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Using a Reinforcer Hierarchy to Increase Compliance and Skill Acquisition

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USING A REINFORCER HIERARCHY TO INCREASE COMPLIANCE AND SKILL ACQUISITION

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Abstract

The purpose of this intervention is to increase compliant behavior and skill acquisition in a child who has been diagnosed with Autism Spectrum Disorder (ASD) with the use of a reinforcer hierarchy. This hierarchy will be determined by conducting preference assessments. These assessments are established by allowing the child to choose the most preferred object of at least two objects which are presented to him by his tutor—a preference assessment can also be conducted by observing which objects or toys the child chooses to interact with the most in his environment. When the preference assessment is established, a reinforcer matrix will be constructed. This matrix will be used to show the child's reinforcers in form of a hierarchy—the hierarchy of reinforcers will be ranked as follows: highly preferred, moderately preferred, less preferred, and least preferred. Procedures used in this intervention will be classified as acquired or mastered procedures—acquired procedures being those which he is still learning, and mastered procedures being those which the child has completed successfully. The child's behavior will be classified as compliant or noncompliant. Highly preferred reinforcers will be delivered when the child is displaying compliant behavior during the procedures which he is still learning (acquired), and moderate or less preferred reinforcers will be delivered during his mastered procedures. Our assumption is that with the use of a reinforcer hierarchy, the child's skill acquisition levels as well as his compliance levels will increase because the hierarchy will increase his motivation to learn.

Introduction

ASD is a neurological-developmental disorder and is one of the most diagnosed disorders in young children today—ASD affects 1 in 110 American children (Morrier, 2012). The prevalence rates of ASD have increased over the past few years, but there is simply no knowing which variable directly contributes to this increase. The International Journal of Epidemiology published an article that examined the possible variables which are responsible for the increased prevalence of Autism Disorder cases. This study found that "Changes in practices for diagnosing autism have had a substantial effect on autism caseloads, accounting for one-quarter of the observed increase in prevalence between 1992 and 2005" (King, 2009). This study's findings suggest that the changes that were made to the diagnostic criteria of Autism after 1992 have contributed to the increase in the diagnosis of Autism Disorder. Autism is a spectrum disorder—

therefore; it is common for one individual with ASD to have more symptoms or deficits than those of the next person, also diagnosed with ASD.

There is no knowing whether or not Autism is present in a child that is not born yet; however, Autism is present within the early months of a child but is not diagnosed until after the age of three. An ASD diagnosis relies strictly on behavior observation; most likely, this is why children under age three are not given a diagnosis because under age three, they are simply not old enough to evoke certain behaviors which are targeted by therapists at the time of an ASD diagnosis. In order for a child to get this diagnosis, he/she needs to be old enough to produce behaviors which meet the criteria of behaviors evoked by a child with ASD; the average ASD diagnosis is made on a child between the ages of 4.5-5.5 (Morrier, 2012). When an Autism diagnosis is made, it is essential for the child to receive behavioral help immediately; research has shown that intensifying therapy during the early years of children with Autism serves them better in the long-run. "Early identification of children with autism and intensive, early intervention during the toddler and preschool years improves outcome for most young children with autism (Filipek, 2000)."

Early behavioral intervention in children with ASD is essential because it teaches them to develop the appropriate repertoires needed for them to be able to attend class with other children and still be able to attend to the instructor. Early behavior interventions also help with the childrens' overall social skills. These interventions usually involve one-on-one sessions—the goal of these sessions is to eventually teach the children to generalize what they are taught to other settings in their natural environments. At this level, children are taught through the use of Discrete Trial Training (DTT). "Discrete-trial Training individualizes and simplifies teaching for

children with developmental disabilities. This method, derived from Learning Theory, is an effective teaching procedure and is especially useful for teaching children with autism when adding new behavioral responses to their repertoires" (Sarokoff, 2004). DTT is especially useful for teaching new forms of behavior, such as speech sounds or motor movements that the child could not initially make. DTT also teaches the child new discriminations, such as responding correctly to requests. It is valuable to keep in mind, also, that DTT can be used to teach more advanced skills and manage disruptive behavior (Smith, 2001). When conducting DTT with children diagnosed with ASD, the general goal is to teach them common principles and skills that will help them to become part of a generalized classroom setting.

Autistic Disorder generally evokes interesting behaviors and affects an individual's ability to produce reciprocal interaction or communicate effectively with others (Morrier, 2012). The deficits in social interaction and communication often affect other areas of these children's lives, resulting in impairments of learning and/or of forming working relationships with their families, peers, or instructors. Children diagnosed with ASD also have difficulties in developing verbal behavior, making them less-likely, and sometimes unable to comply with verbal instruction (Ducharme, 2003).

The Journal of Applied Behavior Analysis (JABA) has published numerous articles that show concern for the prevalence of children with ASD, who have shown deficits in being able to comply with instruction. This is a major concern due to the fact that when children lack compliance, they will also lack the ability to learn and acquire new skills. Even more so, there is a particular interest in experimenters that are designed to increase these children's compliance levels with the use of effective reinforcers. It is predicted that perhaps; when children are

presented with reinforcers which they highly prefer, they will comply and do the work required of them (and thus learn) in order to get hold of those particular highly preferred reinforcers. Conducting preference assessments, therefore, seems like an essential step towards raising the skill acquisition of children with developmental disabilities, who have shown high levels of non-compliant behavior (Schwartzman, 2003). “An important goal of a preference assessment is to identify stimuli that will function as effective positive rienforcers for the client” (Lee, 2010). A reinforcer hierarchy is determined by pairing two objects and determining which of the two objects the client chooses to interact with (Schwartzman, 2003), or simply providing the client with multiple objects to determine which specific object the client chooses to interact with the most (Roane, 1998).

The use of a reinforcer hierarchy has been proven effective in an experiment conducted to increase the social skills of children with developmental disabilities. The clients in this experiment initially preferred to play in isolation as opposed to playing with their peers or siblings. However, when the clients’ peers and/or siblings were paired with reinforcers which were highly preferred by the clients, the clients chose to play with those reinforcers and thus with their peers and/or siblings. Most of the clients in this study chose to play with others when others were paired with highly preferred reinforcers. This intervention showed that highly preferred reinforcers are able to affect choice and therefore can be used to alter behavior and create contingencies suitable for learning in children with developmental disabilities (Hoch, 2002).

The following intervention was conducted on a young boy who was diagnosed with ASD. A reinforcer hierarchy as well as a reinforcer matrix were constructed; the reinforcer hierarchy was used to differentially reinforce the client’s behavior, depending on the client’s level of compliance. The client displayed compliant behavior when he remained seated in his

chair and obeyed verbal demands and prompted directions delivered to him by his tutor. Behavior was recorded as noncompliant when the client had a tantrum, got out of his chair during procedures, or simply refused to do the tasks that were given to him by his tutor. The goal of this experiment is to increase the client's skill acquisition levels while complying with instruction given to him by his tutor.

Methods

Participant Selection/criteria

This intervention was designed to decrease noncompliant behavior and increase skill acquisition—therefore, we were interested in selecting a participant who had, in the past, displayed high levels of noncompliant behavior and low levels of skill acquisition in the classroom. We also were interested in selecting a participant who had a regular school attendance as to not interfere with the progression of the phases involved with the procedures of the study.

We were mainly interested in selecting a participant who has been diagnosed with ASD; keep in mind, however, that this intervention is suitable for individuals with other types of developmental disabilities which caused them to be highly noncompliant and thus acquired very low levels of skill. Similar interventions have been conducted on participants diagnosed with ASD as well as those diagnosed with Mental Retardation; and so for this reason, this intervention can be used across various developmental disorders with behaviors which resemble the ones described above. A team of students from the University of Toronto designed a similar intervention, and their results, published by the Journal of Autism and Developmental Disorders, suggested that a similar intervention can be conducted on children diagnosed with ASD, children who display moderate to severe mental retardation, or children who are at risk of developmental

disorders (Ducharme, 2003). The common behavioral factor that would be required for an individual to participate in this and intervention would be the presence high levels of noncompliance and low levels of skill acquisition. In addition, this intervention would be more suitable for children who are under the age of five, or children who are older than age five but display mental abilities of children who are under the age of five. In this particular intervention, we are interested in non-compliant behavior of children diagnosed with ASD, and so we chose a participant from the ASD population. We narrowed down our selection to Drew, simply because he displayed a history of non-compliant behavior according to his tutors and other classroom staff.

Participant

This was a single-participant intervention. Our participant Drew (name has been altered for participant-researcher confidentiality) is a three-year-old boy who has been diagnosed with ASD. Drew is a student in a preschool classroom of children with Autism and other developmental disabilities. Drew's parents were informed about this study and offered us their consent. Drew attends school Monday-Friday from 11:30AM to 2:30PM; he had reportedly very high levels of noncompliant behaviors, which seemed to affect his skill acquisition levels. Before we could select Drew as our participant, we learned from his classroom teacher that some procedures were removed from his procedure books because he had spent too much time on them without any notable progress. For this reason, Drew's history of noncompliance and low acquisition levels made him an ideal participant for our intervention—also; he seemed to lack motivation during his procedures and our intervention seemed suitable for him because now he would be exposed to highly effective reinforcers, which would increase his motivation levels.

Setting

This intervention was conducted in a preschool classroom for children with developmental disabilities. The intervention was conducted in a classroom with about ten other students who have been diagnosed with ASD or other similar developmental disorders. Each student in the class has his/her own booth, in which they get one-on-one behavioral supervision with an adult who has been trained to shape behaviors that are lacking in that particular child's repertoire through the use of DTT (Refer to introduction section for more about DTT). With the use of DTT, we would teach Drew new motor and discrimination skills while managing his disruptive behavior. DTT has been proven as an effective method of teaching children who have been diagnosed with developmental disabilities (Smith, 2001).

The room used for the intervention was medium sized, and was at about room temperature. The work-space was in a booth—which had two chairs—one for the Drew, and another one for the tutor; the two are separated by a table, which is used to during procedures. The booth also contained two bins. One bin is called the reinforcer bin; all of Drew's reinforcers were kept in this bin. The reinforcer bin contained reinforcers which were ranked highly preferred to least preferred during the preference assessments. The second bin is called the procedure material bin, and it contained materials that were used to conduct the procedures that were used during the course of this intervention. The booth also contained other material, which was used during the sessions. For instance, the tutor had to take data during the sessions, so he/she was required to have data sheets and a pencil at all times during the procedures. Books designed to explain what is to be done in each phase of Drew's procedures also had to be in the booth at all times. Lastly, Drew's Picture Exchange Communication System (PECS) Book had to

be accessible to him at all times in case he wanted to communicate something to his tutor or had a change in reinforcer preference. It is important to note that materials that would distract Drew or are irrelevant to the procedures were kept out of the booth and out of Drew's sight in order to have his attending.

Tools

Before the tutor could begin running procedures with Drew, preference assessments had to be conducted. These assessments were conducted at least once a week to ensure that Drew's preference has/hasn't changed. To conduct these assessments, the tutor would select five objects that Drew seemed to interact with the most. Holding up two objects at a time, the tutor would ask Drew "which one?" and Drew would have to point to object he preferred the most of the two objects. These Objects would be numbered 1-5; each of the five objects would be paired with another object at some point during the assessment. At the end of the assessment, percentages were calculated and the objects were ranked from most preferred to least preferred. For a better understanding of the pairings, refer to **table 1**.

After the conduction of preference assessments, a reinforcer hierarchy was designed. This hierarchy ranked objects as highly preferred moderately preferred, less preferred, and least preferred. Highly preferred reinforcers were used to reward Drew when he was being compliant and delivered a correct response during the procedures that he was still learning. Less and least preferred reinforcers were used as rewards when Drew was being led through procedures which he had already mastered or successfully completed, or was being noncompliant during procedures. We used highly preferred reinforcers to reinforce correct responses and compliant behavior because we needed Drew to have an effective Motivational Operation (MO) during the

procedures which he was still learning. We would also conduct procedures which he had already mastered to get him to attend when he seemed distracted; we would also run mastered procedures as mix-trials with acquired procedures which seemed difficult. For these, we would reward him with either moderate, less, or least preferred reinforcers. Refer to **Table 2** for the reinforcer hierarchy.

Paired Stimulus Preference Assessment Data Sheet							
Student		Assessed by		Date		Time	
Stimulus Items		Overall rank (largest % first)					
1							
2							
3							
4							
5							
Record item with corresponding item number						Circle item selected	
1		2				1 2 3 4 5 N	
5		4				1 2 3 4 5 N	
3		1				1 2 3 4 5 N	
2		4				1 2 3 4 5 N	
4		5				1 2 3 4 5 N	
3		2				1 2 3 4 5 N	
1		5				1 2 3 4 5 N	
3		4				1 2 3 4 5 N	
5		1				1 2 3 4 5 N	
1		4				1 2 3 4 5 N	
2		3				1 2 3 4 5 N	
3		5				1 2 3 4 5 N	
4		2				1 2 3 4 5 N	
5		2				1 2 3 4 5 N	
4		3				1 2 3 4 5 N	
2		5				1 2 3 4 5 N	
1		3				1 2 3 4 5 N	
4		1				1 2 3 4 5 N	
5		3				1 2 3 4 5 N	
2		1				1 2 3 4 5 N	
				Total Time Selected:			
1	/	X100	%				
2	/	X100	%				
3	/	X100	%				
4	/	X100	%				
5	/	X100	%				

Table 1

Table 2: Reinforcer Hierarchy Protocol

Type of Procedure	Noncompliant Behavior	Compliant Behavior

Level 1	**Use less preferred reinforcers:**
	• **Toys that light up**
	  • Ernie & duck light up toy
	  • Light up ball
	• **Toys with moving parts**
	  • Guitar
	  • Activity center
	  • Action figures
	• **Leisure Activities**
	  • Chase
	  • Bike
	• **Bubbles**
	• **Socials**
	  • Hugs
	  • Knee tickles
		Use highly preferred reinforcers:
		• **Musical toys**
		  • Singing radio with microphone
		  • Dancing/singing toys
		  • Singing Spongebob
		  • Sesame Street soundboard
		• **Shiny toys**
		  • Mirror
		  • Shiny space book
		  • Jack in the box
		• **Books with music or texture**
		  • Elmo doorbell book
		  • Animals textured book
		• **Coloring**
		  • Cars coloring book with pencil/markers
		• **Edibles**
		  • Apples
		  • Muffin
		  • Smarties
		  • Nutrigrain bar
		  • Cheez-it
		  • Cookie crisp
		  • Goldfish
		  • Pretzels
		  • Graham cracker
		  • Juice
		  • Cheerios
		  • Fruit loops
		  • Fruity pebbles

Level 2	**Use least preferred reinforcers:**
	• **Toys**
	  • Pop-up toys
	  • Plastic animals
	  • Stuffed animals
	• **Socials**
	  • Neck tickles
	  • Spaghetti arms
		Use moderately preferred reinforcers:
		• **Cars and accessories**
		  • Garage
		  • Bus
		  • Ramp
		• **Plain Books**
		  • Barney Goose Hunt book
		• **Socials**
		  • Armpit tickles
		  • Belly tickles
		  • Peek-a-boo
		  • Anticipation games
		• **Leisure items**
		  • Castle
		  • See saw

Procedures

This intervention involved two procedures: Identify Objects (IO) and Manipulative Imitation (MI). Levels of compliance as well as levels of responding were recorded by the tutor for each procedure. Drew needed to have three consecutive correct responses at 80% or higher or two at 90% or higher in order to get a phase change in each of these procedures. The IO procedure had 13 phases, and the MI procedure had 10 phases. Drew would master the procedures only if he successfully completed all phases of the procedures.

Identify Objects:

Drew had previously been exposed to the IO procedure; unfortunately, the procedure was removed from his book because he had no phase changes for a many weeks. The purpose of this procedure is to teach the child discrimination skills, while also training them to identify objects in their natural and academic environments. For the implementation of this procedure, a verbal S^D was delivered to Drew; for a correct response, Drew had to point or touch the appropriate object, while staying compliant. The tutor would say, "Drew, touch Lion"—the response would be correct if Drew touched the lion. If drew did not touch the Lion, a prompt hierarchy would be used to assist Drew to touch the lion or any other object which he was asked to touch (a prompt hierarchy is performed by giving the child a gestural, partial, and full physical prompt towards obtaining the correct response). Refer to **table 3** below for the IO procedure; notice that Drew had a phase for all the objects involved in the procedure. Also, notice that as Drew got into the higher phases, he would still get exposed to the objects of the phases that he had completed successfully. This procedure is done this way because it helps the child to develop discrimination skills while learning to identify new objects.

Identify Objects Procedure Table

Phase	Stimuli with Data Recorded
1	Baby, Shoe, & Cup
2	Phone
3	Baby, Shoe, Cup, & Phone
4	Car
5	Baby, Shoe, Cup, Phone, & Car
6	Book
7	Baby, Shoe, Cup, Phone, Car, & Book
8	Spoon
9	Baby, Shoe, Cup, Phone, Car, Book, & Spoon
10	Block
11	Baby, Shoe, Cup, Phone, Car, Book, Spoon, & Block
12	Dog
13	Baby, Shoe, Cup, Phone, Car, Book, Spoon, Block, & Dog
14	Sock
15	Baby, Shoe, Cup Phone, Car, Book, Spoon, Block, Dog, & Sock

Table 3

Manipulative Imitation

The MI procedure was designed to teach the Drew how to imitate behavior with the use of objects. The tutor would pick up an object (there are two of each object) and model a behavior using that object. The tutor would deliver the S^D, 'Drew, do this" while modeling a behavior with the object, such as holding and then hugging a baby doll. As soon as the tutor completed modeling the behavior, she would hand Drew the Object. Drew had a correct response when he modeled the behavior within five seconds; if he did not model the behavior appropriately, the tutor would correct him with the use of a prompt hierarchy. Refer to the **table 4** for more imitations involved in this procedure.

Manipulative Imitation Procedure Table

Phase	Stimulus	Behavior #1	Behavior #2
1	Car	Push on table	Put on head
2	Horse	Raise front legs	Jump on table
3	Baby	Hug baby	Kiss baby
4	Phone	Talk on phone	Push buttons on phone
5	Frog	Jump frog on table	Touch frog to elbow
6	Cup	Flip cup upside down	Drink from cup
7	Hammer	Hammer on table	Hammer on hand
8	Hat	Put on head	Put on stomach
	Book	Turn pages of book	Point to cover of book
10	Block	Stack blocks	Push blocks together

Table 4

Results

When the reinforcer hierarchy was introduced, Drew mastered the manipulative imitation procedure within 31, compared to the 136 sessions that he had worked through without a single phase change. In addition to this, Drew demonstrated generalized imitation ability. Overall, the data collected during this intervention shows that a reinforcer hierarchy may be used to increase skill acquisition in children diagnosed with ASD. The data also shows that the lack of compliance during skill acquisition procedures may be due to the lack of effective reinforcers for the child.

Identify Objects

With the use of the reinforcer hierarchy, Drew mastered the IO procedure within 33 sessions, which is the minimum number of sessions required to master this procedure. During baseline, there were no phase changes in the 28 sessions which Drew had been led through; in fact, he had so little progress that this procedure was removed from his book by the classroom

teacher, but introduced back to him when the reinforcer hierarchy was presented. The mean percentage of accuracy in responding before baseline was at 17.14%; comparatively, his mean percentage of accuracy rose up to 97.3%. The average percentage of Josh's compliance during the ID objects procedure was 100%.

Once again, the data collected from the ID objects procedure demonstrates that skill acquisition may be improved by the presentation of a reinforcer hierarchy, and that non-compliance may be due to the lack of effective reinforcers, or lack of a motivating operation for the child. View the results graph in **table 5** below for comparisons between baseline and implementation phases.

Identify Objects Graph

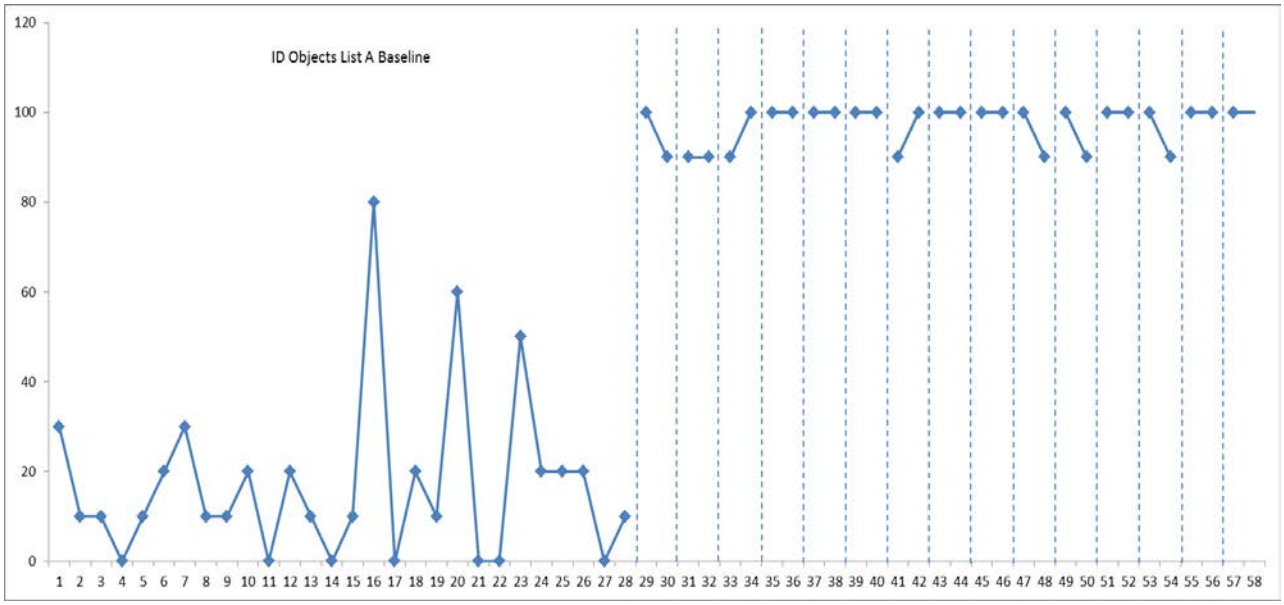
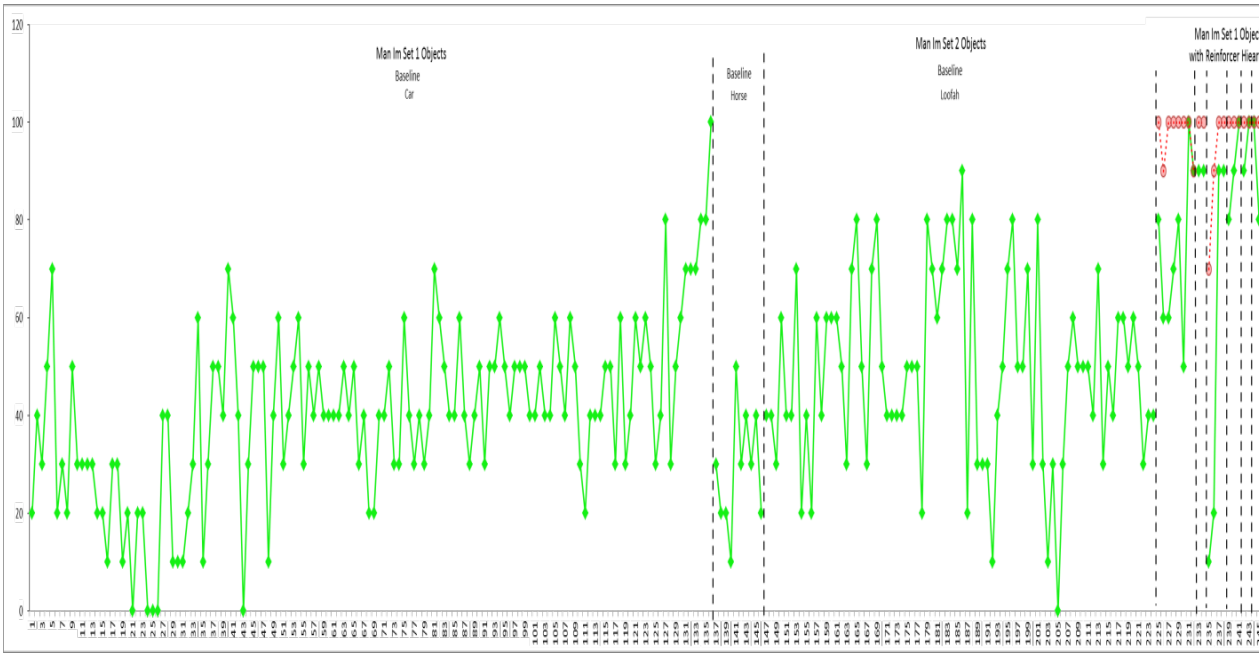


Table 5

Manipulative Imitation

Before the introduction of the reinforcer hierarchy, the mean percentage of accuracy for the response was at 47.77%. After the intervention, the mean percentage of accuracy during the procedure increased to 81.3%. Drew also had in increased rate of compliant behavior when the intervention was implemented—his compliance levels increased to an astonishing 97.79%. Refer to **table 6** for the MI graph.

Manipulative Imitation Graph



Response (%)

sessions

Table 6

Tutor Implementation:

To ensure generalization of learning in both procedures, tutors were instructed to run both the IO and the MI procedures with different materials. For instance, Drew would still do the IO procedure but was given different objects to work with. The new procedure list was named list B.

Drew Mastered list B of within 34 sessions. No baseline data was taken because Drew had previously demonstrated ability in this procedure by mastering the previous IO procedure (list A). The mean percentage of accuracy for the IO procedure during this procedure was 95%, and the levels of compliance were at 95%. Similarly, the MI procedure was implemented by tutors with different materials and imitations following Drew's mastery of the original MI procedure.

Discussion

Articles reviewed upon the conduction of this intervention suggested that preference assessments could be used to increase learning, attention, and overall skills of children with developmental disabilities. Our data did indeed suggest that Drew's ability to comply and learn had a positive correlation with the reinforcer hierarchy. A reinforcer hierarchy, therefore, we found could be used to increase learning and skill acquisition in a child with Autism.

Although our results suggested that preferred reinforcers may be used to increase compliance and acquisition levels, our intervention had limitations. There are variables in our interventions that were out of our control and some that should simply be eliminated if this intervention was replicated.

Something that we could have done better before we implemented this intervention is that we could have taken baseline data of Drew's noncompliant behavior. Even though we persistently insist that Drew had high levels of noncompliant behavior, our data would have been more strongly supported if we closely observed his behavior prior to the intervention and took note of what was going on in his environment as he became noncompliant. Even though our results suggest that his compliance levels increased after the presentation of the hierarchy, one

could argue that there is not enough evidence to state that the hierarchy was responsible for his high compliance. Drew had been exposed to the two procedures which were used, and so there is no knowing if the changes which took place did so just because he had seen the procedures many enough times phase-change. The classroom teacher informed us that although scattered, Drew's often high responses during baseline demonstrated that he was familiar with the procedure but lacked the motivation to attend.

Another limitation of our intervention was that we only had one subject. Whether or not these particular findings of this study would generalize to a bigger generalization is questionable. A few variables were present in this intervention that we had little or no control over. For instance, our client had some absent-days, and when he was present, he had more than one or two tutors to work with. These are all variables may very well have influenced the outcome of our results and findings.

An important notion to point out here is that this intervention is not designed to teach skill to children who are not able to acquire skill at all in their repertoires. This intervention should be conducted on children who are able to learn new skills but seem to lack the appropriate motivation or compliance to do so.

Conclusion

For this intervention, our results led us to conclude that while Drew was capable of learning and acquiring new skills, he lacked the motivation needed to learn prior to the introduction of the hierarchy. By introducing the Reinforcement Hierarchy, we increased his motivation to learn through the use of reinforcer assessments. Based on the results discussed

earlier, we can strongly suggest that the reinforcer hierarchy was responsible for Drew's increased levels of skill acquisition as well as compliance.

Future Research

If this intervention is replicated in the future, researchers should investigate whether it is able to be generalized to a larger population by using it across subjects and across settings. Our use of a single subject may have had many confounding variables, which may in turn have contributed to our findings. Future research should also consider developing interventions which use Other Learning Opportunities (ELOs) as the major motivators for children. This way, the child would be getting reinforced for learning by developing other new, enjoyable, and familiar skills in their repertoire. ELOs are commonly used with DTT but they are not considered more reinforcing than edibles and tangibles; ELOs are tutor-dependent—the tutor may teach the child simple skills at any time before, during, and after procedures. Most children enjoy ELOs, and so it would be interesting to develop interventions which make ELOs interesting enough to be the major reinforcers. If we established ELOs as effective MOs for children with Autistic Disorder, we would be increasing their rates of skills acquisition by a few more folds.

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