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Evaluating the Effectiveness of a Tablet Application to Increase Eye Contact in Children Diagnosed with Autism

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Evaluating the Effectiveness of a Tablet Application to Increase Eye Contact in Children
Diagnosed with Autism

by

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A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Arts
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Abstract

Studies have shown that increasing eye contact can be accomplished by using reinforcement, prompting, shaping, functional movement training, punishment, and self-monitoring. However, there is a lack of research that evaluates the use of technology as a way to increase eye contact. This study tested the effectiveness of a tablet application at increasing eye contact in children diagnosed with autism. The application requires the child to look at a picture of a person's face and identify the number displayed in the person's eyes in order to receive reinforcement. Data was collected immediately after training, one hour after training, and in the natural environment. The tablet application was not effective at increasing eye contact for any of the three participants. Once the tablet application was shown to be ineffective, the researcher used differential reinforcement to increase eye contact. All three participants showed an increase in eye contact once the differential reinforcement training was implemented.

Chapter One: Introduction

Imagine trying to have a conversation with someone and that person refuses to look into your eyes. For some people who have been diagnosed with autism, making eye contact with others can be a common impairment. Donnelly and Luyben (2009) described the importance of eye contact and how it is a common goal to increase eye contact in those who have been diagnosed with autism. They also mentioned that without eye contact, it would be difficult to pick up on social cues that are typically shown on a person's face, such as smiling. Koegel and Koegel (1988) deemed eye contact a pivotal behavior, which can impact functioning with regards to attending. Hamlet, Axelrod, and Kuerschner (1984) detailed how eye contact was an antecedent for compliant behavior and was a necessary step in having a person's attention so that they can complete tasks. Blake and Moss (1967) also described how eye contact was an important factor in making sure that someone is attending, and that attention is a necessary factor when trying to shape one's behavior. For example, Foxx (1977) mentioned that without the basic skill of eye contact, it would be difficult to acquire more complex and advanced skills that are needed to function effectively in society.

A number of different methods have been used to increase eye contact including reinforcement, self-monitoring, and punishment. (e.g., Blake & Moss, 1967; Donnelly & Luyben, 2009; Hamlet et al., 1984). Hamlet et al. (1984) used a prompt along with reinforcement to increase eye contact. During baseline, the teacher said the child's name, waited 2 s and then presented an instruction. The teacher then watched the child until the

demand was completed. During the intervention, the teacher said the child's name and waited 2 s. If the child looked, the teacher stated the instruction, if not, the teacher prompted in a firm voice "(name), look at me." The child had to be looking at the teacher the entire time the instructions were being presented or the teacher started over. Once the child maintained eye contact and followed through with the instruction, the teacher provided praise. An increase in eye contact was observed, as well as the number of instructions followed, for the two children in this study. The authors mentioned that they replicated the study six times to test for generalization. In five of the six studies, the researchers found that eye contact was an effective antecedent for compliance in all of the participants. The authors noted a limitation that the children could have been making more eye contact with their teachers in order to avoid the constant re-prompting that occurred when they stopped looking during instructions. Therefore, negative reinforcement may have played a role in increasing eye contact in addition to the prompting paired with praise.

Differential reinforcement paired with time delay has also been shown to be effective for increasing eye contact. Using this method, Carbone, Albert, and O'Brien (2012) conducted a study that took place during mand training when data were being collected on the child asking for items or actions. During baseline, data were taken on the number of mands made with eye contact. Each mand was immediately reinforced during this phase. During the intervention, the child requested an item or action and the therapist only reinforced the mand once the child was making eye contact while making the request.

Donnelly and Luyben (2009) examined the use of varying levels of positive

reinforcement to increase eye contact toward learning materials using reinforcement across different picture, puzzle, and stacking/cup tasks. The intervention consisted of first implementing continuous reinforcement for eye contact that lasted for at least 1 s and then fading to an intermittent reinforcement schedule. The results of the study showed that varying levels of reinforcement were successful at improving eye contact.

An alternate method used by Koegel and Frea (1993) to increase eye contact and other social skills was self-monitoring and reinforcement. Unlike most studies, Koegel and Frea recorded only inappropriate eye contact, which was considered to be 3 s of continuous looking at something other than the experimenter or relevant conversation item. During the intervention, the client was taught the difference between correct and incorrect social behaviors, including eye contact, with the experimenter engaging in the behaviors and then having the child imitate the behaviors. The experimenter then had the child work on identifying the correct and incorrect behaviors, followed by monitoring his own behavior on an interval schedule. The interval time and the percentage of appropriate eye contact increased and maintained throughout the treatment.

Finally, as a last resort, Foxx (1977) used punishment in the form of functional movement training to increase eye contact. In the intervention phase, the children were prompted to look at the therapist and if the children complied within 5 s their behavior was reinforced with an edible and verbal praise. If the children did not comply, the therapist told the child that they did not look and then began the functional movement training, which consisted of the child moving his or her head in one of three positions and holding that position for 15 s with physical guidance if needed. The results showed that this method was effective and generalized to other people who were not involved in the

study. Blake and Moss (1967) also used punishment when they placed a girl, Dolly, who had little to no eye contact into a booth with a divider containing the experimenter on one side with light and the child on the other side with no light. At the start of the experiment, the experimenter raised the curtain, the light turned on and he provided the prompt “Hi Dolly, look at me”. If Dolly looked at the experimenter, she received ice cream; if not, the experimenter closed the shutter and turned off the light for 15 s and then tried again. Being placed in the dark may have functioned as an aversive stimulus for the child and the author’s mention that she engaged in the correct behaviors to avoid having the light turned off. Pairing that with the reinforcer of ice cream when she did make eye contact, strengthened the eye contact behavior so she was more likely to look when prompted. After these sessions, eye contact was deemed no longer a problem for the child and no further testing was completed, so it is hard to determine if this method was truly effective.

Technology has been shown to be an effective means at creating behavior change (Bellini, Akullian, & Hopf, 2007; Bernard-Opitz, Sriram, & Nakhoda-Sapuan, 2001; Bossler, & Massaro, 2003; Sherer et al., 2001) and recently several tablet applications have been developed to improve social skills such as eye contact. (Autism Speaks Inc., 2013) These applications are often marketed to parents of children with autism. No known research has assessed whether the current tablet applications that have been developed to increase eye contact in children diagnosed with autism are actually successful in improving eye contact. If these applications are effective, they could provide a cost effective and accessible method for parents and teachers to adopt to help children with autism acquire this important skill. The current study evaluated the

effectiveness of a tablet application to increase eye contact in children diagnosed with autism.

Chapter Two: Method

Participants

Three male children diagnosed with autism, from a local behavior clinic participated in this study. All of the participants had substantial verbal repertoires but their lack of eye contact may have held them back from acquiring more complex skills. JK was three-years and eight months at the beginning of the study. He had been receiving services at the clinic for 10 months and had completed the clinic's manding program and had begun the manding with eye contact program prior to the study. Although JK had started the manding with eye contact program, he had only been exposed to it briefly and never made eye contact more than 20% of the time. NP was three-years and seven months old at the beginning of the study. He had been receiving services at the clinic for seven months and had also completed the clinic's manding program and had been recommended for the manding with eye contact program prior to the study. TS was a male who was five-years and 11 months old at the beginning of the study. He had been receiving services at the clinic for 14 months and had not completed the clinic's manding program but was recommended for the manding with eye contact program. NP and TS had no prior exposure to programs designed to increase eye contact.

A behavior analyst who worked at the clinic that provided verbal behavior services to the participants decided which children would benefit from working on an eye contact program. In order to be considered for inclusion for this study, the child needed to be able to mand for items, using either sign or vocals, and have either completed or

was working on the clinic's manding program. The child also could not display any severe behavior problems that would interfere with the study. If the child was eligible to participate in the study, the parents were contacted. The parents were required to sign a consent form and the experimenter attempted to obtain assent from the child if applicable. If the child was unable to give assent, the experimenter observed to ensure that there were no signs of resistance from the child.

Setting

All sessions were conducted at the local clinic when the child's regularly scheduled therapy occurred. Each session took place in either the individual therapy rooms or the natural environment training room. The individual therapy rooms were 3x3 m with three individual cubicles in each. A 1.8 m wall divided the workspaces and each cubicle had a table and chairs, program materials, and reinforcers that were chosen by the child. The natural environment training room was 6x4 m open room with multiple reinforcing items available for the child to engage with. The children all had previous exposure to the rooms that were used in the study.

Target Behavior and Data Collection

The target behavior for the child was making eye contact with the therapist in a mand (i.e., requesting item or task) setting. Manding consisted of the child looking in the data collector's eyes, at any point, while requesting a particular item. A request or mand consisted of either a sign, a single word utterance, or a two or more word utterance to request an item. It is important to note that the mands made by the children may not have been pure mands. In order to have a pure mand, the response that is reinforced by a characteristic consequence is under the functional control of a relevant establishing

operation. If the child requests an item that can be seen, the mand would be under mand-tact control. It is under this control because the request made by the child was evoked by an object that was present and the reinforcement for the response is the requested item. If a prompt is given to evoke a mand, the mand is under mand-intraverbal control. The prompt would be an auditory stimulus in which the child would respond either vocally or with a sign for the item he desired. The mand made by the child in this way would be under the multiple control of the prompt and the establishing operation. Data were taken on the occurrence of eye contact during each session. An occurrence was defined as any duration of eye contact that occurred from the onset to the offset of the mand. A session consisted of 10 trials (see Appendix A). Occurrence of eye contact was recorded as a plus (+) and non-occurrence of eye contact was recorded as a minus (-) on the data sheet. Non-occurrence of eye contact was recorded to ensure that the therapist remained on the correct trial. After each session, the percentage of trials with eye contact was calculated by dividing the number of pluses by 10 and then multiplying that number by 100.

Materials

An Apple iPad[®] was used to allow the child to use the Look in My Eyes Steam Train application (Cort & Cort, 2009). This application allows children to practice eye contact by displaying a number in a person's eyes and having the child complete a match-to-sample. Reinforcers that were found in the clinic were also used for the manding program.

Interobserver Agreement

Interobserver agreement (IOA) data were collected during baseline and intervention phases. An additional trained therapist in the clinic was utilized to record

eye contact during the sessions. In order to have an agreement, both therapists needed to agree on the occurrence or nonoccurrence of the target behavior. An agreement was defined as both observers recording the same for each trial (i.e., both marking either a + or a – on the data sheet) while a disagreement was defined as one observer recording a + and the other observer recording a – on the data sheet. At the end of each session, IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. IOA was taken for JK 36% of the sessions and the percent agreement was 99% (range of 90-100%). NP had IOA taken 37% of the sessions and the percent agreement was 100%. Finally IOA was taken for TS 39% of sessions and the percent agreement was 99% (range of 90-100%).

Social Validity

At the end of each phase, one session was video taped to assess social validity. The experimenter set up a camera behind herself while running the session so that the parent was able to assess the eye contact properly. The parents of the child were asked to view three videos of their child engaging in a manding session and record on a five point likert scale how natural the eye contact appeared. The questions on the scale were ranked from 1-not at all natural to 5-completely natural. There was also an option to record no eye contact during the session. The parents were not told which phase of the study they were watching and had to answer questions regarding each video. There were also questions pertaining to the likeability and effectiveness of the study and the interventions. These additional questions were also rated on a five point likert scale. The scale was ranked from 1-did not like or not effective to 5- like very much or very effective. Appendix B shows the questionnaire that was given to the parents for social validity.

Experimental Design

A multiple baseline across participants design was used to test the effects of the iPad application on eye contact.

Procedure

After the parents were informed about the study, they were asked to complete the informed consent forms. Before beginning the study, the child was required to complete a match-to-sample test while in the individual therapy room. This test ensured that the child had the prerequisite skills required to properly use the application. The child was presented with a number, which he had to match to a numbered grid on the table. The grid was numbered 1 to 9 to replicate the grid that was present in the iPad application. If the child could complete the match to sample task with all nine numbers, he was eligible for the study.

Therapist training. The researcher was the lead therapist collecting data but other therapists in the clinic took data if the researcher was unavailable. Prior to working one-on-one with a child at the clinic, all therapists were trained to run the required programs and to properly collect data. All therapists also passed competency exams that indicated that they were prepared to work with the child. In order to be able to collect data for this study, the researcher trained the therapists using behavior skills training to properly collect data on the occurrence and nonoccurrence of eye contact. After training, the researcher observed the therapist collecting data on eye contact. Once the therapist collected 10 consecutive correct trials of eye contact, the therapist was allowed to take data on his or her own. Behavioral skills training was not needed for each phase because

the therapists had already been trained on the specific procedural details of the study during the training to work in the clinic.

Baseline. During baseline, the child participated in a manding session that typically took place during therapy sessions. Two assessments were completed during baseline. One took place in the individual therapy room and the other took place in the natural environment. Prior to starting the session, the therapist allowed the child to select up to five items that he wanted as reinforcers. The child was allowed to choose from edibles, toys, or electronic devices (i.e. DVD player, iPad). Once the session began, the child was required to make either a vocal or sign request to select his desired item. If the child did not mand for an item within 5 s, the therapist provided the prompt “what do you want?”. If the child still did not mand for an item, the therapist then provided a prompt along with a transfer trial. For example, if the child wanted a movie and he did not request it within 5 s of the initial prompt, the prompt and transfer trial began. The therapist said, “What do you want? Say movie.” Once the child said, “movie” the therapist then represented the prompt of “what do you want?” in which the child independently answered “movie.” During the transfer trial, only the first mand for the item was scored for eye contact. If the child still did not respond when prompted, the therapist asked the child if he wanted to have a different item to ensure that the item that he was engaged with was in fact reinforcing to the child. If the child manded for and received an edible item, once the item was consumed, the next trial began and the child could mand for another item. If the child was playing with a toy or electronic device, he had access to the item for 30 s then the therapist took the reinforcer away and had the child request the item again. During this phase, if the child did make eye contact during

the mand, the experimenter provided praise for the eye contact and completed the request. If he did not make eye contact, the experimenter still completed the request but did not provide praise. If the child tried to take the item from the therapist or began to tantrum, the therapist ignored the behavior and provided a verbal prompt of what was needed from the child in order to receive the item. For each baseline session, the occurrence or non-occurrence of eye contact when the child made a request was recorded for the first 10 times that the child made a request (i.e., 10 trials). Once there was a stable pattern of eye contact in both locations, the child was then moved to the intervention phase.

Eye contact application. After baseline data were obtained, the child was instructed to play with an iPad application designed to increase eye contact while in the individual therapy room. The child only had access to this application during training. This application displayed a person's face and then flashed a number where his/her eyes were located. The faces in the application were of varying age, race, gender, and size. The child had to be looking in the person's eye in order to know which number to press once the number pad was displayed. At the beginning of the game, the child was verbally prompted to look into the person's eye and select the number he saw. These instructions were only provided for the first presentation of the face. If the child picked the correct number, he then received a token on the screen and a visual reinforcer that indicated that he earned a token for making the correct choice. The child also received praise for the first correct response. If he chose the incorrect number, he was visually alerted that he made the wrong choice and another face was displayed. Once the child received four tokens, he was allowed to play an interactive game that lasted for approximately 1 min.

The child then had to earn more tokens to play the game again. Once the child had completed eight correct trials and had played the interactive game twice, the iPad was removed and a post application assessment was conducted. If the child had made four consecutive errors while using the application, the pretest would have been administered again to ensure that the child possessed the necessary prerequisite skills to participate in the study. All of the participants completed the eight consecutive trials during each iPad session and the pretest did not have to be administered more than once.

Post application assessment. Immediately after the child used the application, eye contact was assessed in the individual therapy room. After this assessment there was a 5 min delay in which the child was brought to the natural environment training room and was required to complete demands not associated with this study. Once the delay was complete an immediate generalization assessment was conducted to see if the change in eye contact generalized to another setting. The 5 min delay with demands was necessary to minimize carry over effects between the assessment in the individual therapy room and the assessment in the natural environment training room. An hour after the immediate assessments, another assessment took place in the individual therapy room to gauge whether the initial results were maintained. Following this assessment, there was once again a 5 min delay in which the child was taken to the natural environment training room and required to complete demands not associated with the study. After the 5 min delay a final assessment was completed in the natural environment training room to see if the initial generalization results were maintained. All assessments in this phase were completed in the same manner as in baseline (i.e., each session consisted of the first 10 requests from the child and the therapist completed the request regardless of if eye

contact was made and provided praise if eye contact was made during the mand). If the eye contact application showed an increase in eye contact to 80% in all of the assessments, the child would be finished with the study. However, if the eye contact application was unsuccessful, the child then moved on to a differential reinforcement phase.

Differential reinforcement training. This phase consisted of 10-min training sessions in the individual therapy room. If the child made eye contact with the therapist when requesting an item, the therapist immediately reinforced the child's behavior by providing him with praise and the requested item. If the child did not make eye contact with the therapist when requesting an item, the therapist waited until the child made the request again while using eye contact before reinforcing eye contact by allowing the child to have the requested item. The same prompting procedure that was used in baseline was used if a mand was not made within 5 s.

Differential reinforcement assessment. Immediately after the child completed the differential reinforcement training, eye contact was assessed in the same manner it was assessed following the iPad intervention.

Chapter Three: Results

Figure 1 shows the percentage of trials with eye contact for each of the three participants. Table 1 shows the average percentage of trials with eye contact made by the participants across each of the assessments for each phase. During baseline, JK made eye contact an average of 13.3% of trials, with a range of 0-20% across all assessments. During the tablet application phase, JK made eye contact an average of 12.9% of trials, with a range of 0-50% across all assessments. Once differential reinforcement was introduced, JK made eye contact an average of 85% of trials, with a range of 60-100% across all assessments. JK had greater variability with eye contact during baseline and with the tablet application than NP and TS. During baseline, NP made eye contact an average of 1% of trials, with a range of 0-10% across all assessments. During the tablet application phase, NP made eye contact an average of 0.4% of trials, with a range of 0-10% across all assessments. Once differential reinforcement was introduced, NP made eye contact an average of 75.5% of trials, with a range of 50-90% across all assessments. During baseline, TS made eye contact an average of 4.4% of trials, with a range of 0-20% across all assessments. During the tablet application phase, TS made eye contact an average of 0.4% of trials, with a range of 0-10% across all assessments. Once differential reinforcement was introduced, TS made eye contact an average of 72.5% of trials, with a range of 50-90% across all assessments.

To test social validity of the study, the participants' caregivers were shown three videos in a random order of their children that were taken at the end of each phase of the

study. JK's caregiver reported that after baseline and the tablet application that his eye contact was a 2.5. After the differential reinforcement phase JK's caregiver reported that his eye contact was a 4.5. NP's caregiver reported that after baseline and the tablet application she never saw him make eye contact during the video. After the differential reinforcement phase JK's caregiver reported that his eye contact was a 4. TS's caregiver reported that after baseline and the tablet application she never saw him make eye contact during the video. After the differential reinforcement phase TS's caregiver reported that his eye contact was a 5. All three caregivers gave the tablet application a 1, which meant that that they did not like the tablet application and that they thought it was ineffective. JK and TS's caregivers gave the differential reinforcement training a 5, which indicated that they really liked the training and that they thought it was effective. NP's caregiver gave the differential reinforcement training a 4 because she felt her son's eye contact could still be improved.

Figure 1

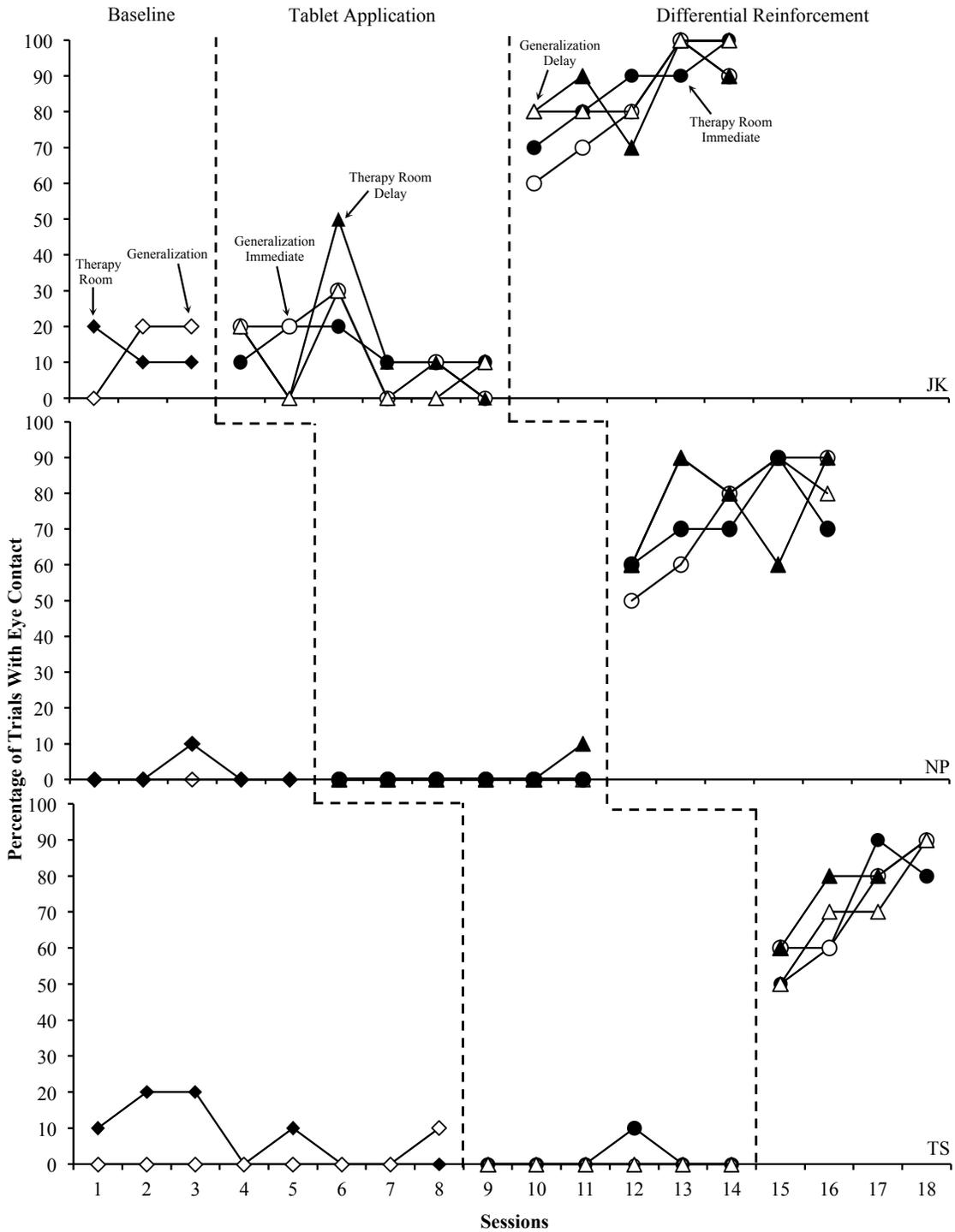


Figure 1. Participant's results. Percentage of requests made while making eye contact across baseline and intervention phases for three children.

Table 1

Average Eye Contact Made by the Participants During Each Assessment

<u>Phase</u>	<u>Assessment Type</u>	<u>JK</u>	<u>NP</u>	<u>TS</u>
Baseline	Table	13.3%	2%	7.5%
	NET Room	13.3%	0%	1.25%
Tablet Application	Table – Immediate	13.3%	0%	1.67%
	NET Room – Immediate	13.3%	0%	0%
	Table – Delay	15%	1.67%	0%
	NET Room – Delay	10%	0%	0%
Differential	Table – Immediate	86%	72%	70%
	NET Room – Immediate	80%	74%	72.5%
Reinforcement	Table – Delay	86%	76%	77.5%
	NET Room – Delay	88%	80%	70%

Chapter Four: Discussion

The current study examined the effectiveness of a tablet application at increasing eye contact. All three participants showed no improvement in eye contact after using the tablet application. Once differential reinforcement was implemented all three participants showed a significant increase in eye contact. The tablet application did appear to be preferred by the children as they all asked to continue playing with it once the tablet application phase was completed. The results of differential reinforcement on eye contact in the current study coincide with findings from the Carbone, et al. (2012) study.

The tablet application was ineffective at increasing eye contact. Prior to using an application that is designed to practice skills, caregivers should ensure that the application has been shown in research to be effective. Otherwise, the caregiver would be wasting money as well as delaying other effective treatments.

Over selectivity is a problem for many children diagnosed with autism (Lovaas, Schreibman, Koegel, & Rehm, 1971). This application may have been ineffective because it taught an over selective response. The application displayed a face with a number appearing where the eyes were. This forced the child to focus on the number rather than the actual eye to receive reinforcement. Looking for the number was differentially reinforced rather than the eye contact that was being made with the face. Another potential problem is that the application uses a 2D picture of a face for training.

This could make training eye contact that would generalize to an actual person more difficult.

All of the participants completed the match to sample on the first try and played with the application correctly without being prompted how to do so by the therapist. NP and TS required three trials with the application on the first exposure with it because looked away from the screen and picked the incorrect number. JK learned the application interface immediately. Once the participants knew how the application worked, they never had more than two exposures to the application before moving on to the assessments.

In the baseline and tablet application phases, JK had more variable eye contact than the other participants. It is believed that this may have been due to prior exposure to the manding with eye contact program at the clinic. It is also important to note that his eye contact started to generalize to his therapist during training when his therapist was collecting IOA data during sessions. JK frequently switched from asking the researcher to asking his therapist for items during the differential reinforcement phase. As long as he was making eye contact during the differential reinforcement training then he was given the requested item. NP and TS had less variability with their eye contact and did not generalize their eye contact to other individuals during training sessions.

The results of the differential reinforcement training are promising because eye contact continued to remain high during the delayed assessments and during the generalization assessments. This suggests that once the child acquired the skill, they were maintaining it as well as generalizing it to other settings. However, it is not known whether this would maintain if the delay was longer or if other settings had been used.

Overall the participants' caregivers and therapists noticed an increase in eye contact for all of the participants that has maintained even though the researcher is no longer present. JK and TS's mothers reported noticing the increase in eye contact while at home. NP's therapist noted that his eye contact had improved and that he went out of his way to ensure he had her eye contact when manding for an item. NP's mother commented that while she did notice an improvement in his eye contact, she believed it felt forced rather than natural. It is important to note that all of the participants will continue with the differential reinforcement training as part of their programming at the clinic until they have two consecutive days of over 90% eye contact. Once they have completed that step, they will then move on to differential reinforcement training where they will be required to make eye contact with the therapist for the entirety of the mand before they are given the requested item.

As expected, there were extinction bursts during the differential reinforcement training phase once manding without making eye contact was placed on extinction. The extinction bursts were very similar for each of the participants. JK screamed his mand, called it a different name, said the mand slower, and even switched to a new mand before finally making eye contact with the researcher and receiving reinforcement. NP whined his mand, yelled his mand, switched his mand and even cried while manding before making eye contact during training. Finally, TS changed the name of the mand, used specific characteristics with his mand, and yelled his mand before making eye contact. All extinction bursts were short lived and were easily manageable.

For all three participants, the topography of their eye contact was the same throughout the baseline and the tablet application phases. All participants almost always

made eye contact with the item they were manding for rather than making eye contact with the therapist. Once differential reinforcement was implemented, the topography changed and the participants started making eye contact with the therapists rather than the items they were requesting.

A limitation of this study was that the majority of assessments were run by the researcher and not by the child's primary therapists or caregivers. This could lead to the results not generalizing to the therapists or caregivers once the researcher leaves. All of the participants' therapists reported that the participants' eye contact had generalized to them and that the children continued to make eye contact even though the researcher was no longer present. The results may have generalized to the therapists because they also had stimulus control over the participants in the setting in which the study was conducted. The results may not generalize to the participants' caregivers because they did not run the program and the program was not run in their homes.

Another limitation is that only one of the three participants achieved 100% eye contact and even then it was not consistent across the different assessments. Achieving eye contact for 100% of the trials would be an appropriate target when a child is asking for items. The child was not required to make eye contact 100% of the time but only for a portion of the mand. Making eye contact 100% of the time might be unrealistic because it may not appear natural to make eye contact for the entirety of a conversation.

Future research should run the differential reinforcement phases longer to see if eye contact can be obtained for 100% of trials across all settings. Research should also be done using differential reinforcement with older clients or clients with different disabilities to see if the results would vary amongst those populations. Older clients will

have longer reinforcement histories of manding without eye contact so their results may differ from those of early learners. Clients with other disabilities may have different levels of functioning that could alter the results of the study. Research could also be extended to novel settings such as school or community settings, such as restaurants. Testing differential reinforcement in other settings could lead to improved generalization. Finally, research should evaluate the effectiveness of differential reinforcement that is implemented by other therapists, teachers, or parents, to ensure that similar results can be achieved. This also could lead to an improvement in generalization.

Future studies could also compare differential reinforcement to other types of applications that are created to increase eye contact. While this iPad application was not successful at increasing eye contact, others may use different methods that could be successful. For example, with the new eye tracking capabilities that are being developed, an application could be developed that could track the child's eye movement on the screen while manding. A face could be displayed and the child's mand would only be reinforced when he or she was making eye contact with the eyes of the face of the screen. This type of application would potentially have the same effects as differential reinforcement training and the results may generalize. If that were the case, then the application would reduce the response effort involved in having a therapist train the child and it could be accessible anywhere.

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Appendices

Appendix A

Eye Contact Data Sheet

Name: _____

Child: _____

Date	Session	1	2	3	4	5	6	7	8	9	10	% EC
	T P I D											
Session Notes												

Date	Session	1	2	3	4	5	6	7	8	9	10	% EC
	T P I D											
Session Notes												

Date	Session	1	2	3	4	5	6	7	8	9	10	% EC
	T P I D											
Session Notes												

Date	Session	1	2	3	4	5	6	7	8	9	10	% EC
	T P I D											
Session Notes												

Date	Session	1	2	3	4	5	6	7	8	9	10	% EC
	T P I D											
Session Notes												

