language skills, (Smith, 2001).

Furthermore, many children with autism have difficulties using spoken language. DTT can focus on teaching alternative communication skills, specifically sign language and picture exchange communication systems, in which the child selects a picture to indicate what they want, like a picture of a toilet to express a need to use the bathroom. Improving alternative communication skills for children not able to communicate normally helps them make huge strides in the other areas discussed, (Smith, 2001).

Discrete Trials Training has shown success in managing disruptive behavior for children with autism. DTT is used to reduce the rate of disruptive behaviors displayed by children with autism. DTT also teaches how to replace such behaviors with alternative, more adaptive behaviors, (Smith, 2001).

Overall, reported improvements have included average IQ increases of twenty points, with similar increases on other standardized tests, and placement in less restrictive classrooms. The largest of gains have been reported in programs that have the most intensive amount of services, like a full time 40 hours per week schedule, (Howard, Cohen, Green, Sparkman, & Stanislaw, 2004).

There is much evidence that Behavior Analysis, and more specifically Discrete Trials Training, is very effective in helping individuals with autism learn and grow. Many of the reasons for this success are because this technique breaks a task down to the simplest of components for the learner, and becomes more complex once the basic components are mastered. One aspect of Behavior Analysis and Discrete Trials Training that has not been looked into deeply, however, is simply the rate and frequency at which demands are placed on the learners throughout the completion of a task.

The more demands placed on the child with autism, the more engaged the child becomes in the given activity. The more engaged the child is, the easier it is for the child to learn the skill. Furthermore; the more opportunities you have to engage the child, the more opportunities they have to learn, and the more time in which they spend learning, altogether strengthening their focus along with acquiring these new skills.

Of all of the research that talks about the effectiveness of Behavior Analysis, there appears to

be a gap in this specific area. The theory behind this thesis topic is simply that a speedy rate and high frequency by which the teacher puts 'demands' on the learner, the better the environment becomes for the learner to develop and acquire skills. It is not just breaking down skills into the smallest of components that makes Behavior Analysis effective, but it is also how often the child is pressed to perform these skills that maximizes the learning process.

There is little research that breaks down the rate and frequency of demands, and therefore I think this takes it in a new direction. This paper will attempt to get a better sense of the average number of 'demands' placed on a child in a given day in hopes of showing how intense Behavior Analysis needs to be in order to have the greatest effect on the child. It is not necessarily a problem in the technique that is in need of a fix, but rather a different look on what exactly is making this technique work so well with these children.

Furthermore, this paper will attempt to find whether or not there is a difference in average demands per hour among male or female students. For the purpose of this study, a demand will be defined as any directive that is presented to the individual in which evokes a response (compliance or non-compliance) including, but not limited to, verbal directives and/or models and gestural prompts and/or guidance.

Methods

Participants

The study was completed at The Futures Clinic, MA in the spring of 2011. The Futures Clinic is a school for children with autism and other related disorders, and the teaching methods focus solely on the practice of Applied Behavior Analysis. The Futures Clinic has 18 students. Ten of the students were chosen at random to be observed for the study. The average age of the students observed is 8.4 years, with a range between six and twelve. Of the ten students observed for this study, 60% were boys, and 40% were girls. The students, mostly of Caucasian race, are all from the North Shore area in Eastern Massachusetts.

Instruments

The main instrument used for this research was a standard tallying device. More specifically, this research used an Adidas brand pitch counter. The second instrument was a chart that broke a 10-minute period down into 10 second intervals. This chart was used to test Inter Observer Agreement between two observers (See Appendix A).

Procedure

The learning environment at Futures was very much suited to testing this research; each student works one on one with different teachers throughout the day. After obtaining permission from the Director of Futures, the study conducted was an observational study. The observational method was the clear choice because the researcher simply needed to observe the students in their natural learning environment. With a standard device used for tallying, in one hour increments, the number of teacher 'demands' was tallied by a researcher positioned behind the student-teacher pair.

Once again, a 'demand' is any directive presented to the student in which evokes a response, either compliant or non-compliant. The study did not count things such as compliments or reinforcements on the child as demands, because those came in response to the child complying with a demand. Also, there were many instances in which a demand was repeated if the child did not respond right away, but for purposes of clarity, only once was that specific demand tallied. Each Student was observed for a total of three hours, but never more than one hour at a time. Observing the students for three hours each allowed the researcher to obtain a more average number of 'demands,' in case any one hour of observation was abnormal to the students' typical average.

The tallied numbers were recorded over time and the data was collected in frequencies. The data collected was an untested measure, so Inter-rater Reliability was something to be considered. Inter-rater reliability is used to assess the degree to which different observers give consistent estimates of the same phenomenon (Trochim, 2006). Multiple researchers were assigned to test for Inter-rater Reliability. The results included 30 hours of tallying.

Results

The theory behind this project was simply that a high rate and frequency of 'demands' placed on students, by teachers, enhances the students' learning environment, and therefore maximizes their ability to learn. For this project we hypothesized that, in a Behavior Analytic setting, the rate and frequency of the demands would occur in large numbers, much exceeding what could be expected in a typical classroom setting.

There were a total of 10 students observed for this project, each one in three different one-hour increments, for a total of 30 hours. The students ranged in ages from 6 to 12, ($M= 8.4$ years, $SD= 2.221$). Frequency distributions were run for the

number of demands observed per hour ($M = 173.47$, $SD = 14.425$).

The second hypothesis for the observations was that there would be a difference in the number of demands per hour between boys and girls. There were four girls observed during this study, ranging in ages from 6 to 7, ($M = 6.25$, $SD = .50$) There were six boys observed in this study, ranging from ages 6 to 12 ($M = 9.83$, $SD = 1.60$)

A t-test to test for a difference in means between the number of demands per hour for girls and for boys. For girls, the $M = 166.50$, $SD = 13.626$, and for boys, the $M = 178.11$, $SD = 14.088$. Although the boys mean was slightly higher, the results were not statistically significant ($t = -1.292$, $p = .232$). The sample size in this project was too small for a t-test, but one was used anyway to show the difference.

Inter-rater Reliability

Observations were also checked for reliability using two different techniques. For one 30 minute period the principle observer tallied demands along with another observer to compare the total number of demands observed by each. For the 30 minute period, demands tallied by observer number 1 equaled 98, and demands for observer 2 equalled 111.

The other technique was used in attempt to figure out a more specific difference in demands noted for each observer. This method involved a total of 10 minutes of tallying data. Each on their own sheet of paper the two observers broke down the 10 minute period into single minute blocks. Each single minute block was then broken down into 10-second intervals. For each 10-second interval, the observers checked whether they did or did not observe demands. Therefore, it was not the amount of demands measured, but rather whether or not a demand occurred. This allowed the observers to get a better sense of agreement. A correlation coefficient was run to determine the correlation between the observers' recordings, ($r = .469$, $p = .001$). This indicates that there was a significant degree of agreement between raters.

Discussion

The mean number of demands per hour, for the 30 hours of observation, was 173.47. As noted in the definition of 'demands,' this included anything from verbal directives, physical models, gestures or guidance. Prior to each individual trial at a student's desk, many demands were observed in order to engage the child in the activity. Instructions included, but were not limited to; showing proper

sitting, having the student pull in their chair, showing good hands, maintaining eye contact with their teacher, and having a quiet or appropriate voice.

The trials themselves consisted of many more demands. Students have individual plans made up of the discrete trials that they are working on learning. A few of these trials include; saying/writing their name, repeating words or sounds modeled by the teacher, writing/speaking in full sentences, maintaining eye contact, counting, and many others that may be used by multiple students, or individual to a specific student.

In addition to discrete trials at their desks, each student engages in many activities away from their desk, all of which consist of demands. One opportunity is through student 'trade-ins,' which occur throughout the day and can be earned through proper, appropriate, behavior during their desk work. Trade-in rewards can be anything from reading a book, watching videos on a computer, playing in the gym, going for a walk, and many others. Students were given demands for things like proper walking, sitting, showing good hands, keeping their arms by their side, showing that they are ready to engage with their trade-in, and a number of others. While a trade-in is a reward for a student, it also provides strong learning opportunities. This is a chance for a student to engage with his or her teacher or other peers, as well as giving the student an opportunity to express what he or she wants to do, or enjoys doing.

Another opportunity away from the desk is through an Adapted Physical Education plan, of which each student has their own. APE periods include demands based around doing jumping jacks, catching/throwing a ball with a peer or teacher, running, skipping, hopping, and more. Multiple APE periods were observed within some of the hours of observation.

Many of the students also spend roughly 20 minutes per day completing a Picture Activity Schedule. The point of this PAS is to have the students complete a series of tasks, such as puzzles and building with Lincoln Logs, in order from a series of pictures. The ideal situation would be to have the student look at the pictures in order, and complete all of the tasks without any demands from the teacher. In most cases, however, the students need many gestural prompts to complete the task. While verbal demands do not occur during PAS, many gestural prompts and guidance demands were noted in the few PAS periods observed.

Snack and lunch periods are also excellent learning opportunities for students. Proper eating is

something that all students work on during their education, so many demands were noted for sitting properly, using silverware, using a napkin, and more. Snack and lunch periods are also good times to have students engage with their peers, so many demands come from having the student speak with their peers or other teachers, ask questions, and make eye contact.

Students are also given demands often when they use words or gestures towards people or objects. They may be asked to speak more clearly, speak in a full sentence, or prompted to speak with proper sentence structure. When a student is exhibiting non-compliance to a task, or exhibiting aggression towards his or her teacher or peers, demands may be used to get the student back on track. In such cases, the initial response of teachers is to maintain safety, but this doubles as a learning opportunity for the student.

General results were provided for participants overall, but there were some special instances that may have affected the data. For example, the student with the lowest average demands per hour was student four, with an average of 155. During two out of the three hours this student was observed she spent much of the hour, exceeding 40 minutes each time, having a tantrum. When this student has a tantrum, she becomes very aggressive towards the staff working with her, and non-compliant to demands.

The staff procedure during her tantrums involves escorting her to a quiet room, giving no verbal demands whatsoever, and observing her in the room for one-minute intervals. After each minute, the door is opened and she is instructed to "have a seat" at her desk. If the student immediately goes back to aggressive, non-compliant behavior, she is once again escorted to the quiet room. As mentioned above, the two tantrums observed during this study lasted longer than 40 minutes each, and since demands only occurred by escorting her to the quiet room, redirecting her hands, and instructing her to "have a seat" during this time, it makes sense that her average number of demands per hour was the lowest of all students.

The one hour that student four did not have a tantrum was one of the highest numbers observed, with a total of 224. Along with that high number, in the short periods of the other two hours when the student was compliant, demands were occurring rapidly. This helped make up for a lot of the time her demands were low, leaving her average not far below the rest of the group. When this particular student is compliant, it is often easy to put many demands on.

She speaks very well and enjoys earning various trade-ins, so her teachers have the ability to challenge her and she responds quite well. Had she not had tantrums for much of those two hours, she likely would have had one of the highest average numbers of demands, rather than the lowest.

The highest single hour observation noted was hour three for student number three, with a total of 256 demands. This particular student has one of the more complex lists of discrete trials, due to his high ability levels. He also speaks very well, and reads and writes almost independently. During this particular hour of observation, I was able to see him pushed to those high levels, and he responded very well, thus the reason for the high number of demands. This student's other two hours produced relatively high numbers as well, but hour number three really exemplified what he is capable of responding to.

The highest three hour average observed was for student number one, the oldest student in the study, with an average of 196 demands per hour. This is another student with a high ability level, and therefore many of his discrete trials consist of many demands, but he also has potentially the most energy of the group observed. In all three hours of observation this student had many demands to "sit down," "pull in your chair," "put your feet on the ground," and others due to his frequent behaviors of jumping up out of his seat and reaching for various objects around his desk. Student one also carries a history of bolting behaviors and therefore every transition he has away from his desk comes with constant guidance demands for proper walking. The student's high energy and fast response time provide his teachers with many opportunities to put demands on.

As mentioned in the results section, the average number of demands put on the female students was 166.50, and the average number put on the male students was 178.11. It also happens to be the case that the male students' average age was more than three years the average of the females, and so there is no way to tell in this study whether or not the difference in average was due to gender or age.

Furthermore, these results were not statistically significant, and therefore one cannot actually say there is much difference at all. Sample size certainly plays a role in this particular result, more students with ages more spread out would be preferred if this study is to be replicated. This finding, however, could speak to the ability of the teachers at Futures; not altering their teaching methods no matter what student they are working with. This is likely ideal for any setting that uses

Behavior Analysis Therapy, it is the teachers' responsibility to alter their techniques to fit the students' ability levels, providing equal learning opportunities to all students, regardless of what they can do.

Limitations and Further Research

Although this study provided a large number of results with a limited number of students, there are some limitations to consider, and areas where this study can be improved for the future. One limitation is that there was only one school tested, in a small area in Northeastern Massachusetts, and although the methods of behavior analysis are similar in many areas, Futures may differ from other schools in their exact teaching methods. Another limitation is that the effect these 'demands' are having on the children is not being measured against another type of teaching, but rather it just shows this as a possible explanation for some of the students' progress. Having another type of school to compare numbers to and progress with would emphasize the results of this study.

There were a few things that occurred within the observation hours that one may want to alter in the future. The principal observer stood closely behind each student-teacher pair, in order to ensure that all demands were accounted for. This, however, could have been a distraction to the children. It's possible that demands needed to either be increased or decreased for various reasons due to the observer's presence.

Also, it's possible that the observer's presence caused the Hawthorne Effect to come into play. The Hawthorne Effect is described as a worker increasing output, largely unconsciously, while they were being studied (Diaper, 1990). Perhaps the teachers of the school slightly changed their teaching methods due to the observer's presence. If this project is to be recreated in the future, one may want to consider devising a way to observe demands without actually being seen by the children or teacher, for example; through use of a two-way mirror.

This project captured students at any time throughout their school day, which included, but is not limited to: parts of lunch periods, snack periods, applied physical education periods, trade-ins, and group meeting sessions, along with the discrete trials at their desk. Certainly the number of demands tallied varied during all of these periods. This project wanted to include all aspects of a student's daily routine, but another researcher may want to observe only discrete trials desk work. For that such case, the

researcher would have to tally demands in short periods, rather than scheduling one hour intervals.

Another slight hitch in the study came in the form of Inter-rater Reliability. Although the first method for testing Inter-rater Reliability produced a strong correlation, the number of demands tallied by each observer were not perfectly similar. This raised the question of where exactly the observers disagreed, and so it led to the study being altered to add in a second way of testing Inter-rater reliability.

The second method, as described in the results section, checked for Inter-Observer Agreement in 10-second intervals over a 10-minute span. There was some disparity over the exact demands tallied within each 10-second interval, leading to the observers only agreeing 43% of the time. A potential cause for some of the disagreement could come down to the timing of the demands tallied. While each observer had a timer set and switched between boxes every 10 seconds, it's possible that one observer marked a demand during the last second of one interval, and the other observer marked the same demand in the first second of the next interval. Perhaps having a central timer between the observers could fix this problem. Furthermore, a solution to this disparity in the future would be better education to all observers on what exactly to tally as demands. One observer may tally a verbal demand to have "good hands," as well as a physical model of proper hands, while the other observer may just tally those two things as one total demand.

Another way of looking at these results is determining if the observers agreed about whether or not demands occurred, or did not occur at all, within the 10-second intervals. In this case, the observers agreed that demands either occurred or did not occur on 76% of the 10-second intervals. Overall, the two observers had a moderately strong, and very significant, agreement of when demands did or did not occur.

Implications

Behavior Analysis is used to change or alter a variety of behaviors, and therefore no learning opportunity goes by without its use. Because of this, the number of demands teachers use on students in this type of setting can be very high. This, however, is necessary to engage the students, and to help them acquire the skills they are capable of acquiring, but might not be able to acquire in a less intense setting.

Behavior Analysis and Discrete Trials Training have shown improvement in a number of areas, including, but not limited to; adding new speech sounds and combining those sounds into words, syllables, and

phrases, making new discriminations between objects, helping children learn new language skills, teaching alternative communication skills, managing disruptive behavior and replacing such behaviors with alternative, more adaptive behaviors, (Smith, 2001).

Behavior Analysis has become the preferred method of treatment for children with autism, and its methods will continue to help children and families

all over. The more demands that are placed on these children, the more engaged the child can become in the activity. The more engaged the child is, the easier it is for the child to learn the skill. Also, a high number of demands will lead to more learning opportunities, and the more time in which the children spend learning. The results of this research noted an average of 173.47 demands per hour on each student, which helps provide for the greatest possible learning environment.

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APPENDIX A

Student:

Observer:

Date:

Min 0-1		
0 - 10		
11 - 20		
21 - 30		
31 - 40		
41 - 50		
51 - 60		

Min 5-6		
0 - 10		
11 - 20		
21 - 30		
31 - 40		
41 - 50		
51 - 60		

Min 1-2		
0 - 10		
11 - 20		
21 - 30		
31 - 40		
41 - 50		
51 - 60		

Min 6-7		
0 - 10		
11 - 20		
21 - 30		
31 - 40		
41 - 50		
51 - 60		

Min 2-3		
0 - 10		
11 - 20		
21 - 30		
31 - 40		
41 - 50		
51 - 60		

Min 7-8		
0 - 10		
11 - 20		
21 - 30		
31 - 40		
41 - 50		
51 - 60		

Min 3-4		
0 - 10		
11 - 20		
21 - 30		
31 - 40		
41 - 50		
51 - 60		

Min 8-9		
0 - 10		
11 - 20		
21 - 30		
31 - 40		
41 - 50		
51 - 60		

Min 4-5		
0 - 10		
11 - 20		
21 - 30		
31 - 40		
41 - 50		
51 - 60		

Min 9-10		
0 - 10		
11 - 20		
21 - 30		
31 - 40		
41 - 50		
51 - 60		