A COMPARISON OF INSTRUCTIVE FEEDBACK DURING HIGH AND LOW DEMAND CONTEXTS ON INTRAVERBALS FOR CHILDREN WITH AUTISM SPECTRUM DISORDER

by

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A DISSERTATION

Presented to the Department of Special Education and Clinical Sciences
and the Graduate School of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Doctor of Philosophy

June 2019

DISSERTATION APPROVAL PAGE

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Title: A Comparison of Instructive Feedback During High and Low Demand Contexts on Intraverbals for Children with Autism Spectrum Disorder

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Degree awarded June 2019.

DISSERTATION ABSTRACT

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Doctor of Philosophy

Special Education and Clinical Sciences

August 2018

Title: A Comparison of Instructive Feedback During Play and Demand Contexts on Intraverbals for Children with Autism Spectrum Disorder

An adapted alternating treatments design was used to evaluate the effect of context on the acquisition of intraverbals for three young children with autism spectrum disorder (ASD) when utilizing instructive feedback (IF). All participants acquired secondary targets when presented in an instructional setting along with primary targets. Two participants acquired secondary targets in the absence of primary targets and treatment – one participant in an instructional setting (high demand) and another participant in a novel setting (low demand). A third participant did not acquire any secondary targets in the absence of primary targets and direct training. All participants had generalized responding to novel therapists and untrained Wh-questions. Responding maintained across 2- and 4-week probes for most participants, with some mild (e.g., less than 10% reduction) to moderate decrements (e.g., over 50% reduction in responding) observed. Finally, caregivers provided social validity ratings of the procedures used. Caregivers provided generally positive ratings of the procedures, but these ratings appeared to change once caregivers were shown how their individual child responded to each procedure. Specifically, caregivers tended to rate procedures that were effective for

their child more favorably following a review of their child's performance. Future directions for research and clinical applications of IF procedures are discussed.

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ACKNOWLEDGMENTS

There are many individuals I wish to acknowledge. I would like to thank Dr. Laura Lee for serving as my advisor, dissertation chair, and mentor. I also wish to thank Drs. Angela Whalen, Wendy Machalicek, and Tiffany Kodak for their supervision and teaching, each of you have shaped my identify as a clinician and scholar. Thank you, Drs. Stephanie Shire and Jeffrey Todahl for serving on my dissertation committee.

I also wish to express my gratitude to my peers and colleagues. Drs. Tracy Jane Raulston and Shaji Haq provided ongoing support regarding many technical aspects of this study. Their feedback has been invaluable. Christine Drew, Matthew Luehring, Buket Ertuk, Hannah Barton, and Tasia Brafford collected data and provided child care during the course of my dissertation. I appreciate your flexibility, input, words of encouragement, and the amount of time you each put into supporting this study.

Finally, I want to acknowledge the parents and children who participated in my study. Thank you for allowing me to work with your children, it was a privilege and an honor to get to know you and your children.

I dedicate this dissertation to my grandparents and my mentors – Drs. Laura Lee McIntyre and Angela Whalen.

To my grandmother, Patricia J. Zemantic, you have modeled such a strong love of learning and curiosity about the world, which I will carry with me always.

To my grandfather, Robert K. Zemantic, thank you for teaching me to have a sense of humor no matter what life throws my way. It's helped me to navigate so many of life's challenges.

To Drs. Laura Lee McIntyre and Angela Whalen, I could not have asked for better mentors than you. You are not just excellent scholars, clinicians, and teachers, but also two amazingly kind and strong human beings. I feel lucky to have worked with you and hope to work with each of you in the future.

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CHAPTER I

INTRODUCTION

Language and children with autism spectrum disorder

Autism spectrum disorder (ASD) is developmental disability affecting an estimated 1 in 59 children in the United States (Baio et al., 2018). It is characterized by symptoms organized into two broad categories (1) pervasive impairments in "social communication and social interaction", as well as (2) "restricted, repetitive patterns of behavior, interests, or activities" (American Psychiatric Association, 2013 p. 1). Despite changes in the diagnostic criteria used in the *Diagnostic and Statistical Manual of Mental Disorders* over time, impairments in language and communication have been a consistent component of the diagnostic criteria for ASD since the 1970's (Volkmar & Reichow, 2013).

Within the area of communication, the acquisition of vocal verbal behavior has been identified in the literature as a prevalent deficit for individuals with ASD (e.g. Anderson et al., 2007; Mody et al., 2013; Picket, Pullara, O'Grady, & Gordon, 2009; Wodka, Mathy, & Kalb, 2013). Between 25 to 30% of individuals with autism do not acquire fluent speech (Anderson et al., 2007; Mody et al., 2013; Picket et al., 2009; Wodka et al., 2013). Further, impairments in language broadly may impact other areas of functioning, such as the development of social skills over time (e.g., Anderson et al., 2007) and academic achievement (Durkin, Conti-Ramsden, & Simkin, 2012).

Effective Interventions for Children with ASD

Early and intensive interventions are recommended for young children with ASD (National Resource Council [NRC], 2001). This may be particularly important when it

comes to interventions that promote language acquisition for this population, as younger children may have a better response to interventions targeting language (Anderson et al., 2007; Pickett et al., 2009). Interventions based on the principles of applied behavior analysis are most strongly supported in the literature (ABA; NRC, 2001; National Autism Center [NAC], 2015).

Although there are treatment guidelines regarding the dosage, nature, and type of interventions provided to young children with ASD, several studies suggest that discrepancies between recommendations and actual practice persist (e.g., Downs & Downs, 2010; McIntyre & Zemantic, 2017; Wise, Little, Holliman, Wise, & Wang, 2010). For example, in their investigation of service utilization for young children with ASD, McIntyre and Zemantic (2017) examined service utilization for young children with ASD. Children were between the ages of about 3 and 5 ½ years of age. Although most children in the sample received some kind of educational or therapeutic services, the average number of service hours received was relatively low, with an average of about 13 hours per week. Children in the early intervention group (birth to 3) received the fewest number of services hour per week, with an average about 3 hours per week. Only children in kindergarten received near the 25 hours of intervention recommended by the NRC (2001) for young children with ASD; they received an average of about 23 hours per week. Additionally, children tended to receive a variety of services, including those with and without empirical support. Only about 22% of caregivers reported that their child received some type of behavioral programming or applied behavior analysis.

Services children with ASD receive appear to be discrepant from recommended guidelines in terms of dosage and also the types of services provided. Therefore, it's

important to identify ways to increase the efficiency of instruction when these children do have access to effective interventions in order to maximize learning.

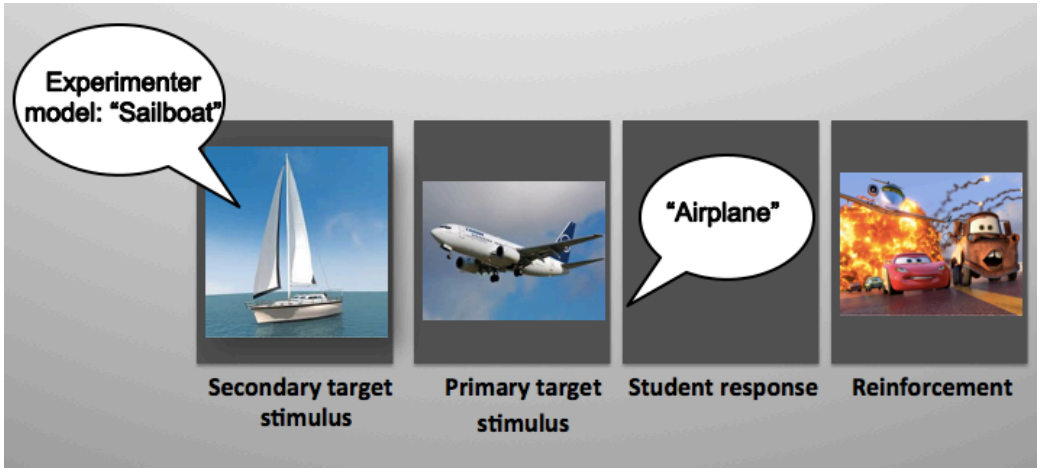
Instructive feedback

Instructive feedback is an instructional procedure used to increase the efficiency of instruction by embedding additional information, or secondary targets (Vladescu & Kodak, 2013), into learning trials (e.g., Nottingham, Vladescu, & Kodak, 2015). Secondary targets are presented without requiring a response from the learner, and no differential consequences are provided based on the learner's response. In the literature, secondary targets have been evaluated in the presence and absence of primary targets (e.g., Jones, Carroll, Cheatham, & Conlan, 2017; Vladescu & Kodak, 2013). For primary targets, learners are required to engage in a response and differential consequences, such as prompting and reinforcement, are provided based on the learner's response to primary targets (Nottingham, Vladescu, & Kodak, 2015)

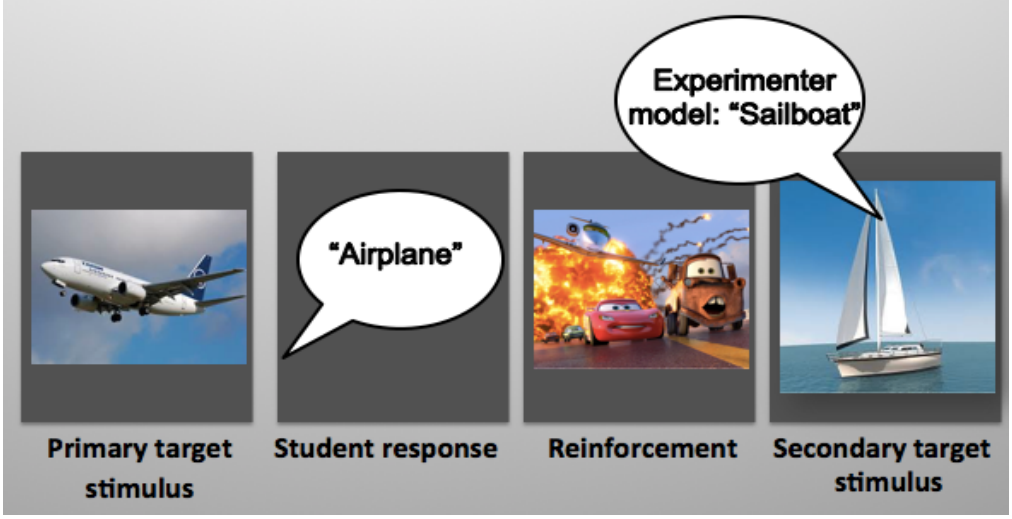
Procedural variations of instructive feedback. Three primary procedural variations of instructive feedback have been previously evaluated in the literature, including antecedent-based instructive feedback, consequence-based instructive feedback, and embedded instructive feedback (Nottingham et al., 2015). When implementing antecedent-based instructive feedback, the experimenter presents the secondary target at the beginning of the learning trial after attending has been secured (Nottingham et al., 2015; Vladescu & Kodak, 2013) and before presenting the primary target. In contrast, when implementing consequence-based instructive feedback, the experimenter presents the secondary target during the reinforcement interval (Nottingham et al., 2015; Vladescu & Kodak, 2013). In one variation of consequence-based instructive

feedback, the secondary target is presented after praise for responding to the primary target but immediately before the reinforcer is delivered (e.g., Loughrey, Betz, Majdalany, & Nicholson, 2014; Reichow & Wolery, 2011). In another variation of consequence-based instructive feedback, the secondary target is delivered immediately following the delivery of the reinforcer (e.g., Carroll & Kodak, 2015; Grow, Kodak, & Clements, 2017; Delmolino, Hansford, Bamond, Fiske, & LaRue; 2013). Embedded-instructive feedback has been less commonly investigated in the instructive feedback literature (e.g., Fiscus, Schuster, Morse, & Collins, 2002; Groskreutz, Karsina, Miguel, & Groskreutz, 2010). In this procedural variation, the experimenter embeds secondary targets within instruction for primary targets, such as in the antecedent verbal stimulus.

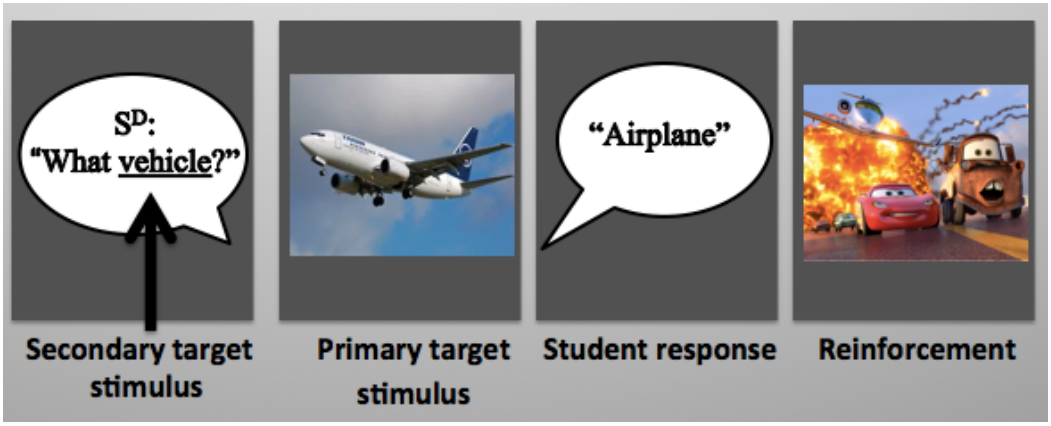
Model of antecedent-based feedback



Model of consequence-based instructive feedback



Model of embedded-instructive feedback



Applications of instructive feedback for people with disabilities. Werts, Wolery, Holcombe, and Gast (1995) reviewed 23 studies investigating instructive feedback for individuals with a variety of disabilities, such as intellectual disabilities (e.g., Gast, Wolery, Morris, Doyle, & Meyer, 1990), ASD (e.g., Wolery, Schuster, & Collins, 2000), and behavioral disorders (e.g., Werts, Wolery, Holcombe, & Frederick, 1993). In these studies, instructive feedback was provided in one-to-one (Gast, Doyle,

Wolery, Ault, & Farmer, 1991), small group (e.g., Gast, Wolery, Morris, Doyle, & Meyer, 1990), and large group settings (e.g., Werts, Wolery, Venn, Demblowski, & Doren, 1996). In the review by Werts et al. (1995), they found that the inclusion of secondary targets did not interfere with acquisition of primary targets and that the inclusion of secondary targets typically increased the efficiency of instruction by either (1) resulting in acquisition of secondary targets in the absence of instruction (e.g., Holcombe, Wolery, Werts, & Hrenkevich, 1993) or (2) fewer treatment sessions to mastery compared to primary targets, once direct treatment of secondary targets was introduced (e.g., Gast et al., 1991). Participants also appeared to have similar benefits when two secondary targets were included within each learning trial (Gast, Doyle, Wolery, Ault, & Kolenda, 1994).

A third of studies reviewed by Werts and colleagues (1995) included measures maintenance of responding (e.g., Gast et al., 1994). Although findings were mixed, maintenance of secondary targets was stable for a large portion of participants but increased over time for some participants and decreased over time for others. Maintenance of responding for group based instructive feedback reported for groups as a whole, indicated either stable responding in maintenance or increasing responding over time (e.g., Gast et al., 1994).

Instructive feedback for individuals with ASD. More recently, a number of studies have evaluated the use of instructive feedback for children with ASD specifically (Carroll & Kodak, 2015; Grow et al., 2016; Delmolino et al., 2013; Haq, Kodak, Yosick, Zemantic, & Schillingsburg, in preparation; Haq, Zemantic, Kodak, LeBlanc, & Ruppert, 2017; Jones, Carroll, Cheatham, & Conlan, 2017; Leaf et al., 2016; Ledford, Gast,

Luscre, & Ayres, 2008; Loughrey et al, 2014; Nottingham, Vladescu & Kodak, 2013; Nottingham, Vladescu, Kodak, & Kisamore, 2017; Vladescu & Kodak, 2013; Tullis, Frampton, Delfs, and Shillingsburg, 2016; Reichow & Wolery, 2011). Targets have included tacts (e.g., Delmolino et al., Haq et al., 2017; Jones et al., 2017; Leaf et al, 2016; Ledford et al., 2008; Nottingham et al., 2017; Reichow & Wolery, 2011; Tullis et al., 2016; Vladescu & Kodak, 2013), intraverbals (e.g., Caroll & Kodak, 2015, Haq et al., 2017, Haq et al., in preparation; Jones et al., 2017), play behavior (i.e., motor response; Grow & Kodak), and listener responding (e.g., Loughrey et al., 2014; Tullis et al., 2016). In most studies, instructive feedback was provided in a one-to-one setting except for a few studies (i.e., Delmolino et al., 2013; Leaf et al., 2016, Ledford, et al., 2008). Leaf et al. (2017) provided instruction in small groups, while Ledford et al. (2008) and Delmolino et al. (2013) provided instruction in dyads.

With the exception of Tullis et al. (2016) and Grow et al. (2016) the studies cited above have all investigated primary and secondary targets that are related. Related targets, or expansion targets, are primary and secondary targets that are related in terms of the response type (i.e., tacts, intraverbals, listener responding, etc.) or concept (i.e., vehicles, vegetables, tools). In contrast, primary targets and secondary targets were unrelated, or novel targets, in the studies conducted by Tullis and colleagues (2016) and Grow and colleagues (2016). Novel targets describe primary and secondary targets that are unrelated in terms of the response type or concept. For example, primary targets involve a listener response and secondary targets involved a vocal verbal response in the study completed by Tullis and colleagues (2016). Specifically, participants touched or handed a picture depicting a problem in response to the antecedent verbal stimulus (i.e.,

Where is the problem?) for primary targets. Next, the secondary target was presented, which was a vocal model of the problem explanation (e.g., the batteries are missing).

These recent investigations of instructive feedback for learners with ASD have produced inconsent results (e.g., Delmolino et al., 2013; Haq et al., 2017; Reichow & Wolery, 2011; Vladescu & Kodak, 2013). Reichow and Wolery (2011) evaluated the efficacy of instructive feedback to teach Spanish or English sight words to four young children with ASD. They used a progressive prompt delay to teach primary targets with and without secondary targets. When secondary targets were included, they were embedded during the consequence portion trials. All participants acquired at least one set of secondary targets. Responding during maintenance probes completed approximately two months after the intervention was variable across and within participants. However, this study did not conduct probes of secondary targets following each session in which they were embedded into learning trials but instead conducted probes after primary targets were mastered. Thus, it's unclear the specific session in which secondary targets were mastered. Additionally, all maintenance probes were conducted at a single point in time. This resulted in differences between the time that target sets were mastered and maintenance probes were completed.

Delmolino et al. (2013) evaluated the effectiveness of instructive feedback for children with ASD. Participants included three young children (i.e., 5-8 years old), and one adolescent (i.e., 13 years old). Participants also had intellectual impairment. Primary targets were tacts and secondary targets were intraverbals. A multiple-probe design was utilized, such that probes were conducted following every 3 to 5 teaching sessions. One participant acquired one set of secondary targets out the three secondary target sets

presented without direct treatment. During subsequent direct treatment of secondary targets, two participants required the same or fewer sessions to acquire secondary targets compared to primary targets, indicating that exposure to secondary targets resulted in more rapid acquisition during subsequent exposure to treatment. For the other participants, this pattern was less clear. Some sets of secondary targets required a greater number of sessions of treatment compared to primary targets to achieve mastery, and other sets of secondary targets required fewer sessions of treatment to achieve mastery. Because probes of primary and secondary targets were not conducted following every treatment session, it makes it difficult to identify the specific session in which primary and secondary targets were mastered. Thus, comparisons regarding efficiency in terms of number of sessions to mastery are imprecise. Maintenance and generalization were not evaluated.

In another study, Vladescu and Kodak (2013) evaluated the effectiveness and efficiency of instructive feedback to teach tacts or intraverbal fill-in-the blank statements to four young children with ASD. Like Reichow and Wolery (2011), they used a progressive prompt delay to teach primary targets. They compared four conditions, including antecedent-based instructive feedback, consequence-based instructive feedback, primary targets only, and secondary targets only. Three out of four participants acquired secondary targets without direct treatment. Additionally, for these participants, responding was consistent across all conditions including secondary targets. Thus, embedding secondary targets in either the antecedent or consequence portions of learning trials, or presenting secondary targets in isolation, appeared to be equally effective in producing acquisition of secondary targets.

Vladescu and Kodak (2013) also collected data on whether participants correctly echoed secondary targets. They defined echoic behavior as the "participant correctly imitating the expermenter's vocal model of the secondary target within 5 s" (p. 807). Participants who acquired secondary targets without direct treatment engaged in a correct echo following the presentation of secondary targets between 93% to 100% of the trials in which secondary targets were presented. In contrast, the participant for whom instructive feedback was not effective engaged in a correct echo following the presentation of secondary targets between 85% to 90% of the trials. Kodak and Vladescu (2013) conducted secondary target probes every one to three sessions of treatment to monitor acquisition of secondary target probes. For this reason, it's unclear at what point participant's mastered secondary targets because secondary target probes were not conducted following every session in which secondary targets were presented.

Haq et al. (2017) examined variables that may impact participants' response to instructive feedback procedures. Participants were two children with ASD. Primary and secondary targets were either tacts (i.e., common household items, Transformers™) for one participant, and fill-in-the-blank intraverbals for the other participant. Consequence-based instructive feedback was implemented for both children. One participant had relatively high levels of echoic behavior during consequence-based instructive feedback, but relatively low levels of attending to secondary targets (i.e., an average of 41% of trials). This participant did not acquire secondary targets without direct treatment. In a subsequent set of primary and targets, this participant was required to attend to secondary targets. He had a somewhat better response to instructive feedback under these conditions and acquired two out of three secondary targets without direct treatment but never

acquired the third secondary target in the set even after 9 sessions of direct treatment. Finally, antecedent-based instructive feedback was implemented for a third set of primary and targets. Attending to secondary targets was at nearly 100% without prompting during this procedural variation. He had some correct responding to secondary targets, and subsequently acquired secondary targets following only 3 sessions of direct treatment.

The other participant acquired the first two sets of secondary targets without additional instruction and moderate levels of echoic behavior (i.e., 69%, 66%). However, in a subsequent set of secondary targets, echoic behavior was variable during sessions and relatively low (i.e., 42%). Experimenters then began requiring an echo following the presentation of secondary targets; however, there was a particular secondary target that she would not echo and she never acquired that secondary target.

Overall, these results suggest that acquisition of secondary targets may relate to learner characteristics, such as echoic behavior and attending. Procedural variations based on these characteristics, such as the location of secondary targets, or requiring some learner responses (i.e., echoic behavior or attending) may enhance the efficacy of instructive feedback.

Maintenance and generalization of instructive feedback procedures. A growing number of instructive feedback studies have included evaluations of maintenance (e.g., Haq et al., in preparation; Leaf et al., 2017, Reichow & Wolery, 2011; Tullis, 2016) and generalization (e.g., Grow et al., 2016; Haq et al., 2017; Ledford et al., 2008). Despite including evaluations of maintenance and generalization, few of these evaluations were systematic with the exceptions of Haq and colleagues (in preparation) and Grow and colleagues (2016). This makes analysis of these learner outcomes

challenging. For maintenance, there are differences in the duration between mastery of targets and when probes were conducted across participants (e.g., Leaf et al., 2017; Reichow & Wolery, 2011), or study authors failed to specify when maintenance probes were conducted in relation to the acquisition of primary or secondary targets (Tullis et al., 2017).

Generalization has been less extensively evaluated in the instructive feedback literature (e.g., Grow et al., 2016, Haq et al., in preparation; Ledford et al., 2008). Studies have evaluated generalization of secondary targets to a different setting (i.e., instructional setting vs. play setting; Grow et al., 2016), the emergence of responding to untrained Wh-questions presented by known and novel therapists (i.e., Haq et al., in preparation), as well as generalization of tacts in response to untrained visual stimuli located in an instructional setting (i.e., sight words on signs; Ledford et al., 2008).

Haq and colleagues (in preparation) systematically evaluated generalization and maintenance of primary and secondary targets. Primary and secondary targets were intraverbal fill-in-the blank statements. Generalization targets were untrained Wh-questions. Responding to primary, secondary, and generalization targets was probed two and four weeks after stimulus sets were mastered. Overall, maintenance during responding to primary targets was higher but more variable across participants when compared to secondary targets. The outcomes for generalization were less consistent across participants. For one participant, responding to primary (i.e., 90 to 100%) and secondary (i.e., 90%) generalization targets was similar. A second participant had much lower responding to primary targets (i.e., 30%) compared secondary targets (i.e., 70%). For a third participant, responding during generalization probes to primary targets was

variable (i.e., 50 to 100%) and high for secondary targets (i.e., 90%).

B**ehavioral mechanisms.** Although the underlying behavioral mechanisms that contribute to the acquisition of secondary targets are unclear, a number of mechanisms have been posited in the literature, including observational learning (Wolery, Werts, & Holocombe, 1993; Nottingham, 2015), learner characteristics and repertoires (Nottingham, 2015; Vladescu & Kodak, 2013), indiscriminable contingencies (Nottingham, 2015; Vladescu & Kodak, 2013), and demand characteristics (Jones, Carroll, Cheatham, & Conlan, 2017; Nottingham et al., 2015; Vladescu & Kodak, 2013; Wolery, et al., 1993).

Instructive feedback typically involves repeated presentations of the secondary target. Thus, some suggest that acquisition of secondary targets relates to observational learning; that is, the learner acquires the secondary targets by observing the relevant discriminative stimulus paired with the target response (e.g., Nottingham, et al., 2015; Wolery, et al., 1993). As pointed out by Nottingham and colleagues (2015), learners have acquired stimuli in an experimental condition where incorrect responses resulted in a model of the correct response only (Kodak et al., 2016; McGhan & Lerman, 2013). Participants in this condition were not required to respond to the model of the correct response, and differential consequences were not provided based on participants' responses to the prompt. Kodak et al. (2016) evaluated the effects of this procedure on the acquisition of tacts of sight words or prepositions. While three participants benefited from the procedure, one participant did not. The one participant for whom this procedure was not effective, rarely echoed the target response when a prompt was delivered, whereas the three participants for whom the procedure was effective, engaged in an

echoic response during nearly every presentation.

Learner characteristics, such as echoic behavior, may play a role in acquisition of instructive feedback (Nottingham, et al., 2015; Haq et al., 2017; Vladescu & Kodak, 2013). Specifically, individuals who have a generalized imitative repertoire may be more likely to imitate reinforced and non-reinforced behaviors (Nottingham et al., 2015). When primary and secondary targets are presented, the different contingencies in place (i.e., reinforcement or non-reinforcement) may be indiscriminable. This may contribute to responding to secondary targets (i.e., echoic behavior, emitting the target responses during probes) even in the absence of reinforcement. However, the inclusion of data on echoic behavior, or attempts of participants to imitate secondary targets in some way, is less commonly included in studies (e.g., Carroll & Kodak, 2016; Grow et al., 2016; Haq et al., 2017, Vladescu & Kodak, 2013).

The location of the secondary target within learning trials may also impact the ability of learners to discriminate the different contingencies in place for responding to primary versus secondary targets. Specifically, given the temporal proximity of the presentation of secondary targets to the reinforcer in consequence-based instructive feedback, learners may not discriminate that responding to the primary target results in the delivery of the reinforcer, rather than a response to the secondary target. Operant conditioning is also a behavioral mechanism that may play a role in acquisition of secondary targets, although this has not been directly mentioned in the literature. Specifically, in consequence-based instructive feedback, the secondary targets are repeatedly paired with the presentation of a reinforcer. Overtime, the secondary targets may become a conditioned reinforcer, which could impact participants' responding to

secondary targets.

Demand characteristics may also play a role in the acquisition of secondary targets (Vladescu & Kodak, 2013; Wolery, et al., 1993; Jones, Carroll, Cheatham, & Conlan, 2017; Nottingham et al., 2015). All the previously mentioned studies evaluating instructive feedback for children with ASD have been completed in instructional settings. It's possible that learners have a history of responding under these stimulus conditions (i.e., sitting at table or desk, working in a classroom or clinic room), including attending and responding to various demands (Vladescu & Kodak, 2013; Nottingham et al., 2015). Only one study has evaluated the effects of demand characteristics on the acquisition of secondary targets for children with ASD (Jones et al., 2017) by manipulating the context in which secondary targets were presented.

Jones and colleagues (2017) evaluated the effectiveness of instructive feedback on the acquisition of tacts and intraverbals for three young children with ASD who had generalized imitative and echoic repertoires. Four experimental conditions were implemented, including prompt delay (PD), prompt delay with instructive feedback (PD-IF), instructive feedback at the table (IF-Table), and instructive feedback play (IF-Play). The PD condition included primary targets only. In this condition, correct responses to primary targets resulted in praise and access to a preferred item. The PD-IF condition was identical to the PD condition, except that secondary targets were embedded in the consequence portion of learning trials.

The IF-Table and IF-Play conditions included secondary targets only. In the IF-Table condition, secondary targets were presented in between a 5 s inter-trial interval in an instructional area while the experimenter and participant were seated at a small table.

Preferred items were provided for appropriate session behavior (e.g., sitting nicely in a chair). In the IF-Play condition, secondary targets were presented once every 25 s in a play area while four play activities were freely available. Participants were not required to respond to secondary targets, nor were differential consequences provided if responses to secondary targets occurred. Participants were required to attend to any discriminative stimulus that included a visual stimulus. Attending was secured by holding the stimulus in close proximity to participants. In the IF-Play condition this occasionally involved placing the stimulus close to the participant's face in front of play items. Secondary target probes were performed once after each condition that included secondary targets was completed to measure the acquisition of secondary targets.

Two participants acquired secondary targets without direct treatment. For one participant, the IF-Table condition was more efficient that the IF-Play condition, indicating that the context in which secondary targets were presented played a role in acquisition. For the other participant, there was no difference in efficiency of acquisition between the IF-Table and IF-Play conditions.

Similar to other studies on instructive feedback (i.e., Reichow & Wolery, 2011), the inclusion of secondary targets in the PD-IF condition appeared to increase the efficiency of acquisition of primary targets. Specifically, all participants acquired primary targets in fewer sessions in the PD-IF condition compared to the PD condition.

Several limitations were present in the study conducted by Jones and colleagues (2017), including the frequency with which secondary target probes were conducted, failure to report data on echoic behavior, and differences between the IF-Table and IF-Play conditions. Secondary target probes were not conducted following every session that

included the presentation of secondary targets. This prevents our ability to accurately identify the number of sessions to mastery for secondary targets. Without this information, accurate comparisons of efficiency in terms of sessions to mastery for primary and secondary targets cannot be made. Moreover, echoic behavior has been suggested as a variable that may impact the efficacy of instructive feedback on acquisition of secondary targets (Haq et al, 2017; Vladescu & Kodak, 2013). Echoic behavior may have differed during the instructive feedback conditions and may account for the differences in participants' acquisition of secondary targets. That is, echoic behavior may serve as a self-delivered practice opportunity and, in this manner, promote acquisition.

The purpose of the instructive feedback only conditions was to make direct comparisons about the effect of the context on acquisition of secondary targets; however, these conditions differed in several ways besides context. Difference included the duration of the inter-trial interval, the presence and selection of toys, and the delivery of reinforcers for appropriate session behaviors. Shorter inter-trial intervals (i.e., 2 s) have been shown in the literature to result in more efficient acquisition in comparison to longer inter-intervals (i.e., 20 s; Cariveau, Kodak, & Campbell, 2016), which could have provided an advantage in the IF-Table condition.

No information was provided about how toys were selected for inclusion during the IF-Play condition. It's unclear whether these items were preferred. Although access to toys was not blocked specifically during the presentation of secondary targets, on trials where the participant did not attend to secondary targets that included a visual stimulus, the experimenter placed the visual stimulus close to the participant's face to secure

attending. Securing attending in this manner and in this context, could be conceptualized as temporarily blocking access to toys. Next, the experimenter provided a vocal model of the response, which was immediately followed by the removal of the visual stimulus, which resulted in the participant gaining access to the toys. Attending to the visual stimulus might then be repeatedly paired with blocked access to toys and the removal of the visual stimulus would be associated with gaining access to toys. On the other hand, the vocal model of the correct response would then be associated with gaining access to toys. Since no toys were present in the IF-Table condition, there were not be the same opportunities for these behavioral relationships to occur. Finally, appropriate session behaviors (i.e., sitting quietly) were reinforced during the IF-Table condition and no reinforcers were delivered in the IF-Play condition for appropriate behaviors. The relative availability of reinforcement may also have impacted responding.

Limitations of Extant Literature

The behavioral mechanisms that account for acquisition of secondary targets during instructive feedback are unclear, although it's likely that there are multiple behavioral mechanisms at play (e.g., Haq et al., 2016; Nottingham et al., 2015; Vladescu & Kodak, 2013; Wolery, Werts, & Holocombe, 1993). Learning history is one behavioral mechanism that may account for this phenomenon; that is, participants attend to and respond to secondary targets because they have a history of receiving reinforcement for these behaviors in a specific context. Only one study has attempted to directly evaluate the effects of context on the acquisition of secondary targets (i.e., Jones et al., 2017). Due to the procedures utilized, there were differences present in the two comparison conditions that may have contributed to differences in the acquisition of secondary targets

unrelated to the contexts in which secondary targets were presented, including duration of inter-trial intervals, presence of toys, and reinforcement for appropriate session behavior. In addition to context, other learner characteristics may also play a role (e.g., Haq et al., 2016; Vladescu & Kodak), such as the occurrence of echoic behavior in response to the presentation of secondary targets. Jones et al., 2017 did not report data on echoic behaviors; therefore, it's unknown whether differences in context lead to differences in echoic behavior, and impacted acquisition of secondary targets. Finally, secondary target probes were not conducted following every session that included secondary targets but rather very two sessions. This means that the specific session in which secondary targets were mastered is unknown and that any comparisons made regarding sessions to mastery are imprecise.

The majority of research has evaluated the effectiveness of instructive feedback, rather than including multiple measures of efficiency, such as sessions to mastery or exposures to stimuli. Exposures to stimuli, that is, how many times each stimulus is paired with a model of the correct response, may be an important dimension of efficiency, especially for practitioners when selecting intervention procedures. Both of these measures of efficiency have become more prevalent in skill acquisition research (e.g., Kodak et al., 2016; McGhan & Lerman, 2013). Although graphical displays of correct responding to primary targets and secondary target probes may allow for comparisons of the number of sessions to mastery for primary and secondary targets, this can be impacted based on the frequency of secondary target probes. Specifically, in some studies secondary target probes were not conducted following each session in which secondary targets are embedded, meaning that only secondary target probes conducted

every few sessions are displayed graphically. Conducting secondary probes following every session that includes the presentation of secondary targets, as well as presenting graphical displays depicting the number of sessions to mastery and the number of exposures to stimuli, enhances our ability to make comparisons regarding the efficiency of instructive feedback.

Learners with ASD in particular may have difficulty maintaining and generalizing skills (Lovaas, Koegel, & Schriebman, 1979) and there is a need to identify effective interventions that promote these two outcomes (National Research Council, 2001). The available data regarding maintenance and generalization for primary and secondary targets exposed to instructive feedback procedures is limited, and few studies have gathered both maintenance and generalization measures systematically (i.e., Haq et al., in preparation). Finally, no studies to date have evaluated the social validity of instructive feedback procedures for learners with ASD.

Summary

Children with ASD often experience impairments in the development of vocal verbal behavior (Anderson et al., 2007). Despite recommendations regarding intervention dosage and intensity, children with ASD tend to receive far fewer hours of intervention than recommended (e.g., Downs & Downs, 2010; McIntyre & Zemantic, 2017; Wise et al., 2010). Therefore, there is a need to identify effective and efficient procedures for producing the development of vocal verbal behavior for this population. Although instructive feedback has been an effective procedure for increasing the efficiency of instruction, the behavioral mechanisms that contribute to the acquisition for secondary targets are unclear. Evaluating the effect of context on the acquisition of secondary

targets will add to the body of literature regarding investigations of the underlying behavioral mechanisms that may contribute to the effectiveness and efficacy of instructive feedback.

Study Purpose and Research Questions

The purpose of the present study was to extend the work of Jones et al., (2017) to evaluate the effect of context on the acquisition of secondary targets. Echoic behavior in response to secondary targets were measured, secondary target probes were conducted following each session in which secondary targets were presented, multiple measures of efficiency were collected and graphically displayed, maintenance and generalization were evaluated systematically. Finally, socially validity was evaluated by caregivers.

Research questions: Three primary research questions were evaluated within the experimental single-case design; bar graphs were used to provide additional models of efficiency and a table was used to display echoic behavior.

1. Is there a difference in the effectiveness of instructive feedback on the acquisition of secondary targets in a high demand versus a low demand context for individuals with ASD?
2. What condition is the most efficient procedure for producing acquisition of targets?
3. Does echoic behavior vary by condition?

Six non-experimental secondary research questions were evaluated through use of pre-test posttest comparisons, or post-tests only.

1. How well do primary and secondary targets generalize to untrained Wh-questions?

2. How well do primary and secondary targets generalized to untrained Wh-questions presented by a novel experimenter?
3. How well do primary and secondary targets maintain 2 to 4 weeks post-mastery?
4. How well do generalization targets maintain 2 to 4 weeks post-mastery?
5. What condition do caregivers rate as most socially valid?
6. Will caregivers' social validity ratings change following the receipt of information regarding their child's response to each condition?

CHAPTER II

METHODS

Participant Inclusion Criteria

This study included three child participants – Eric, Joel, and Gary – who were between the ages of 3 and 7 years old. All three participants had medical diagnoses and educational eligibilities of ASD, generalized tact and echoic repertoires, and no problem behavior or mild problem behavior. To be included in the study child participants were a) between the ages of 3-7 b) have a medical diagnosis or educational eligibility of ASD c) perform at a level 2 or above on the Tacts subdomain of the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP) and within level 2 of the Early Echoic Skills Assessment (EESA) d) have no problem behavior or mild problem behavior.

Recruitment Procedures

After receiving approval from the University of Oregon's Institutional Review Board, a brochure that described the purpose of the study, eligibility criteria of the study, and study requirements was placed in the Eugene Weekly and disseminated by professionals at Early Childhood Cares and at Bethel School District to families of children with ASD between the ages of 3 and 7. A total of 140 brochures were disseminated through these agencies. Brochures were also placed on public message boards at local businesses (e.g., Capella's, Connect-the-Dots, Tsunami Books). Participants were also recruited from caregivers on the waitlist to obtain services or who were currently obtaining services through the HEDCO Autism Research and Treatment Center (HART Center). Three caregivers contacted the lead researcher via phone or email

and indicated interest in having six children participate in the study. Two caregivers were contacted through the HART Center by the lead researcher.

Screening Procedures

A brief questionnaire containing 13 questions was administered to five caregivers regarding a total of six children to determine if children met initial inclusionary criteria, and included some items adapted from the (VB-MAPP; Sundberg, 2008). The lead experimenter administered the questionnaire via phone to four caregivers and in-person to a fifth caregiver, as this caregiver was present at the HART center for activities unrelated to the present study. The following questions were asked: 1) Are you at least 18 years of age? 2) Do you have legal and educational rights over the child you are interested in having participate in this study? 3) Does your child have a medical diagnosis of ASD or educational eligibility of autism? 4) Does your child have any hearing or vision problems that would prevent them from being able to see pictures or hear basic directions? 5) Does your child experience any physical challenges that would prevent them from sitting in a chair at a table or playing with toys on the floor? 6) Are you willing to drop your child off at a university clinic two to four times per week for two to two and half hour appointments over the course of about 12 weeks? 7) Does your child communicate using vocal speech (e.g., talking in words)? 8) Does your child have difficulty describing, labeling, and answering questions about things in their environment? For example, details about items (e.g., an orange has a peel) 9) Can they imitate simple sounds? (e.g., wow, bee, oo)? 10) Can they imitate two syllable sounds? (e.g., baby, window, mommy)? 11) How many different items can they label? 12) Does your child have problem behavior? If yes, tell me what this looks like? 13) Are you or

your child currently enrolled or planning to enroll in any other research studies designed to promote language in children?

Caregivers who met the following criteria were invited to participate in an in-person intake at the HART Center: the caregiver answered a) "yes" to the first 3 questions, b) "no" to questions 4 and 5 c) "yes" to questions 6 through 10, and d) the answer to item 11 is 20 or more but not greater than 500, e) the child has mild or no problem behavior, and f) planned or current enrollment in other research studies does not provide language interventions that are likely to promote tacts or intraverbals.

Four children were retained at this level. Two children were excluded because the caregiver was unable to transport their children to and from the HART Center for appointments.

Exceptions relating to moderate or intense problem behavior were made if the problem behavior occurred rarely or under conditions that were unlikely to occur in the context of the present study for three children. Problem behaviors reported by three caregivers included elopement and self-injury (e.g., hitting head against objects with force but did not leave marks). One child was in the process of receiving behavioral services through HART Center, so it was unclear whether problem behavior would continue in this setting with behavioral supports in place. The caregiver for this child also indicated that the child's language may be too high to benefit from the study, but that he did have some difficulty responding to questions; thus, an exception was made in order to gather further information about language. Thus, a total of four caregivers were invited to complete an in-person intake at the HART Center with the lead researcher.

Informed consent was obtained during the in-person intake completed at the HART Center. Then selected domains of the Verbal Milestones Assessment and Placement Program (Sundberg, 2008; Tacts, Motor Imitation, Listener Responding By Feature Function Class, Listener Responding, Intraverbals, and the EESA) were administered to children across one to three appointments. For two children, VB-MAPP assessments were updated since they had recently been assessed by staff members of the HART Center. Three children who performed within level 2 of the Tacts subdomain and within level 2 of the EESA were retained. A fourth child performed was a level 3 learner across selected subdomains and a level 2 on the EESA. He frequently manded for information from multiple adults while in clinic (e.g., What is sedimentary rock?) and did not demonstrate difficulty answering questions. He was also able to use electronics to access information. He was not retained for the present study, as programming more appropriate to his skill level was available to him at the clinic, including reading and basic math programming.

Screening Measures

The Verbal Behavior Milestones Assessment and Placement Program. The VB-MAPP (Sundberg, 2008) is designed to assess verbal behavior in children with language delays, autism spectrum disorder, and other developmental disabilities. Selected domains of the VB-MAPP Milestones Assessment were completed, including Tacts, Motor Imitation, Listener Responding By Feature Function Class, Listener Responding, and Intraverbals. Performance within each domain was evaluated using a combination of caregiver report, direct testing, and observation. Ratings for each domain correspond to the developmental age at which children are expected to perform skills. Level 1 refers to

skills typically acquired between 0-18 months, Level 2 refers to skills typically acquired between 18-30 months, and Level 3 refers to skills typically acquired between 30-48 months. The Early Echoic Skills Assessment (EESA) subtest is included in the VB-MAPP Milestones Assessment. The EESA evaluates the extent to which children can a) echo one, two, and three syllable sounds and words, as well as b) imitate phrases while matching prosody, pitch, loudness, and duration. For the EESA, the maximum rating is a Level 2. The VB-MAPP is one of the most commonly used curriculum-based ABA assessments (Gould, Dixon, Najdowski, Smith, & Tarbox 2011). However, limited validity and reliability data are available. External validity is high between the VB-MAPP and other verbal measures (r = .83; Dixon, Belisle, Stanley, Rowsey, Darr, & Szekely, 2015). Construct validity and reliability was promising based on the evaluation of the intraverbal subdomain conducted by (Sundberg & Sundberg, 2010).

Pre-baseline Procedures

Immediately after informed consent was obtained, caregivers completed the Reinforcer Assessment for Individuals with Severe Disability (RAISD, Fisher, Piazza, Bowman, & Amari, 1996) to identify potential items to include during subsequent direct assessments of child preference. Caregivers also completed a brief demographic and educational information survey, the Vineland Adaptive Behavior Scale – 3rd Edition, Survey Interview Form (Vineland III; Sparrow, Cicchetti, & Saulnier, 2016), and the Childhood Autism Rating Scale – 2nd Edition (CARS2; Schopler, Van Bourgondien, Wellman, & Love, 2010) during a subsequent appointment. These measures were completed by two caregivers in person or via phone, depending upon caregiver preference with a lead researcher. The demographics and educational questionnaire

obtained basic demographic data about the child (i.e., age, gender, race, ASD diagnosis) and caregiver, as well as information about the child's current and prior educational services. The Vineland-3 was used to obtain information about the child's adaptive functioning. The CARS2 was used to gain information about the severity of autism symptomatology.

Pre-baseline measures administered to the participants included either two or three paired stimulus preference assessments (Fisher e al., 1992) to identify hierarchies of items that may function as reinforcers and pre-test probes to identify items for each condition.

Pre-baseline Measures

The Reinforcer Assessment for Individuals with Severe Disability. The RAISD (Fisher et al., 1996) is a structured interview that asks caregivers of individuals with disabilities to identify potential reinforcers across various categories of stimuli (i.e., visual, auditory, olfactory, tastes, etc.). Caregivers were then asked to identify and rank items, and to indicate any reinforcers they do not want provided to their child.

Demographic and educational information survey. A brief demographics and educational information survey were completed as an interview with the caregiver. It was adapted from McIntyre and Zemantic (2017). Items include basic demographic information about the child (i.e., age, race, gender) and caregiver, as well as information about the child's current and prior educational services (Appendix A)

Vineland Adaptive Behavior Scale – 3rd Edition. The Survey Interview Form of the Vineland-3 (Sparrow et al., 2016) includes 502 items, although not all items are typically administered, and takes between 35 to 40 minutes to complete. Results are

provided in the form of *v*-scale scores with a mean of 15 and a standard deviation of 3 in the domains of communication, daily living skills, socialization, and motor skills. Performance across the domains is combined to provide the Adaptive Behavior Composite, which is reported in the form of standard scores with a mean of 100 and a standard deviation of 15. Internal consistency reliability for the Comprehensive Interview Form is strong across domains (Communication α = .95; Daily Living Skills α = .94; Socialization α = .96; Motor α = .96), as well as for the Adaptive Behavior Composite (α = .98; Sparrow et al., 2016).

The Childhood Autism Rating Scale – 2nd Edition. The CARS2 Standard Version includes 15 items that relate to a domain of behavior that may be impaired in individuals with ASD (e.g., relating to people, adaptation to change, verbal communication). Items are rated on a 7-point numerical scale, where a one indicates that the child is functioning within normal limits, and a four indicates that the child is functioning in an abnormal or severe range compared to same-age peers (Schopler et al., 2010). Assessors may assign half points when the child's functioning falls between categories (i.e., 1.5, 2.5, 3.5). Scores for each domain are combined to yield an overall score ranging from 15 to 60 and scores 30 or above are considered within the "autistic" range. The CARS-ST has strong internal consistency reliability (α = .93; Vaughan, 2011) and strong concurrent validity with another measure of autism symptomatology, the Autism Diagnostic Observation Schedules (α = .79; Vaughan, 2011).

Paired Stimulus Preference Assessment. The Paired Stimulus Preference Assessment (Fisher et al., 1992) is a direct assessment of preference wherein items identified as potential reinforcers are presented in pairs to an individual until every item

has been presented with all other items. This results in a hierarchy of items that are likely to function as reinforcers. Data are collected on approach behaviors (e.g., positive vocalizations, smiling), consumption responses (e.g., eye contact, eating item) and avoidance behaviors (e.g., pushing item away, moving away from item). The number of times each item is approached and consumed is divided by the total number of times the item was presented. The quotient was then multiplied by 100 to yield a percentage. Paired stimulus preference assessments were conducted for participants to identify hierarchies of edibles and tangible items. For one participant (Gary), paired stimulus preference assessments were conducted for large (e.g., medium sized toys, play sets) and small tangibles (e.g., toys that could be held in one hand), as well as edibles because his mother indicated a history of food selectivity, which suggested edibles may not be effective reinforcers.

Participant Demographics

Child and parent demographic information are presented in Tables 1 and 2. Eric was a 7-year, 11-month-old White/Hispanic male with both a medical diagnosis of ASD, as well as educational eligibilities of ASD and communication disorder. He attended a public school and was primarily served in an English Language Development program but attended specials with his general education class. He received speech language therapy twice per month. Most of Eric's skills were classified as Level 2 or Level 3 on the VB-MAPP. For Tacts, Listener Responding Feature Function Class, and Intraverbals he was classified as a Level 3 learner. For Motor Imitation, Listener Responding, and EESA he was classified as a Level 2 learner. Although Eric performed within level 3 of the VB-MAPP, during the assessment he had some spontaneous language (i.e., 1-3 word

phrases), and had difficulty discriminating among different types of questions. For example, tacting an item when asked to provide the function of an item. He also had a stutter which impacted the fluency of his speech production. His adaptive behavior composite on the Vineland-3 placed him in the low range. His raw score on the CARS2 was a 28.5, which placed him in the mild-to-moderate range for autism symptoms. Eric engaged in motor stereotypy during sessions, which looked like body rocking, body tensing, and hand flapping. However, motor stereotypy was typically easily redirected by prompting Eric to put his hands in his lap. Sheila, his biological mother, was a White 32-year-old female. Her highest education level was a bachelors degree in Spanish. She was employed full-time and reported that her family *only had to worry about money for fun or extras.*

Joel was a 7-year, 11 month-old Black male with both a medical diagnosis of ASD and educational eligibility of ASD. He was homeschooled, received neurofeedback 4 times per month, and respite services about 5 days per week. Most of Joel's skills were classified as Level 1 or Level 2 on the VB-MAPP. For Tacts, Motor Imitation, and EESA he was classified as a Level 2 learner. For Listener Responding, Listener Responding Feature Function Class, and Intraverbals, he was classified as a Level 1 learner. Joel required persistent prompts to respond during the VB-MAPP and did not engage in any spontaneous language that was not stereotyped in nature. Specifically, he repeated statements from movies repeatedly. He also engaged in motor stereotypy, which took the form of hand flapping, body tensing, as well as jumping while tapping his chest. He also engaged in stereotypy with toys, including moving toys back and forth and peering at them closely or rubbing them on parts of his body. It was generally difficult to redirect

motor and vocal stereotypy, and it often took the presentation of multiple motor tasks to get Joel to demonstrate ready behavior (e.g., hands in lap, attending to examiner and relevant visual stimulus). His adaptive behavior composite on the Vineland-3 placed him in the low range. His raw score on the CARS2 was a 44, which placed him in the severe symptom range for autism symptoms. Joel also engaged in a variety of problem behaviors during sessions, including screaming, slapping, swiping instructional materials, as well as closing his eyes and turning away from the experimenter. Abby, his biological mother, was a White 42-year-old female. Her highest education level was an associate's degree in Liberal Arts. She was a full-time homemaker and reported that her family *had just enough money to get by.*

Gary was a 3-year, 1 month-old White male with both a medical diagnosis of ASD and educational eligibility of ASD. He also had a sleep disorder. He received 12 sessions of behavioral services (i.e., 1:1 applied behavior analysis) per month in a clinic setting, as well as 2 sessions of play therapy per month. All of Gary's skills were classified as Level 2 on the VB-MAPP (Tacts, Motor Imitation, Listener Responding, Listener Responding Feature Function Class, Intraverbals, and EESA). Gary frequently engaged in spontaneous language during the VB-MAPP assessment, including tacts, mands, and intraverbals. However, he tended to talk over adults, engaged in some stereotyped language, and avoided prompts from adults to repeat certain words or phrases. His adaptive behavior composite on the Vineland-3 placed him in the moderately low range. His raw score on the CARS2 was a 40.5, which placed him in the mild-to-moderate range for autism symptoms. He engaged in verbal protests, shaking his head no repeatedly, turning away from the experimenter, crying, as well as expelling

mucus from his nose and wiping it on the table. Anne, his biological mother, was a White 33-year-old female. Her highest education level was an associates degree in Business. She was unemployed and reported that her family had *not enough money to get by.*

Table 1. *Child Demographics*

	Age	Sex	Vineland-3	CARS-2
Eric	7:11	Male	61 Low	28.5 Mild-to-Moderate Symptoms
Joel	7:11	Male	53 Low	44 Severe Symptoms
Gary	3:1	Male	79 Moderately Low	40.5 Mild-to-Moderate Symptoms

Note. Age is reported in years and months. Standard scores are reported for Vineland-3. Raw scores are reported for CARS-2.

Table 1. This table depicts child participants' demographic information

Table 2. *Parent Demographics*

	Age	Sex	Education Level	Income	Perceived Income to Needs Ratio	Employment Status	Number of Children Supporting
Sheila	32	Female	Bachelor's degree	$70,000 - 79,000	We only have to worry about money for fun or extras	Full time	6
Abby	42	Female	Junior College/Associate's degree	$30,000-$39,000	Just enough to get by	Homemaker	2
Anne	33	Female	Junior College/Associate's degree	$20- - 29,000	Not enough to get by	Unemployed	1

Note. Age is reported in years. Income is reported in US dollars and perceived income-to-needs ratio.

Table 2. This table depicts parents' demographic information

Settings and Materials

Initial screening screenings and pre-baseline measures administered to caregivers occurred via phone or in-person in a private office in the HART Center. Social validity measures were administered in a private office in the HART Center.

Pre-baseline measures administered to child participants, as well as, baseline, treatment, maintenance and generalization measures occurred at the HART Center. The VB-MAPP was administered to child participants in a 10' X 14' clinic area that was portioned off from the rest of the clinic space. The area included toys, a large 2' X 4' table with chairs, iPad, and bins containing VB-MAPP assessment materials.

The remainder of child participant sessions occurred in a 10' X 10' clinic room that was divided in half with partitions to create two smaller areas. One side included a 2' X 4' table covered in green construction paper, chairs, and toys assigned to the Low Demand condition for each participant (hereafter referred to as low demand area). The other side included a 2' X 2' red table, chairs, and toys assigned to the High Demand condition, as well as play items used for session breaks (hereafter referred to as demand side). Toys were placed on the floor when not in use for the High Demand condition or for breaks in between sessions. Pre-test, baseline, PD-IF, High Demand, maintenance and generalization conditions occurred in this area at the red table, while Low Demand occurred on the other side of the room.

Session materials included a timer, data sheets, an interval timer, visual schedule, clipboards, pens, edibles, toys that were assigned conditions or used for breaks, and 2" by 3" color pictures of stimuli (for Joel only).

Paired stimulus preference assessment. Data from the tangible preference assessment were used to pseudorandomly assign two relatively equally preferred tangible items relatively equal in size to either the High or Low Demand condition. For Eric, a Lego™ set and comic book were assigned to the Low Demand condition, and a car set and squishy tube were assigned to the High Demand condition (Figure 1). For Joel, a wheel toy and silly putty were assigned to the Low Demand condition, and a car set and light toy were assigned to the High Demand condition (Figure 2). For Gary, a car set and light toy were assigned to the Low Demand condition, and a house and small rubber bunny and shark. For Gary, data gathered from both of the tangible preference assessments were used to identify high preferred items to assign to conditions to ensure that items assigned to the conditions actually fit on the tables, and items that required significant adult support (e.g., using a pump to inflate balloons) were not assigned to conditions (Figures 3 and 4).

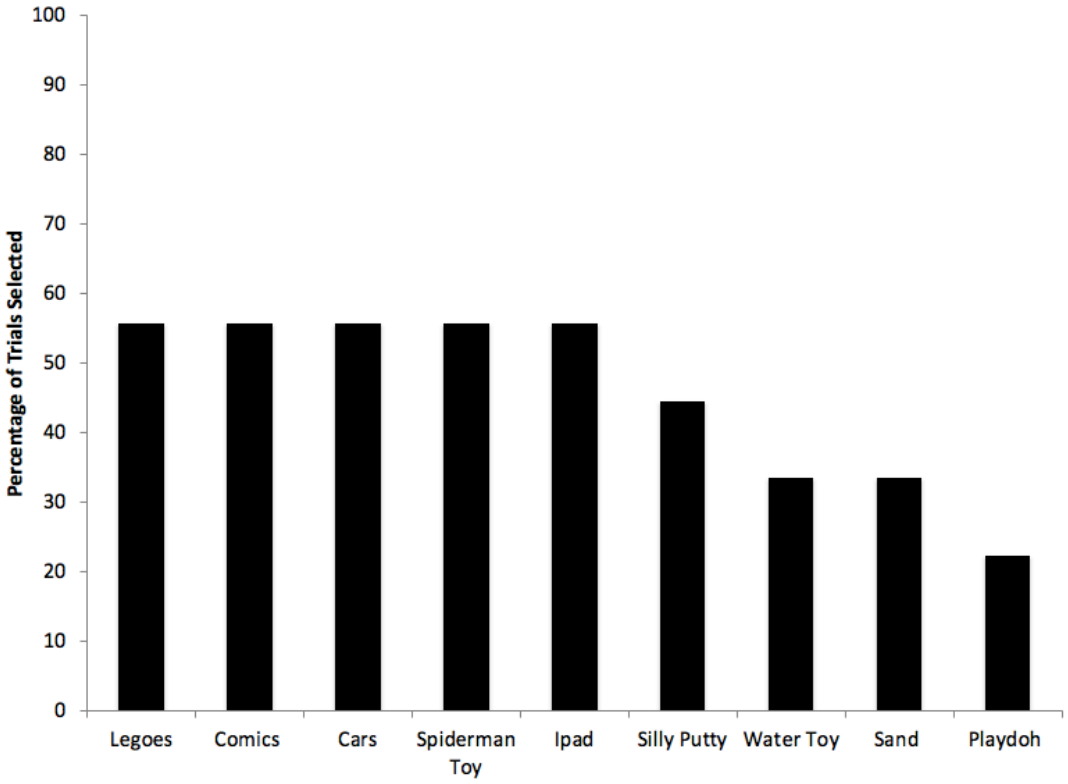


Figure 1. This graph depicts the percentage of trials in which Eric selected and engaged with a tangible item.

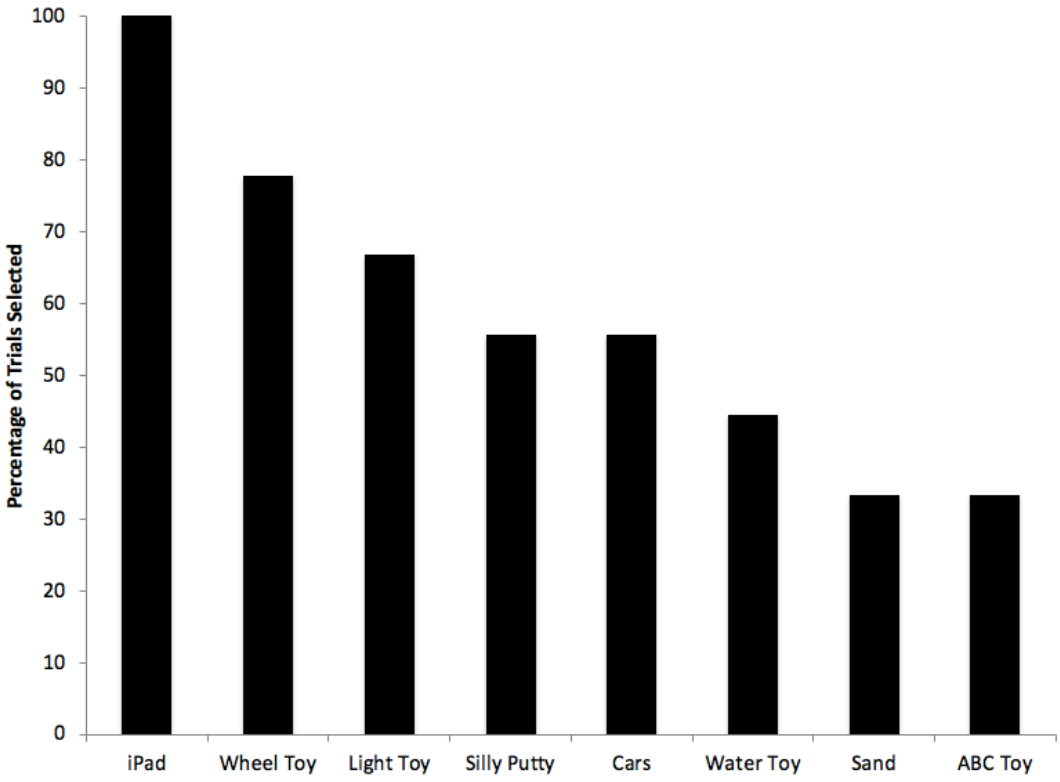


Figure 2. This graph depicts the percentage of trials in which Joel selected and engaged with a tangible item.

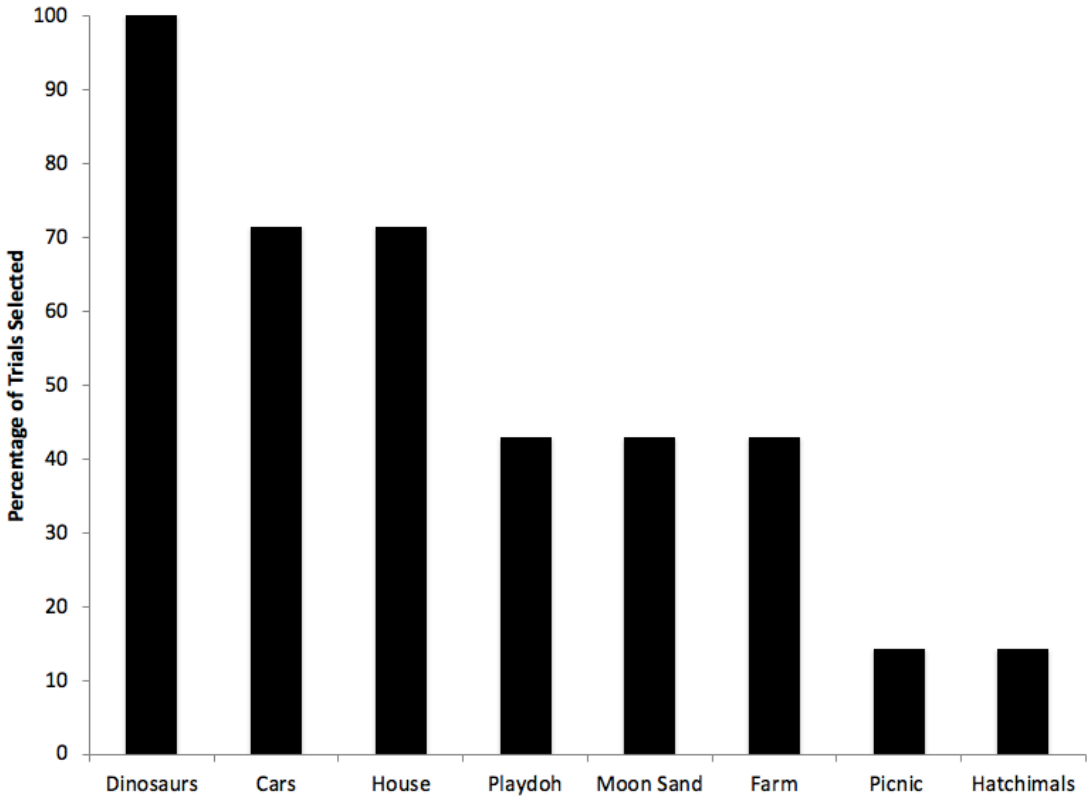


Figure 3. This graph depicts the percentage of trials in which Gary selected and engaged with a medium to large tangible item.

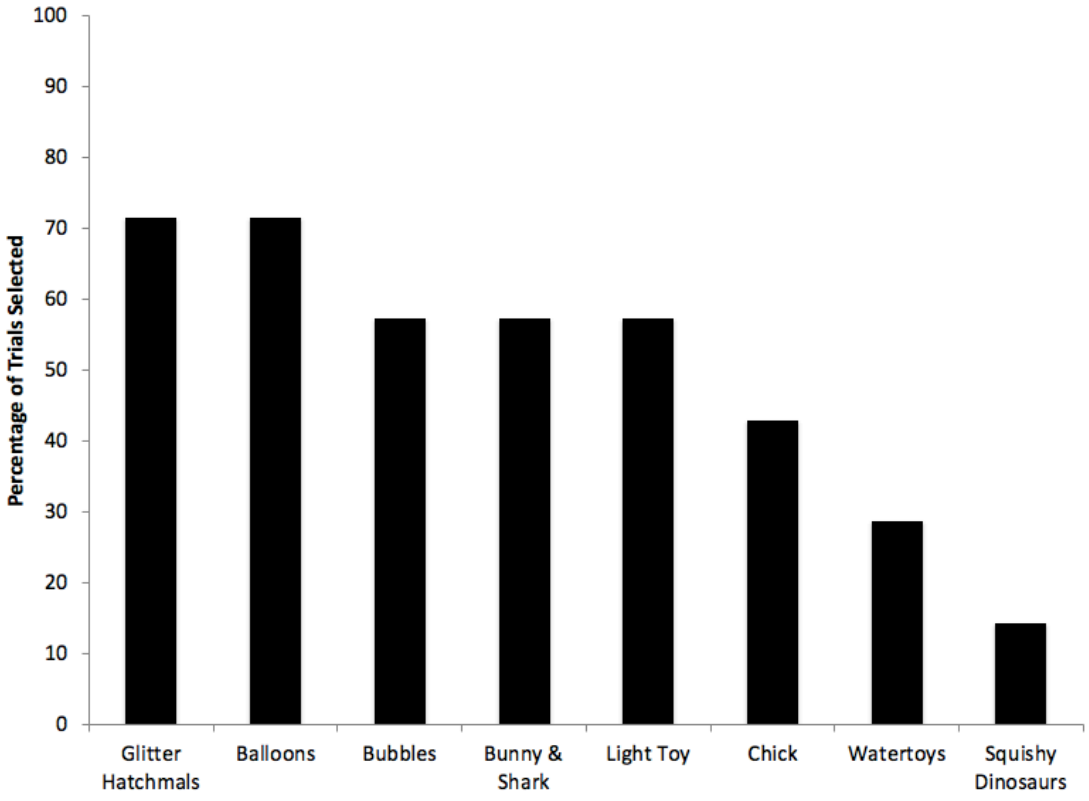


Figure 4. This graph depicts the percentage of trials in which Gary selected and engaged with a small tangible item.

Study Design

A single case adapted alternating treatments design (AATD) was employed (Sindelar, Rosenberg, & Wilson, 1985) to evaluate the effects of each instructive feedback condition on the acquisition of primary and secondary targets. The mastery criterion was two consecutive sessions with unprompted correct responding at or above 89%. This mastery criterion was selected because responding near this level is frequently used in the instructive feedback literature (e.g., Haq et al., 2017; Vladescu & Kodak, 2013). Measures of unprompted correct responding during baseline and following

treatment were compared to examine generalization and maintenance of primary and secondary targets.

General Procedures

Appointments occurred between 2 and 4 days per week and were 2 to 2 ½ hours in duration. At the beginning of each appointment, participants were offered a 5-10 min opportunity to play. Gary typically selected animals or dinosaurs for play breaks, but often declined this initial play opportunity, stating "I want to go work at the red table." Eric and Joel typically selected the iPad. A general visual schedule was used for all participants with one icon representing work at the table and the other icon representing a break; this was used across all conditions and presented immediately prior to starting a Multiple Stimulus Without Replacement (MSWO; Car, Nicolson, & Higbee, 2000; DeLeon & Iwata, 1996). Next, an MSWO was used to identify the top three edibles to be used as reinforcers during sessions. Participants were provided 3 to 5 min breaks every 3-10 sessions on average. Joel typically received a break after every 1 to 3 sessions during baseline sessions and generalization probes due to high rates of problem behavior during these sessions.

All participants were taught a vocal verbal response (e.g., "popsicle") to an intraverbal frame (e.g., "You freeze …"). For Joel, there was an antecedent visual stimulus in additional to the intraverbal frame. There was a total of three targets per each stimulus set for all participants. The prompt delay condition included a set of primary and secondary targets. Sessions included 9 trials, with each target presented a total of three times. Sessions were conducted until participants met the mastery criterion of each set. The mastery criterion was two sessions at or above unprompted correct responding. For

the PD-IF condition, if primary targets were mastered prior to secondary targets, then a new set of primary targets was introduced following a minimum of five baseline sessions of the primary set to be introduced. If secondary targets in the PD-IF were mastered prior to primary targets, then a new set of secondary targets was embedded into instruction following a minimum of five baseline sessions of the secondary set to be introduced. In the event that the participant mastered two sets of targets for any one condition, all remaining targets were moved to a 5 s constant prompt delay with error correction.

Prompting. Least to most prompting was used to ensure ready behavior (e.g., sitting with hands in lap, oriented toward the examiner, sitting in chair) or attending to the relevant antecedent visual stimuli. However, in the event that participants did not respond to this procedure, behavioral momentum was used (Cooper, Heron, & Heward, 2007). This involved presenting a series of 2-3 simple requests, such as motor imitation or simple listener responding tasks (e.g., "touch head") before prompting attending or ready behavior and the relevant target. All three participants engaged in vocal or motor stereotypy during sessions, or combination of both. Eric engaged in motor stereotypy, Joel engaged in vocal and motor stereotypy, and Gary engaged in vocal stereotypy. Joel and Gary attempted to get access to physical attention during the PD-IF condition, as well as probes (maintenance, generalization, baseline, and control conditions) but not during the instructive feedback only conditions. For example, Gary jumped into the experimenter's lap during the PD-IF condition. The experimenter asked "What's going on?" and Gary stated "I just need huggies" (i.e., hugs). To encourage appropriate mands for physical attention, the experimenter modeled appropriate mands for physical attention (e.g., hugs, big squeeze, high five) when these participants attempted to engage in

physical contact during sessions. These requests were also modeled during breaks. If participants manded for physical attention – prompted or unprompted – a few seconds of physical contact was provided.

Preference assessment. A brief multiple-stimulus-without-replacement preference assessment based on the procedures described by Car et al., (2000) was conducted at the beginning of each appointment. The experimenter presented the top 5-6 items (i.e., edibles or small tangibles) from the paired stimulus preference assessment in a pseudorandomly ordered linear array. After participants scanned the array, the experimenter said, "Pick one." Participants were given up to 10 s to consume the item. If participants picked up the item and did not place the item in their mouths within 5 s of selection, the experimenter provided the prompt, "eat it." Participants were blocked from selecting more than one item at a time. If contact was made with multiple items, the item selected first was provided. After an item was selected, it was removed from the array and the item on the left end of the array was placed to the right end. The process was repeated until participants selected every item presented. The first three items selected were pseudorandomly presented as reinforcers for the appointment, unless the participant manded for any other item included in the MSWO (Figures 5, 6, and 7).

For Gary, the top 7-9 items in the paired stimulus preference assessment were included in the MSWO, except for one item (e.g., Peanut M&M). It was removed from MSWOs after two appointments in which Gary repeatedly held the item in his cheek, required verbal prompts to chew and swallow the item. There were also concerns that this may present a choking hazard, as he would continue talking with the item tucked into his cheek. A greater number of items were included in MSWOS for Gary due to a history of

food selectivity and rejection of some of the edibles during the first several MSWOs. Specifically, he occasionally pushed two items away and stated something like "Eww" or "That's disgusting." When this occurred, he was prompted to say "No, thanks," the experimenter said "Ok, you don't have to eat it," and removed the item from the array. Rejected items were periodically reintroduced (e.g., during the next 3-5 appointments) and he occasionally would select those as one of the edibles to be used in the sessions.

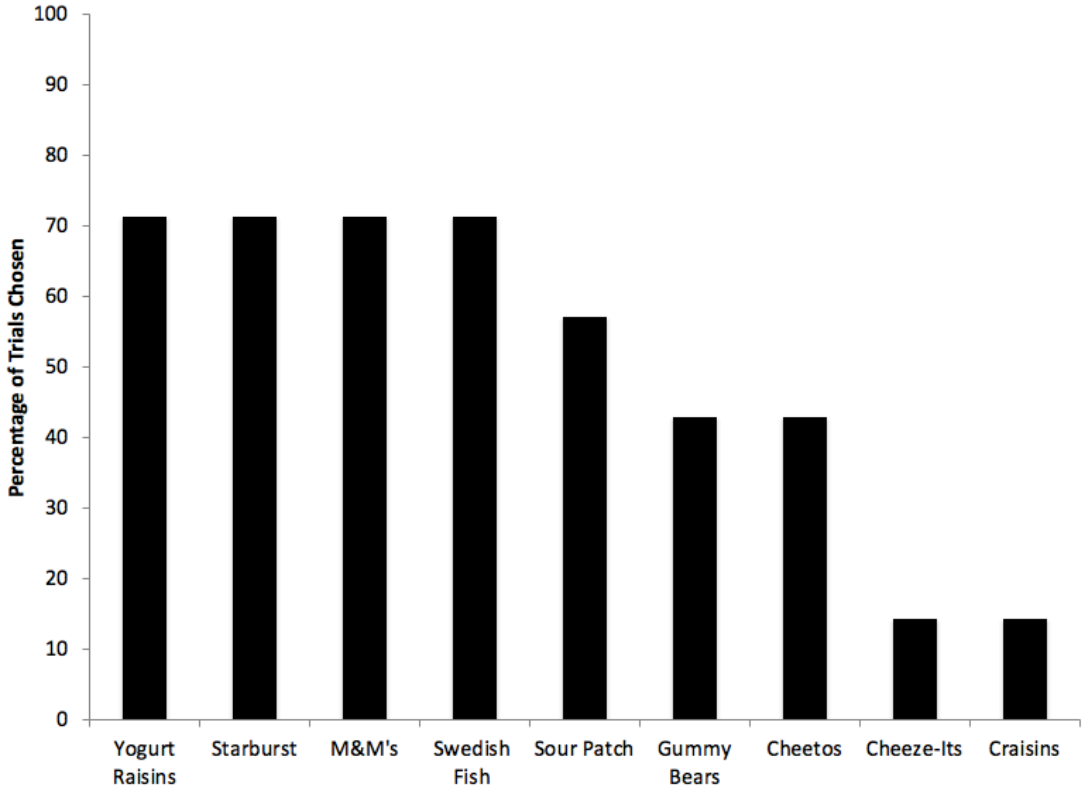


Figure 5. This graph depicts the percentage of trials in which Eric selected and consumed an edible item.

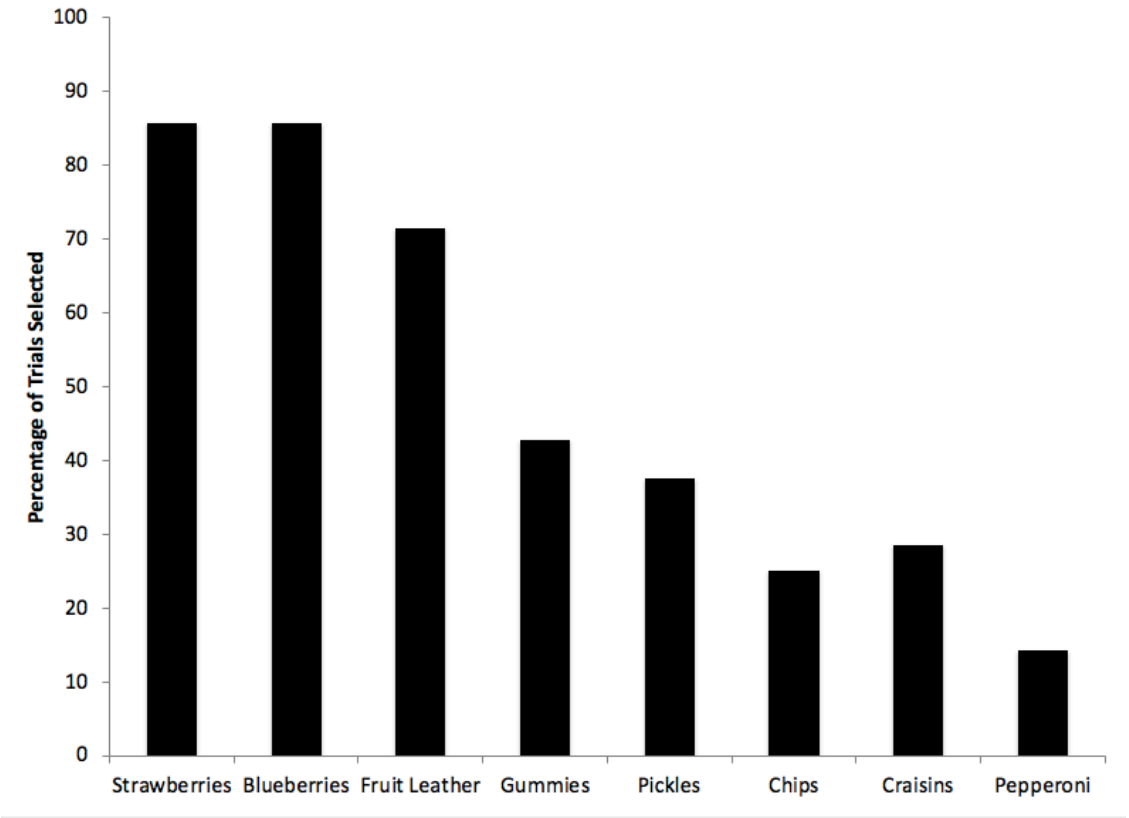


Figure 6. This graph depicts the percentage of trials in which Joel selected and consumed an edible item.

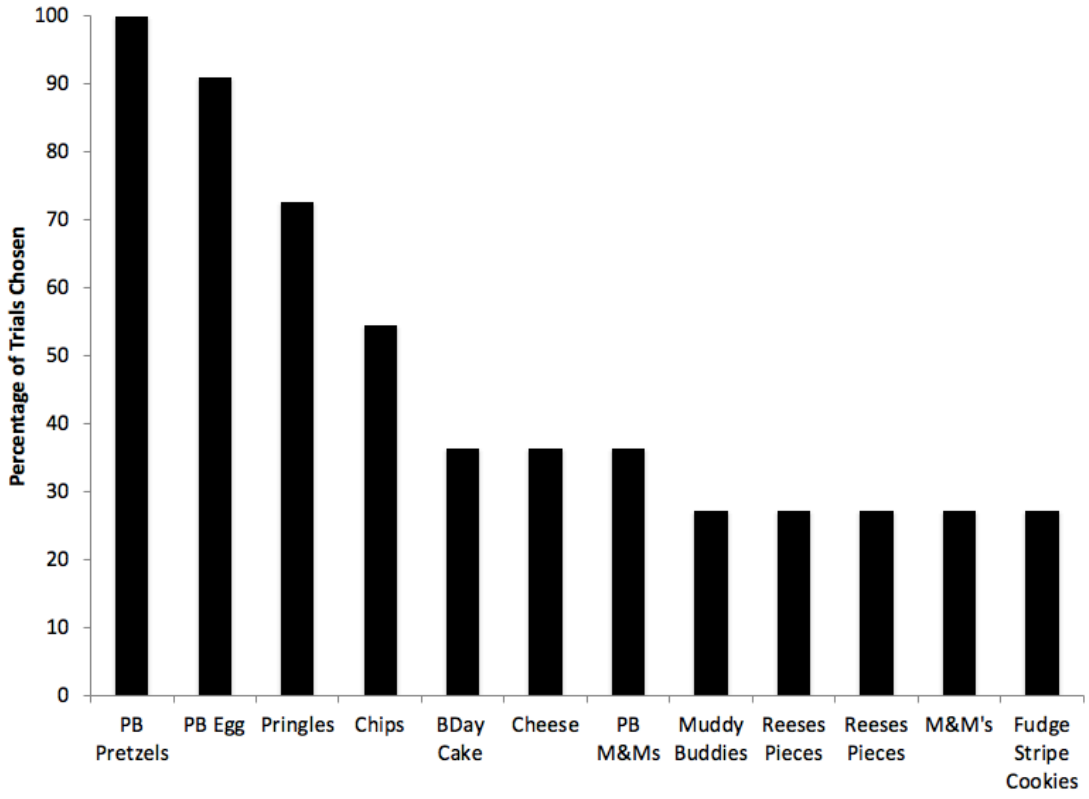


Figure 7. This graph depicts the percentage of trials in which Gary selected and engaged with a small tangible item.

Baseline. A minimum of five baseline sessions were conducted for each treatment condition. The experimenter presented the relevant discriminative stimulus and waited up to 5 s for a response. No feedback was provided for correct or incorrect responses. Every other trial on average, the experimenter provided reinforcement for appropriate session behaviors (e.g., sitting at the table, calm body). Reinforcement included praise and access to a highly preferred edible. Any stimulus with correct responding during baseline sessions was replaced with a new stimulus and re-probed.

Control. A control set of stimuli was included to demonstrate that acquisition did not occur in the absence of instruction and that acquisition of targets was the result of experimental procedures, rather than the result of maturation or other instruction provided

outside of study sessions. A minimum of two control sessions were conducted during baseline. Thereafter, a control session was conducted every 3 to 10 treatment sessions. The experimenter presented the relevant discriminative stimulus and waited up to 5 s for a response. No feedback was provided for correct or incorrect responses. Every other trial on average, the experimenter provided reinforcement for appropriate session behaviors (e.g., sitting at the table, calm body). Reinforcement included praise and access to a highly preferred edible item.

Prompt delay with instructive feedback (PD-IF). During these sessions, participants were seated at the red table with toys placed on the floor next to the experimenter. The first two instructional sessions were implemented with a 0-s prompt delay, in which the experimenter immediately provided a vocal model of the correct response following the presentation of each discriminative stimulus for primary targets only. Thereafter, all sessions were conducted at a 5-s constant prompt delay with error correction. Specifically, the experimenter presented the relevant discriminative stimulus and waited up to 5 s for a response. Primary and secondary targets were not paired; that is, primary and secondary targets were presented in a pseudorandom fashion and no more than two trials per session included the same primary and secondary target.

Unprompted correct responses resulted in praise and access to a highly preferred edible. Incorrect responses resulted in the presentation of a vocal model of the correct response and error correction. Praise followed prompted correct responses (e.g., “Yeah, that’s right!”). During error correction, the experimenter represented the relevant discriminative stimulus and waited up to 5 s for a response; however, only the first response in the trial was used to calculate unprompted correct responses for each trial.

Secondary targets were presented within 10 s of the presentation of the reinforcer, during the consequence portion of learning trials. Table 3 describes the key components of each instructional strategy.

High demand. During these sessions, toys assigned to the high demand condition were placed on the red table and were freely available. At the beginning of the session with the participant seated at the table, the experimenter stated, "Play at the table" and provided a model of a secondary target. After providing 20 s of time for the participant to play with toys, the experimenter provided another model of a secondary target. Models included the relevant discriminative stimulus and the target response (e.g., A tire has a rim). This sequence was repeated until secondary target was presented a total of three times. Secondary targets were presented in a pseudorandom fashion. No differential consequences were provided based on participants' response to the presentation of secondary targets. Contingent upon appropriate behavior (e.g., sitting at the table, playing with toys), the experimenter provided praise and access to a highly preferred edible every other trial on average. The experimenter engaged with the participant at least once during each trial by commenting on the participant's play behavior or modeling a play action. The experimenter responded to any interaction initiated by the participant either verbally (e.g., "I see what you are doing") or physically (e.g., picking up a toy the participant dropped).

Low demand. During these sessions, toys assigned to the low demand condition were placed on the green table and were freely available. The procedures were identical to the High Demand condition except that participants were not prompted to sit down if they left the table but remained in the low demand area. Participants did not leave the

chair during this condition, except to retrieve items dropped onto the floor. However, Joel stood on the chair and attempted to stand on the table to reach a shelf. Least-to-most prompting was utilized in this instance due to safety concerns, and he was physically prompted to sit down.

Secondary target probes. The experimenter conducted a probe of secondary targets within 10 minutes of completing each of the treatment conditions including secondary targets using procedures described for the control condition. The purpose of this condition is to measure participants' acquisition of secondary targets. For Gary, one probe was conducted at the beginning of the next appointment due to toileting and his caregiver arriving early for departure.

Prompt delay. Any secondary targets not acquired through instructive feedback were moved to training using a 5 s constant prompt delay with error correction, using the procedures described in the PD-IF condition except that no secondary targets were presented in the consequence portion of learning trials.

Generalization. Probes for primary and secondary targets were conducted using similar procedures described for control. The purpose of this condition was to compare the extent to which primary and secondary targets generalized to novel antecedent verbal stimuli and novel therapists. Items were Wh-questions (e.g., "What does a zebra have?") that corresponded to each intraverbal or intraverbal-tact (for Joel). Three sessions were conducted during baseline and three sessions were conducted as a post-test within two weeks of mastery of the relevant stimulus set. These were conducted with the primary therapist and also with a novel therapist. Novel therapists were research assistants who did not provide direct intervention to participants during the course of the study but were

present during some sessions for the purpose of gathering interobserver agreement data. Due to scheduling issues, a portion of Gary's generalization to a novel therapist probes were completed by a research assistant who had been present during some of his sessions at the HART Center unrelated to the study. In situations where a correct response other than the target response was provided, the experimenter said "Yeah, that's right. What else does a [target] have?" or a similar verbal discriminative stimulus to evoke the target response and to not extinguish varied correct responses. The experimenter provided a maximum of 5 of these opportunities before marking the item incorrect to ensure that participants had an opportunity to provide the target response and to not punish correct responses for children who have difficulty acquiring language. This procedure was not utilized during treatment conditions because only items without any correct responding were included into treatment and because we wanted to keep feedback consistent during all treatment conditions as written.

For Joel only, generalization post-test probes were conducted two weeks post mastery for targets without the presence of a picture to evaluate the extent to which correct responding continued in the absence of a visual antecedent stimulus.

Maintenance. Probe session for primary targets, secondary targets, and generalization targets (i.e., Wh-questions) were conducted approximately 2 and 4 weeks following mastery of the relevant condition using control procedures. These were probed by the primary therapist for Eric and Joel. For Gary, a portion of these probes were conducted by another familiar therapist who had been providing clinical services to him for over a year.

Table 3. *Instructional Conditions*

Condition	Location	Toys on Table	Primary Targets	Primary Target Treatment	Secondary Targets	Secondary Target Treatment
PD-IF	Red Table	No	Yes	5-s constant prompt delay with error correction	Yes	Modeled during reinforcement interval
High Demand	Red Table	Yes	No	No	Yes	Modeled every 20 s
Low Demand	Green Table	Yes	No	NA	Yes	Modeled every 20 s
Prompt Delay	Red Table	No	Yes	5-s constant prompt delay with error correction	No	N/A

Social validity. Following maintenance, parents completed a modified version of the TARF-R (Reimers & Wacker, 1988; see Appendix B) to evaluate acceptability, effectiveness, and disadvantages for each of the treatment procedures. Items were modified to relate to the goals of the study procedures and were ranked on a 5-point Likert scale. For example, "How acceptable did you find this teaching strategy?" or "How willing are you to carry out this strategy?". Item rankings generally indicated lower acceptability or effectiveness, and higher rankings indicated higher acceptability or effectiveness. However, items in the disadvantages category were reverse scored, such that higher scores indicated fewer disadvantages (Items 4,5,8,11) and lower scores indicated greater disadvantages. The modified TARF-R included a total of 13 items and an open-ended item was included on the last TARF-R completed by mothers in the present study. Caregivers provided ratings immediately after being read a description of the study procedure and watching a 2 min clip of their child during the procedure that displayed a minimum of two trials of the procedure. Next, caregivers were shown graphs along with written and verbal explanations describing the efficiency of each procedures, including total number of sessions, number of exposures, and session duration for each condition. Any questions asked by the caregivers were answered by the experimenter. Finally, caregivers completed the TARF-R for each condition. The order in which conditions were presented was randomly assigned through use of a random sequence generator to prevent order effects.

The recording shown to caregivers varied based on recording errors and the number of trials within a 2 min segment. For Eric, recordings were from the 3rd session; these sessions were selected using a random number generator. For Joel, recordings were

from the 1st session; these sessions were selected using a random number generator. Only the first two sessions for each procedure were recorded due to a recording error. For Gary, recordings for high and low demand were from the 3rd session, but the PD-IF recording was from the 4th session. Although the random number generator indicated the 3rd sessions of procedures, there was not a 2 min segment during the 3rd session of the PD-IF condition that included at least 2 trials. Clips started at least 30 s into each condition and lasted for a total of 2 min. A recording error occurred, so that only the first and second sessions of each treatment condition were video recorded for Joel, meaning that this included the PD-IF condition at a 0 s time delay rather than the 5-s constant prompt delay.

At the end of this session, caregivers were also given a brief report combined with verbal explanations of their child's VB-MAPP and paired stimulus preference assessment results, as well as a list of targets their child acquired, and any behavioral strategies that were used with their child during the course of the study.

Data Collection

Data were collected during each session using data sheets developed for conditions in each phase on the dependent variables by the experimenter (Appendix C).

Probes were conducted to identify targets for each condition prior to baseline. For pretest trials, the experimenter presented the relevant discriminative stimulus and waited up to 5 s for a response. Correct responses resulted in reinforcement in the form of praise and access to a highly preferred edible. No feedback was provided for incorrect responses. Every other trial on average, the experimenter provided reinforcement for appropriate session behaviors (e.g., sitting at the table, calm body). Reinforcement

included praise and access to a highly preferred edible. Each stimulus was presented a total of three times in a non-consecutive order. Stimuli without any correct responding during each of the three probes were assigned to conditions and included in baseline.

A logistical analysis method (Gast, 2010) was used to assign targets to each condition in an effort to ensure that targets included in sets were of similarly equal difficulty for participants to acquire and that learning of targets in one set did not enhance learning in another set. Conditions contained responses with the same or a similar total number of syllables, and targets with similar sounds were assigned to different conditions (Appendix D).

For Eric, primary and secondary targets were intraverbals of science targets taken from a first-grade science curriculum to support his participation in general education (e.g., Paleontologists study ___). For Joel, primary and secondary targets were intraverbal-tacts (e.g., A tire has a _____ + a visual stimulus). For Gary, primary and secondary targets were intraverbals of functions of common items (e.g., You freeze ___). For Eric and Gary, discriminative stimuli included the presentation of an antecedent verbal stimulus. For Joel, discriminative stimuli included the presentation of an antecedent verbal and visual stimulus. For generalization, only antecedent verbal stimuli were presented (i.e., Wh-question and corresponded to the assigned targets.

Dependent variables. Dependent variables included unprompted correct responses, incorrect responses, prompted correct responses, echoic behavior, number of exposures to stimuli, and number of sessions to mastery. Definitions were based on those utilized by Kodak and colleagues (2016) and Haq et al. (2017).

Unprompted correct responses were scored if the participant provided the target response within 5 s of initiation of the trial. *Incorrect responses* were scored if the participant failed to provide the target response within 5 s of initiation of the trial. The percentage of unprompted correct responses was calculated by dividing the total number of unprompted correct trials in a session in response to the initial presentation of the discriminative stimulus by the number of trials per session and multiplying the quotient by 100 to yield a percentage. *Prompted correct responses* were scored if the participant provided the target response within 5 s of the presentation of an echoic prompt.

Echoic behavior was scored if the participant repeated the experimenter's model of the target response for secondary targets within 3 s of the experimenter's model. A full echo was scored if the participant echoed the entire target response and a partial echo was scored if the participant echoed part of the target response. For example, if the participant said "zebra" when the target response was zebra, a full echo was scored. In contrast, if the participant said "z" a partial echo was scored. Full echoes and partial echoes were collapsed to identify the percentage of secondary trials with echoic behavior. The percentage of secondary trials with echoic behavior was calculated by dividing the total number of times echoic behavior occurred by the total number of presentations of the secondary target per treatment session and multiplying this number by 100 to yield a percentage.

Exposures to stimuli per condition was defined as the total number of presentations of stimuli paired with the correct target response during treatment sessions, including echoic prompts. The total number of exposures to stimuli for each set of targets in each condition was summed. For the PD-IF condition the number of exposures varied

based on participant responding. Participant's first response to an echoic prompt was recorded and subsequent models were indicated by a tally mark.

Sessions to mastery included the total number of treatment sessions completed for each condition.

Interobserver Agreement (IOA)

The lead researcher trained four IOA data collectors using either live demonstrations of study procedures or video clips depicting study procedures. Data collectors recorded a minimum of 3 trials with 100% accuracy for each condition type. Discrepancies were discussed, and the trial in which an error occurred was represented. All data collectors were doctoral students in special education and school psychology with a minimum of two years of experience implementing behavior analytic interventions, including discrete-trial-treatment.

Data were collected by two independent observers across a minimum of 77.33% of baseline sessions (range = 52 to 100), 36.49% of PD-IF sessions (range = 35.29 to 35.71), 42.86% of high demand sessions (range = 40.74 to 46.67), 32.25% of low demand sessions (range = 14.40 to 41.18), 38.90% of control/secondary target probe sessions (range = 31.25 to 51.06), 24.67% of prompt delay sessions (range = 12.50 to 39.29), 44.63% of generalization with primary therapist sessions (range = 30.55 to 56.67), and 77.50% of generalization with novel therapist sessions (range = 62.50 to 100), and 48.06% of maintenance sessions (range = 40.00 to 541.17). This range was due to scheduling changes in order to meet changing participant needs. Several participants had to reschedule sessions due to illnesses or participants' engagement in problem behavior. Due these scheduling changes, appointments sometimes occurred outside of

secondary data collectors' availability. A secondary independent observer collected data on reliability in vivo.

Trial-by-trial agreement was calculated for unprompted responses, prompted responses, and echoic behavior. An instance of agreement was scored if the data collected by each observer matches for a specific variable. Trial-by-trial agreement was calculated by dividing the sum of the agreements by the total number of trials and multiplying the quotient by 100 to yield a percentage. Total agreement was calculated for frequency of exposures to the correct response and session duration by dividing the smaller number by the larger number and multiplying this quotient to yield a percentage. Session duration was converted to seconds. Agreement for frequency of exposures to the correct response was not calculated during the high and low demand conditions because this number remained constant.

For Eric, the mean IOA for unprompted responses during baseline was 100% and 100% during control/secondary target probes. The mean IOA for unprompted response to the initial trial and error correction was 100% during PD-IF. The mean IOA for prompted responses to a model during PD-IF was 96.13 (range = 88.89 to 100). The mean IOA for echoic behavior was 93.38 (range 77.78 to 100) during PD-IF. The mean IOA for unprompted correct response to the initial trial and error correction was 97.98 (range = 88.89 to 100) and 96.97 (range = 88.89 to 100) during prompt delay. The mean IOA for prompted responses to a model during prompt delay was 96.97 (range = 88.89 to 100). The mean IOA for unprompted responses during generalization and maintenance was 100%. The mean IOA for echoic behavior during high demand was 93.67 (range 77.78 to 100) and 100% for low demand. The mean IOA for frequency of exposures to the correct

response was 96.13 (range = 92.31 to 100) during PD-IF and 92.42 (range = 75 to 100) during prompt delay. The mean IOA for session duration was 95.06 (range = 95.56 to 100) for PD-IF, 99.38 for high demand (range 99.53 to 100), 100% for low demand, and 99.77 (range = 99.56 to 100%) for prompt delay.

For Joel, the mean IOA for unprompted responses during baseline was 100% and 100% during control/secondary target probes. The mean IOA for unprompted responses to the initial trial was 100% and 96.30 (range = 77.78 to 100) to error correction during PD-IF. The mean IOA for prompted responses to a model during PD-IF was 79.63 (range = 33.33 to 100). The mean IOA for echoic behavior was 98.15 (range 88.89 to 100) during PD-IF. The mean IOA for unprompted correct response to the initial trial and error correction was 100% during prompt delay. The mean IOA for prompted responses to a model during prompt delay was 100%. The mean IOA for unprompted responses during generalization with the primary therapist was 98.04 (range 77.78 to 100) and 98.55 (range 88.89 to 100) for generalization with a novel therapist. The mean IOA for unprompted responses during maintenance was 100%. The mean IOA for echoic behavior during high demand was 100% and 92.06% (range = 77.78 to 100) for low demand. The mean IOA for frequency of exposures to the correct response was 90.94 (range = 77.78 to 100) during PD-IF and 100% during prompt delay. The mean IOA for session duration was 99.83 (range = 99.46 to 100) for PD-IF, 100% for high demand, 99.94% (range = 99.55 to 100%) for low demand, and 99.29 (range = 99.67 to 100%) for prompt delay.

For Gary, the mean IOA for unprompted responses during baseline was 100% and 99.54% (range = 88.89 to 100) during control/secondary target probes. The mean IOA for unprompted responses to the initial trial and to error correction during PD-IF was 100%.

The mean IOA for prompted responses to a model during PD-IF was 100%. The mean IOA for echoic behavior was 95.56 (range = 88.89 to 100) during PD-IF. The mean IOA for unprompted correct response to the initial trial was 100% and 97.22% (range = 88.89 to 100) for error correction during prompt delay. The mean IOA for prompted responses to a model during prompt delay was 97.22% (range 88.89 to 100). The mean IOA for unprompted responses during generalization with the primary therapist was 97.98 (range 88.89 to 100) and 98.15 (range 88.89 to 100) for generalization with a novel therapist. The mean IOA for unprompted responses during maintenance was 98.29% (range = 88.89 to 100%). The mean IOA for echoic behavior during high demand was 97.78% (range = 88.89 to 100%) and 96.83% (range = 88.89 to 100) for low demand. The mean IOA for frequency of exposures to the correct response was 93.68 (range = 68.42 to 100) during PD-IF and 100% during prompt delay. The mean IOA for session duration was 99.95 (range = 99.73 to 100) for PD-IF, 99.57% (range = 99.46 to 100) for high demand, 98.26% (range = 89.43 to 100%) for low demand, and 100 % for prompt delay.

When interobserver agreement fell below 80% for any dependent variable during any session, then the lead experimenter checked-in with the secondary data collector. A number of variables impacted IOA. First, appointments with other clients occurred in the clinic during a portion of sessions for all participants, which at times generated extraneous noise impacting the audibility of participant responses. Additionally, Gary and Joel had articulation difficulties, and all three participants emitted at least some responses at very quiet volume (i.e., whisper) during at least some of the sessions. Finally, all three participants exhibited problem behaviors (e.g., motor stereotypy, vocal stereotypy, crying, and yelling) which further impacted data collection.

Missing data. Sessions were conducted approximately two to four days per week for two to two and half hours. If no sessions occurred for an entire week, a line break was added to the y-axis. This occurred for Gary due to a family trip during which he caught an upper respiratory infection, which resulted in two weeks break between baseline and the start of intervention.

Therapist Qualifications and Training

The lead experimenter served as a primary therapist for all participants. At the time of the study, she held a masters degree in special education and was an advanced graduate student in a school psychology doctoral program. She had implemented instructive feedback procedures for three individuals as part of studies evaluating instructive feedback and had one publication in a peer reviewed journal on the effectiveness and efficiency of instructive feedback for individuals with ASD. Novel therapists were secondary data collectors who had been trained to collect data on study procedures. The primary therapist was present for all sessions conducted by novel therapists. For Gary, the final 8 sessions of maintenance were conducted by another familiar therapist who also served as a secondary. This therapist had worked with Gary for over a year providing clinical services, including discrete trial instruction, held a masters degree in special education, and was an advanced doctoral student in special education.

Procedural Integrity

Integrity was assessed by independent observers during sessions in which IOA data were collected and had been trained on the study procedures via video models or live models of study procedures. All data collectors were doctoral students in special

education and school psychology with a minimum of two years of experience implementing behavior analytic interventions, including discrete-trial-training. A sheet was developed including the steps of each procedure and provided to each data collector.

For PD-IF procedural integrity included (1) securing attending defined as 1 s of eye contact with the stimulus (for visual stimuli, if relevant) or having the participant oriented toward the examiner (when discriminative stimuli were auditory only) (2) waiting up to 5 s for a response (3) presenting the correct stimulus, (4) providing an echoic prompt (if relevant), (5) presenting the secondary target within 10 s of providing access to edible or tangible reinforcer following an unprompted correct response (6) not providing feedback for echoic behavior following presentation of secondary targets and (7) providing reinforcement for unprompted correct responses.

For high demand procedural integrity included (1) securing attending defined as 1 s of eye contact with the stimulus (if relevant), (2), presenting the correct stimulus every 20 to 30 s (3) not providing feedback for echoic behavior following presentation of secondary targets (4) providing reinforcement for appropriate session behavior every other trial on average (5) playing with the participant at least once per play opportunity.

For low demand, procedural integrity included (1) securing attending defined as 1 s of eye contact with the stimulus without providing any verbal or physical prompts, other than putting the visual stimulus within view of the participant (if relevant), (2), presenting the correct stimulus every 20 to 30 s (3) not providing feedback for echoic behavior following presentation of secondary targets (4) providing reinforcement for appropriate session behavior every other trial on average (5) playing with the participant at least once per play opportunity.

During baseline, control, secondary target probes, and maintenance, procedural integrity l included (1) securing attending defined as 1 s of eye contact with the stimulus (for visual stimuli, if relevant) or having the participant oriented toward the examiner (when discriminative stimuli were auditory only) (2), presenting the correct stimulus (3) not providing feedback for responses (4) providing reinforcement for appropriate session behavior every other trial on average.

For generalization probes, procedural integrity included (1) s securing attending defined as 1 s of eye contact with the stimulus (for visual stimuli, if relevant) or having the participant oriented toward the examiner (when discriminative stimuli were auditory only), (2) presenting the correct stimulus (3) waiting up to 5 s for a response (4) not providing feedback for correct or incorrect responses (5) providing a prompt such as "Yeah, that's right. What else does a [target] have?" if participants emit a correct response other than the target response (6) providing reinforcement for appropriate session behavior every other trial on average.

Procedural integrity was calculated for each session by dividing the sum of trials implemented correctly by the number of trials in each session and multiplying the quotient by 100 to obtain a percentage. Any errors occurring during a trial resulted in a score of zero for integrity for that trial. If procedural integrity fell below 80% for any session, then the experimenter discussed the errors observed by the data collectors to minimize the likelihood of errors in the future.

Procedural integrity across each condition is depicted in Table 4. Overall, procedural integrity was relatively high across all conditions for all participants.

Table 4. *Procedural Integrity*

Condition	Eric		Joel		Gary	
	M	Range	*M*	Range	*M*	Range
Baseline	98.57	88.89 - 100	98.89	88.89 - 100	99.21	88.89 - 100
PD-IF	95.06	88.89 - 100	92.59	77.78 - 100	97.78	88.89 - 100
High Demand	100	100 -100	95.24	77.78 - 100	100	100 -100
Low Demand	100	100 -100	96.83	88.89 - 100	96.83	88.89 - 100
Control/Secondary Target Probes	100	100 -100	100	100 -100	99.07	88.89 - 100
Generalization Primary	100	100 -100	100	100 -100	98.99	88.89 - 100
Generalization Novel	99.29	88.89 - 100	99.52	88.89 - 100	93.38	77.78 - 100
Prompt Delay	96.97	88.89 - 100	100	100 -100	100	100 - 100
Maintenance	96.67	66.67 - 100	100	100 -100	96.58	77.78 - 100

Data Analysis

The percentage of unprompted correct responses was depicted on a line graph to evaluate the effectiveness and efficiency of instructive feedback on acquisition. Because secondary target probes were conducted following every treatment session, this graph provides an accurate depiction of the number of sessions to mastery. Visual analysis was used according to procedures described by Kratochwill et al. (2010), including level, trend, variability, immediacy of effect, overlap across consistent phases, and consistency of responding across similar phases (Horner, et al., 2005).

Descriptive data were depicted in bar graphs to evaluate the non-experimental questions. The number of sessions to mastery, the number of exposures to stimuli, session duration, and number of trials are depicted in a graph. Echoic behavior in response to secondary targets was displayed in a table. Generalization and maintenance data were depicted in a bar graph.

and echoic behavior will be depicted in a graph**.** Social validity data were depicted in a table.

CHAPTER III

RESULTS

Eric

Eric's results from treatment are depicted in Figure 8. During baseline, Eric did not respond correctly to any items. Eric met the mastery criterion for secondary targets in the low demand condition, following 10 sessions. Next, he met the mastery criterion for secondary targets in the PD-IF condition, following 11 sessions. In order to continue running the PD-IF condition, a new set of secondary target stimuli (PD-IF secondary set 2) was introduced in baseline. He did not engage in correct responding in baseline to targets in the PD-IF secondary set 2 and these items were subsequently introduced into treatment for the PD-IF condition. Shortly thereafter, a within appointment decrease in responding was observed, such that the percentage of unprompted correct responses tended to decrease toward the end of Eric's appointment. As a result, session breaks were increased in duration (5-10 min) and frequency (about every 3-5 sessions), and a movement component was introduced such that Eric had the option of dancing or going outside for a portion of his break. However, responding to secondary targets remained moderate and stable following this change. Eric mastered primary targets in the PD-IF condition following 26 sessions of treatment. All remaining secondary targets were moved to a 5-s constant prompt delay with error correction; responding remained moderate and stable. During ~~a~~ session 148, Eric placed an edible down his shirt rather than consume it. When questioned by the experimenter, Eric requested to work for toys instead. Immediately thereafter, unprompted correct responses resulted in praise and 20 to 30 s access to a tangible. A basket of 5 to 10 small toys was placed in front of Eric and

the experimenter prompted Eric to select one of the items in the basket. He mastered the remaining secondary target sets following 13 (PD-IF secondary set 2) and 15 (high demand) sessions of direct training.

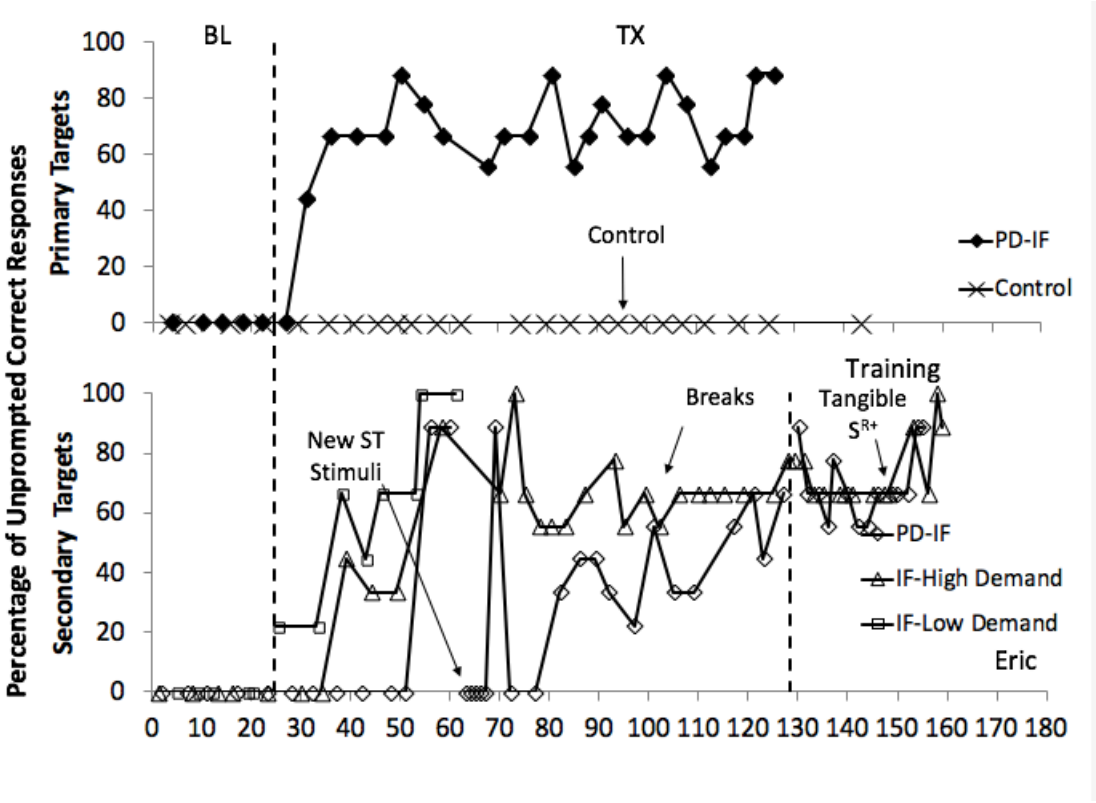


Figure 8. This graph depicts the percentage of unprompted correct responses to primary, secondary, and control stimuli for Eric.

Echoic behavior across conditions for Eric is displayed in Table 5. His echoic behavior varied across conditions. He had the highest mean echoic behavior during PD-IF secondary set 2 and the lowest mean echoic behavior during PD-IF secondary set 1.

Condition	Minimum	Maximum	Average
PD-IF Set 1	22.22%	100%	73.74%
PD-IF Set 2	44.44%	100%	86.81%
High Demand	22.22%	100%	80.61%
Low Demand	55.56%	100%	82.22%

Table 5. Minimum, maximum, and mean levels of echoic responding during instructive feedback sessions for Eric.

Eric's sessions to mastery are displayed in Figure 9. For Eric, the low demand condition was the most efficient on this measure of efficiency. He achieved the mastery criterion in 10 sessions. He mastered the first set of secondary targets in the PD-IF condition (PD-IF secondary set 1) in 11 sessions. He required a total of 26 sessions to reach mastery for primary targets in the PD-IF condition. Recall that the second set of secondary targets in the PD-IF condition (PD-IF secondary set 2) and secondary targets in the high demand condition were moved to training. He acquired PD-IF secondary set 2 following a total of 29 sessions, including a combination of treatment (16 sessions) and direct training (13 sessions). He did not acquire any sets of secondary targets in the high demand condition without direct training and required a total number of 42 sessions to achieve the mastery criterion for secondary targets in the high demand condition. This included a combination of treatment (27 sessions) and direct training (15 sessions). For the PD-IF conditions, the primary and secondary targets were run within the same session, until PD-IF secondary set 2 was moved to direct training. This means that he acquired 9 targets in a total of 39 sessions, which equates to about 4.33 sessions per target. This is still less efficient than the low demand condition which required a total of 10 sessions, which equates to about 3.33 sessions per target.

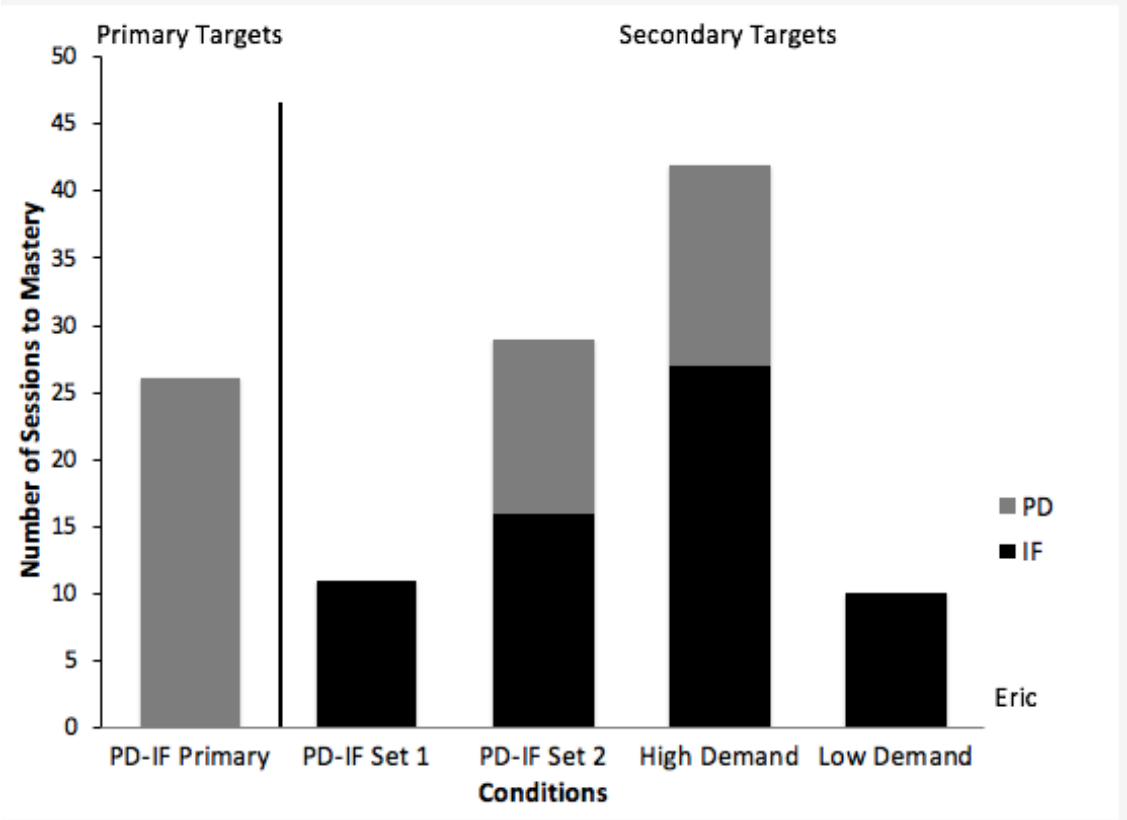


Figure 9. This graph depicts the number of sessions to mastery for each condition for Eric. The gray portion of columns represents the number of sessions that were conducted utilizing a 5s constant prompt delay with error correction.

Eric's number of exposures to target stimuli are displayed in Figure 10. For Eric, the low demand was the most efficient on this measure of efficiency. He achieved the mastery criterion following 90 exposures in the low demand condition. He mastered the secondary targets in PD-IF set 1 following 99 exposures, the primary targets in the PD-IF condition following 147 exposures, and the secondary targets in PD-IF set 2 in 203 exposures. The high demand condition was the least efficient; Eric required a total of 302 exposures to reach mastery.

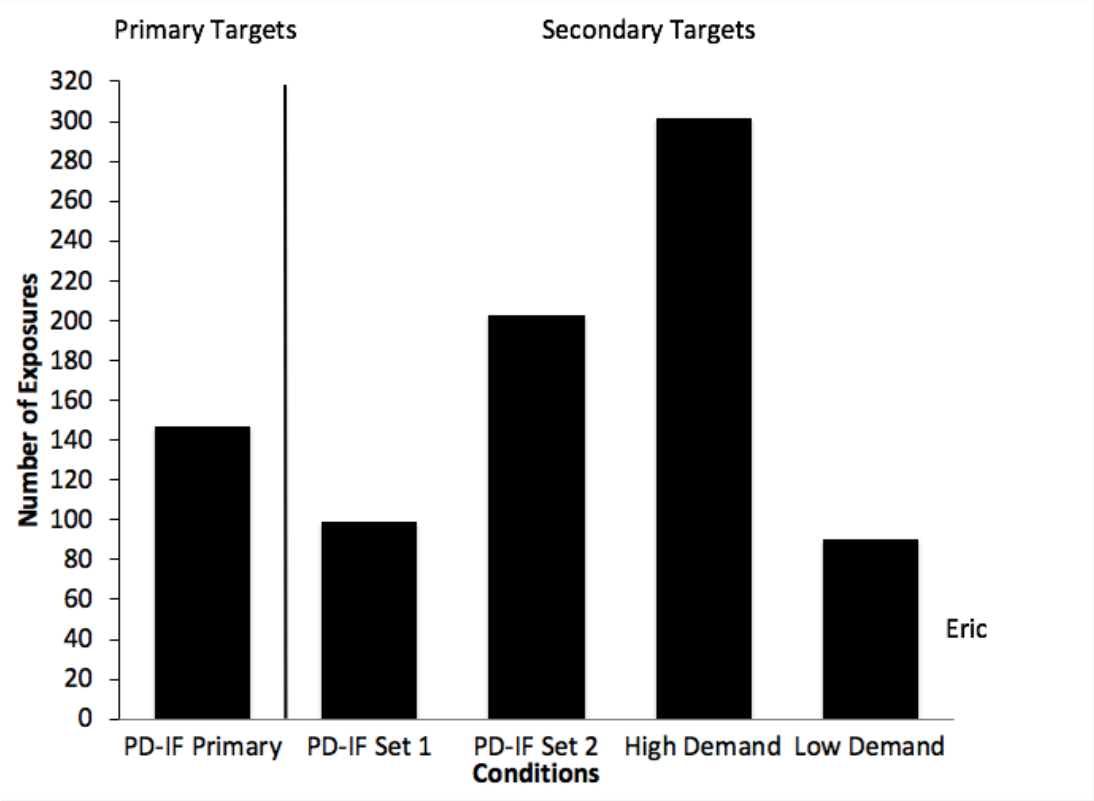


Figure 10. This graph depicts the total number of exposures to each target involving a model of the correct response for Eric.

Eric's session duration is displayed in Figure 11. For Eric, the low demand condition was the most efficient on this measure of efficiency. He met the mastery criterion for secondary targets in the low demand condition in about 36 min. He met the mastery criterion for primary and secondary targets in about 151 min. He acquired secondary targets in the high demand condition in about 157 min. However, there were 3 targets in the high and low demand conditions, and a total of 9 targets in the PD-IF condition overall. Even when considering time per target, the low demand condition was the most efficient.

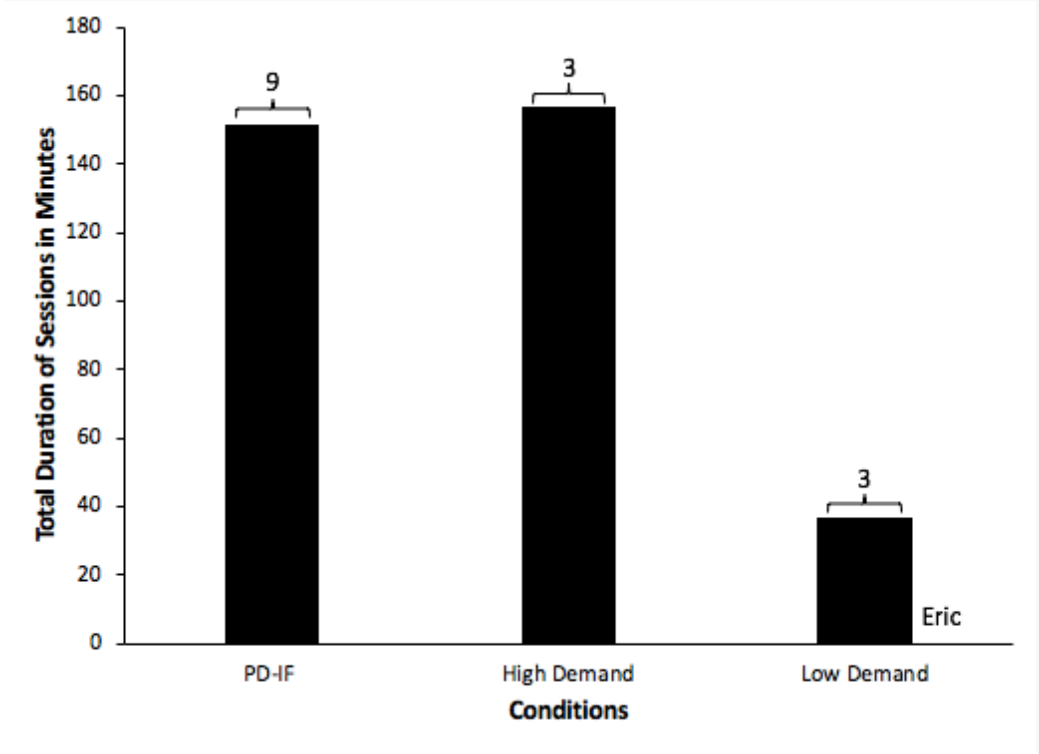


Figure 11. This graph depicts total session duration for each condition for Eric.

Eric's trials to mastery are displayed in Figure 12. For Eric, the low demand condition was the most efficient on this measure of efficiency. He met the mastery criterion for secondary targets in the low demand condition following 90 trials. He met the mastery criterion for primary and secondary targets in the PD-IF condition 351 trials. He met the mastery criterion for secondary targets in the high demand condition following 378 trials. Even when considering the number of trials per target, the low demand condition was the most efficient.

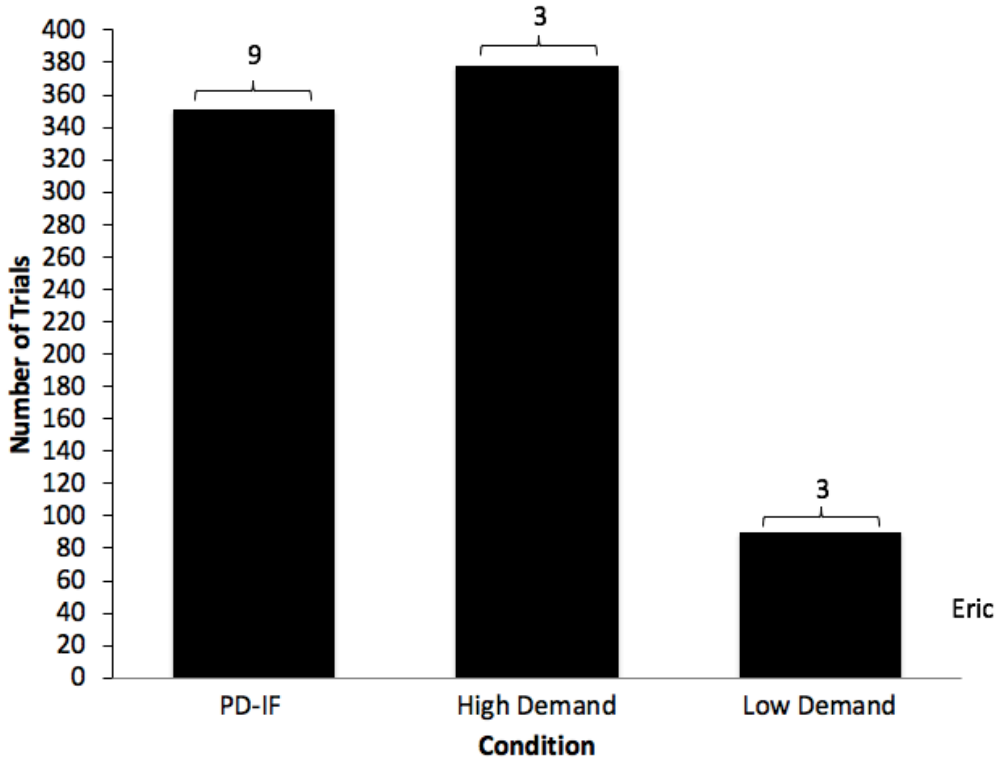


Figure 12. This graph depicts the total number of trials to mastery for each condition for Eric.

Pre- and post-test comparisons of generalization to untrained Wh-questions with a primary therapist are displayed in Figure 13. Eric had no correct responding to during pre-test (i.e., baseline). During post-test, Eric had 59.26% correct responding to primary targets. His responding to secondary targets during post-test varied from 11.11% correct responding to 66.67% correct responding. He had the highest generalization in the PD-IF set 2 and high demand conditions. Recall that both of these sets were first exposed to treatment (i.e., instructive feedback) before being moved to training.

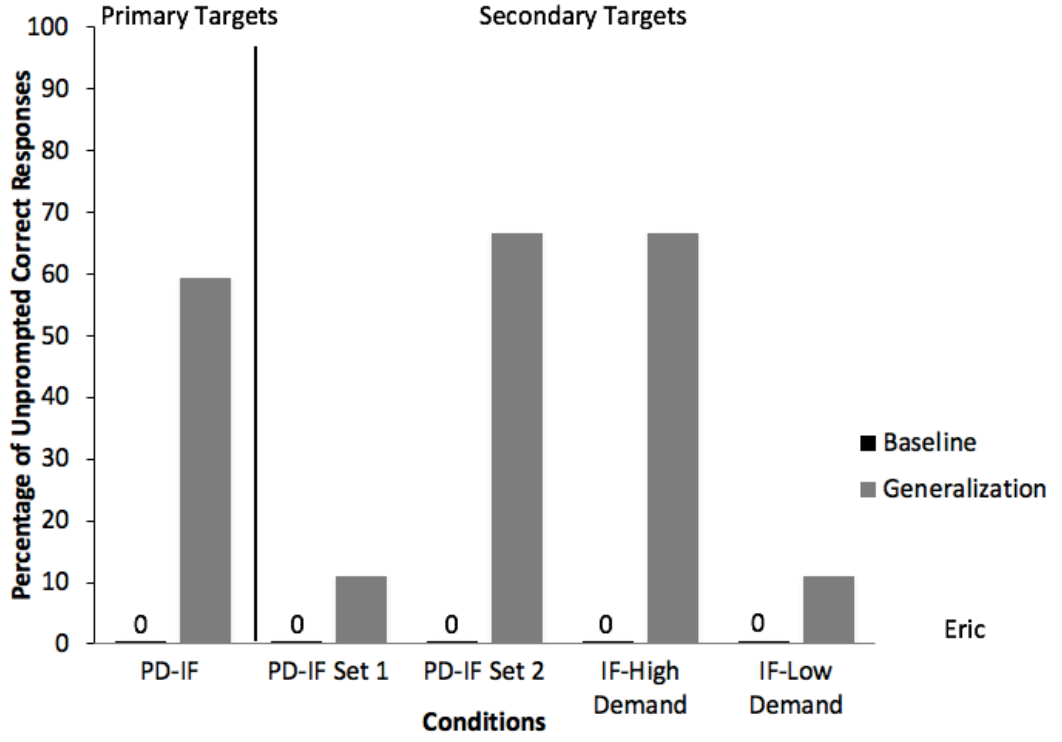


Figure 13. This graph depicts the percentage of unprompted correct responses to untrained Wh-questions for Eric.

Pre- and post-test comparisons of generalization to untrained Wh-questions with a novel therapist are displayed in Figure 14. Eric had no correct responding to during pre-test (i.e., baseline). During post-test, Eric had 25.93% correct responding to primary targets. His responding to secondary targets during post-test varied from 0.00% correct responding to 66.67% correct responding. He had the highest generalization in the PD-IF set 2 and high demand conditions. Both of these sets were first exposed to treatment (i.e., instructive feedback) before being moved to training.

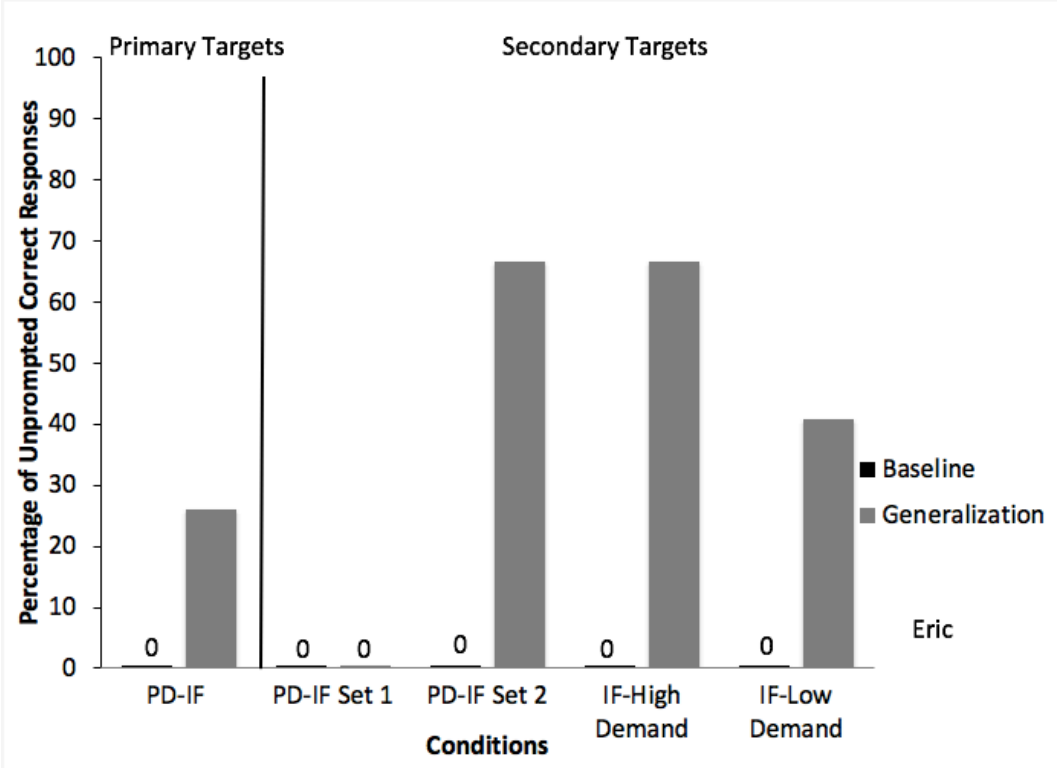


Figure 14. This graph depicts the percentage of unprompted correct responses to untrained Wh-questions presented by a novel experimenter for Eric.

Pre- and post-test comparisons maintenance of primary and secondary targets approximately two and four weeks post-mastery is displayed in Figure 15. During probes conducted two weeks following mastery, correct responding to primary targets was 55.56% correct responding. Correct responding to secondary targets varied from 44.44% correct responding to 66.67% correct responding. There were decreases in correct responding during probes conducted four weeks post-mastery for primary targets and secondary targets in the PD-IF conditions. Correct responding ranged from 22.22% to 33.33% during these probes. However, correct responding to secondary targets in the high and low demand conditions remained stable.

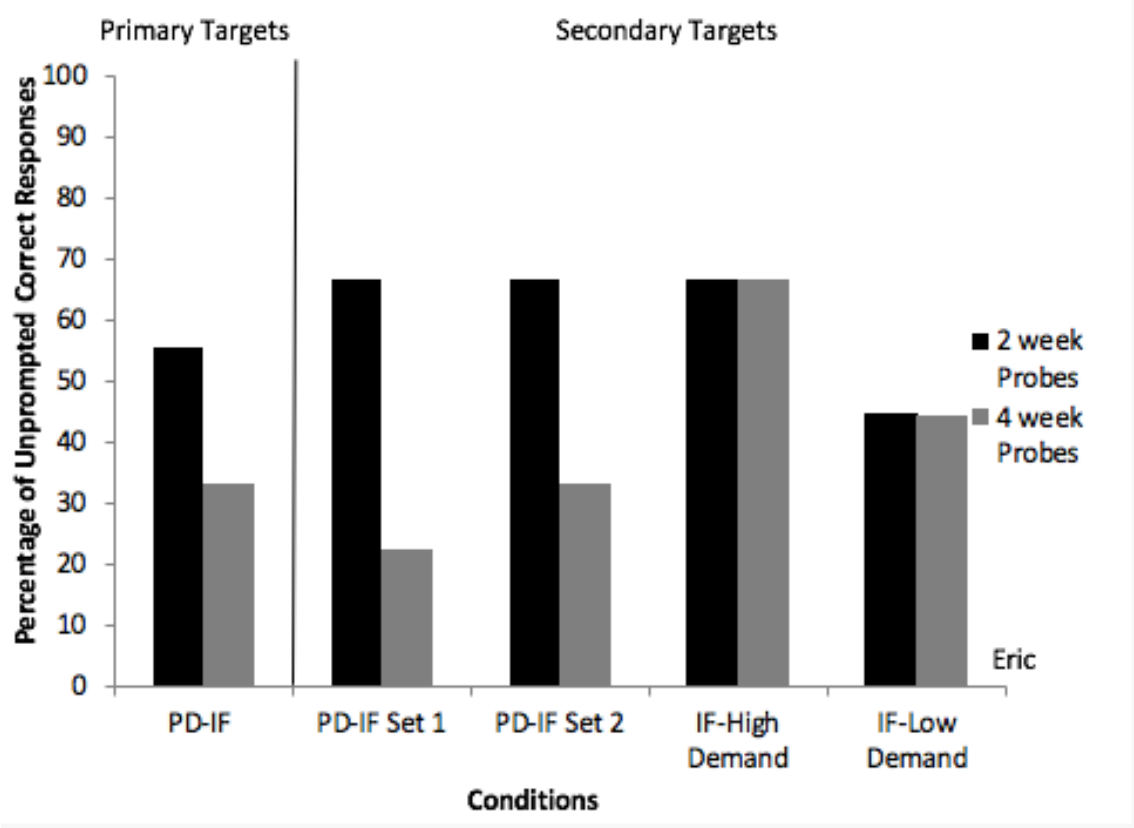


Figure 15. This graph depicts the percentage of unprompted correct responses to primary and secondary targets two and four weeks post-mastery for Eric.

Pre- and post-test comparisons maintenance of untrained Wh-questions approximately two and four weeks post-mastery is displayed in Figure 16. During probes conducted two weeks following mastery, correct responding to primary targets was 77.78% correct responding. Correct responding to secondary targets varied from 0.00% correct responding to 66.67% correct responding. There was a decrease in correct responding during probes four weeks post-mastery for primary targets in the PD-IF condition only. Correct responding to secondary targets in the high demand and low demand conditions remained stable during these probes. For the secondary targets in the PD-IF condition, there was an increase in correct responding during these probes – 33% correct responding for set 1 and 44.44% correct responding for set 2.

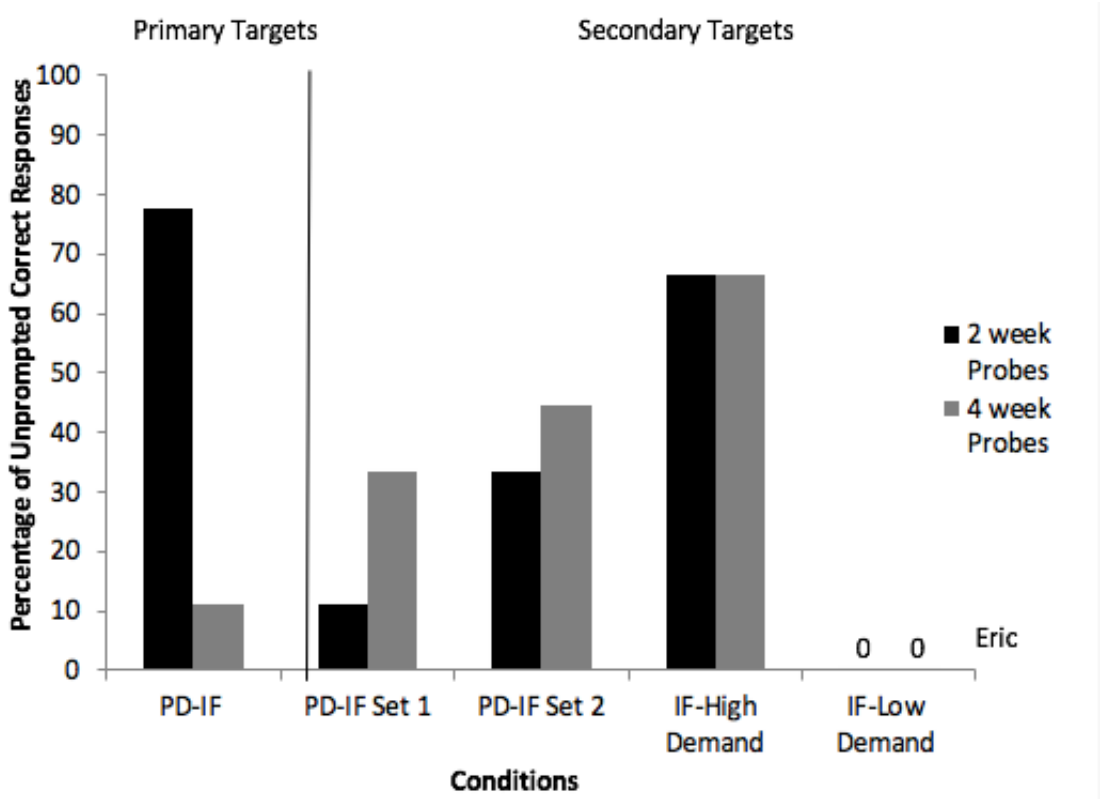


Figure 16. This graph depicts the percentage of unprompted correct responses untrained Wh-question two and four weeks post-mastery for Eric.

Joel

Joel's results from treatment are depicted in Figure 17. During baseline, Joel did not respond correctly to any items. A within appointment decrease in responding was observed (session 70), such that the percentage of unprompted correct responses tended to decrease toward the end of Joel's appointment. As a result, session breaks were increased in duration (5-10 min) and frequency (about every 3-5 sessions), and a movement component was introduced such that Eric had the option of getting up from the table to blow bubbles and use squishy toys while listening to music. He often manded for hugs, squeezes, and spins during these breaks. He met the mastery criterion for secondary targets in the PD-IF condition, following 14 sessions. In order to continue running the

PD-IF condition, a new set of secondary target stimuli (PD-IF secondary set 2) was introduced in baseline. He did not engage in correct responding in baseline to targets in the PD-IF secondary set 2 and these items were subsequently introduced into treatment for the PD-IF condition. Joel met the mastery criterion for the high demand condition following 15 sessions. He then met the mastery criterion for primary targets in the PD-IF condition following 17 sessions. All remaining secondary targets were moved to a 5-s constant prompt delay with error correction. He met the mastery criterion for the remaining secondary sets following 6 (PD-IF secondary set 2) and 10 (high demand) sessions of direct training.

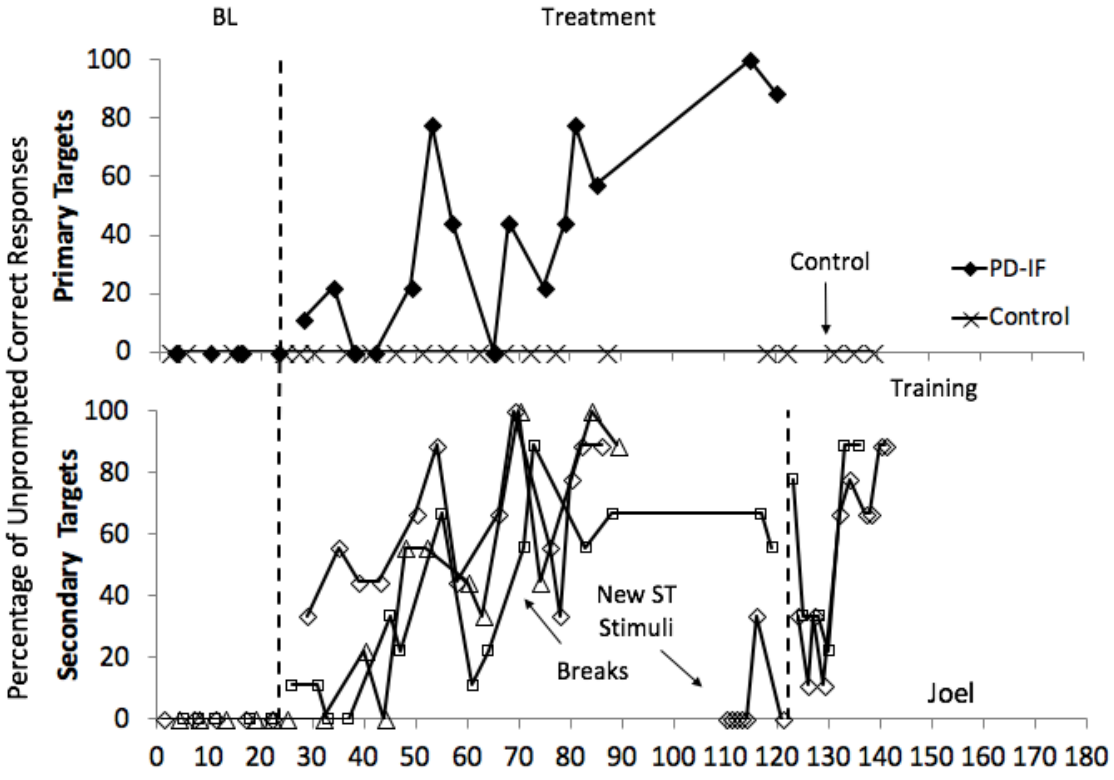


Figure 17. This graph depicts the percentage of unprompted correct responses to primary, secondary, and control stimuli for Joel.

Echoic behavior across conditions for Joel is displayed in Table 6. His echoic behavior varied across conditions. He had the highest mean echoic behavior during PD-IF secondary set 1 and PD-ID secondary set 2, and the lowest mean echoic behavior during the low demand condition.

Condition	Minimum	Maximum	Average
PD-IF Set 1	22.222%	100.00%	88.10%
PD-IF Set 2	100.00%	100.00%	100.00
High Demand	44.44%	100.00%	87.00%
Low Demand	44.44%	100.00%	71.90%

Table 6. Minimum, maximum, and mean levels of echoic responding during instructive feedback sessions for Joel.

Joel's sessions to mastery are displayed in Figure 18. For Joel, acquisition of the secondary targets in the PD-IF condition was most efficient according to this measure of efficiency. He achieved the mastery criterion in 14 (PD-IF secondary set 1) and 12 (PD-IF secondary set 2) sessions respectively. He required a total of 15 sessions to reach mastery for secondary targets in the high demand condition, followed closely by primary targets in the PD-IF condition (17 sessions). Secondary targets in the low demand condition required a total of 23 sessions to reach mastery, including a combination of treatment (17 sessions) and direct training (6 sessions). He did not acquire any sets of secondary targets in the low demand condition without direct training. Even if we consider the number of sessions to reach mastery per target, the PD-IF condition was the most efficient on this measure.

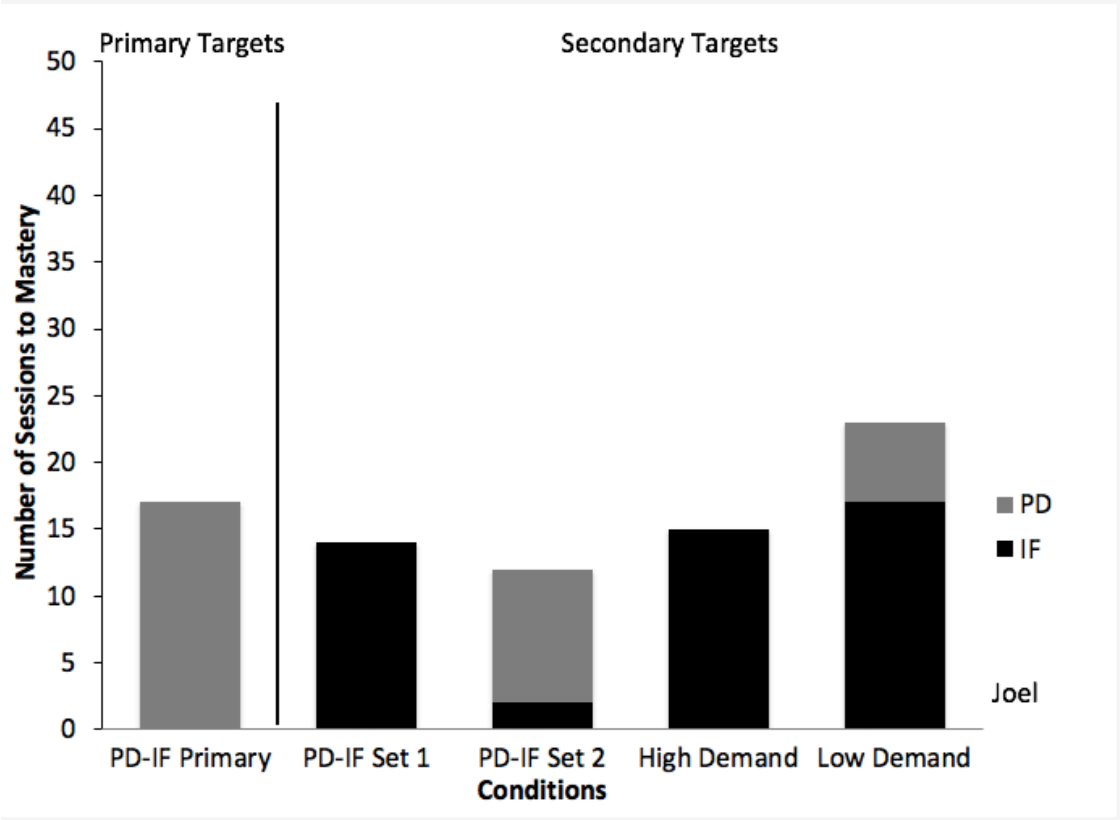


Figure 18. This graph depicts the number of sessions to mastery for each condition. The gray portion of columns represents the number of sessions that were conducted utilizing a 5s constant prompt delay with error correction for Joel.

Joel's number of exposures to target stimuli are displayed in Figure 19. For Joel, acquisition of the primary targets in the PD-IF condition was the most efficient, requiring a total of 125 exposures. There were differences between PD-IF secondary set 1 and secondary set 2, with the former requiring 126 exposures and the latter requiring 191 exposures. The number of exposures required to reach mastery for secondary targets in the high demand condition was similar to PD-IF secondary set 1, with a total of 135 exposures. Finally, the low demand condition required a total of 178 exposures.

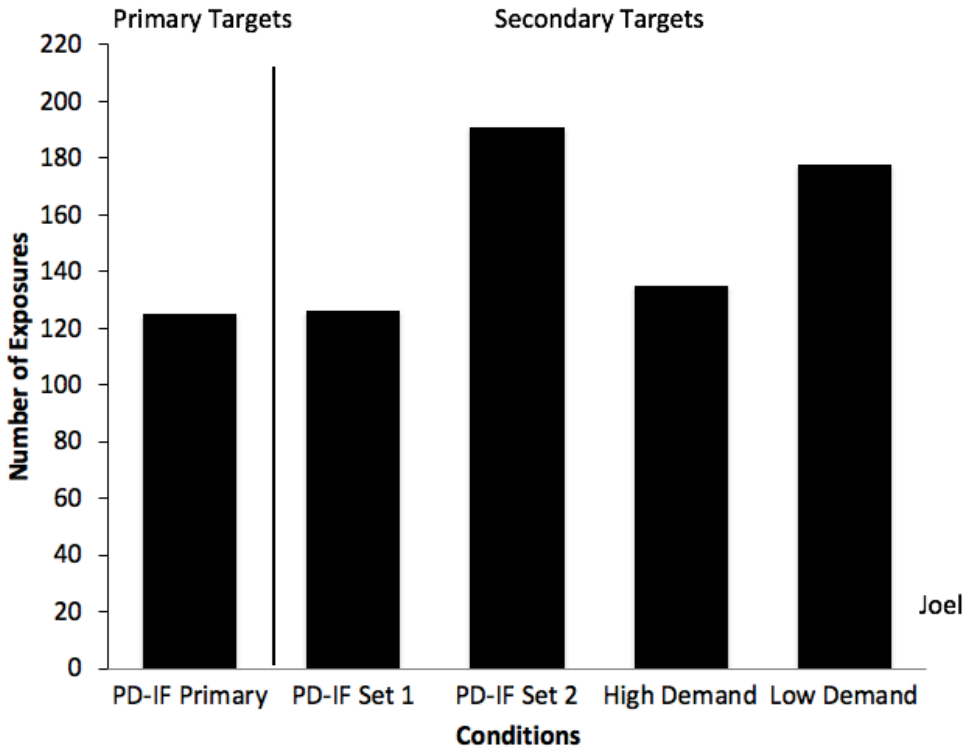


Figure 19. This graph depicts the total number of exposures to each target involving a model of the correct response for Joel.

Joel's session duration is displayed in Figure 20. For Joel, the high demand condition was the most efficient on this measure of efficiency. He met the mastery criterion for secondary targets in the high demand condition in about 52 min. He met the mastery criterion for primary and secondary targets in about 151 min. He acquired secondary targets in the low demand condition in about 86 min. However, there were 3 targets in the high and low demand conditions, and a total of 9 targets in the PD-IF condition overall. However, if we consider time per target, then the PD-IF condition was the most efficient for Joel.

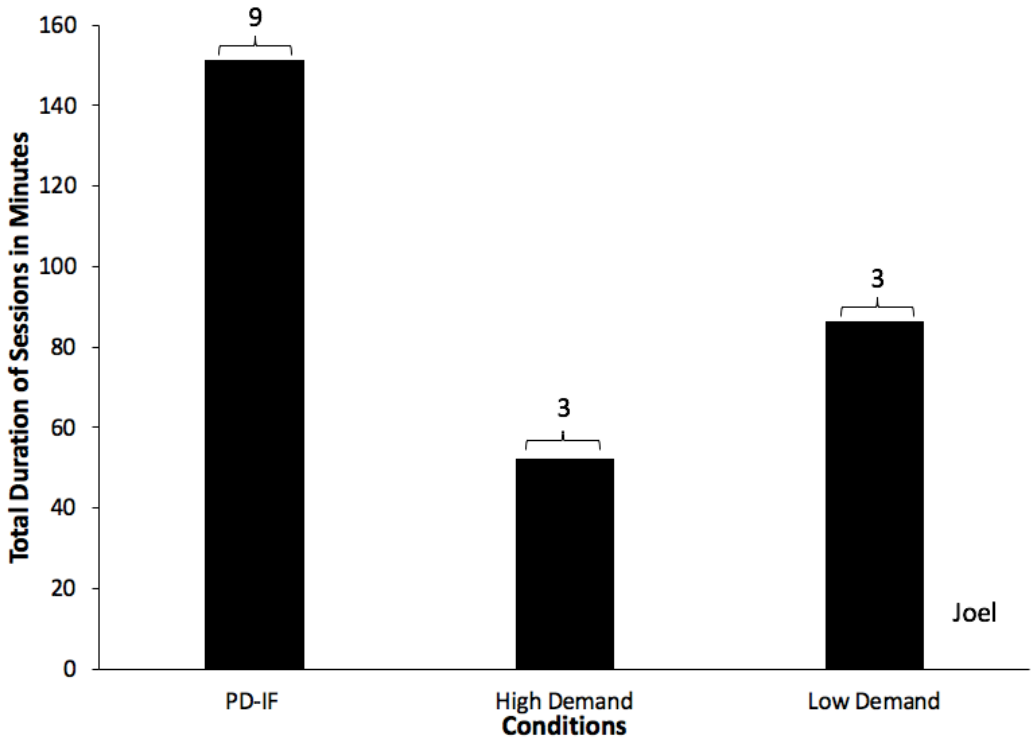


Figure 20. This graph depicts total session duration for each condition for Joel.

Joel's trials to mastery are displayed in Figure 21. For Joel, the high demand condition was the most efficient on this measure of efficiency. He met the mastery criterion for secondary targets in the high demand condition following 135 trials. He met the mastery criterion for primary and secondary targets in the PD-IF condition 243 trials. He met the mastery criterion for secondary targets in the low demand condition following 207 trials. However, if we consider the number of trials per target, the PD-IF condition was the most efficient.

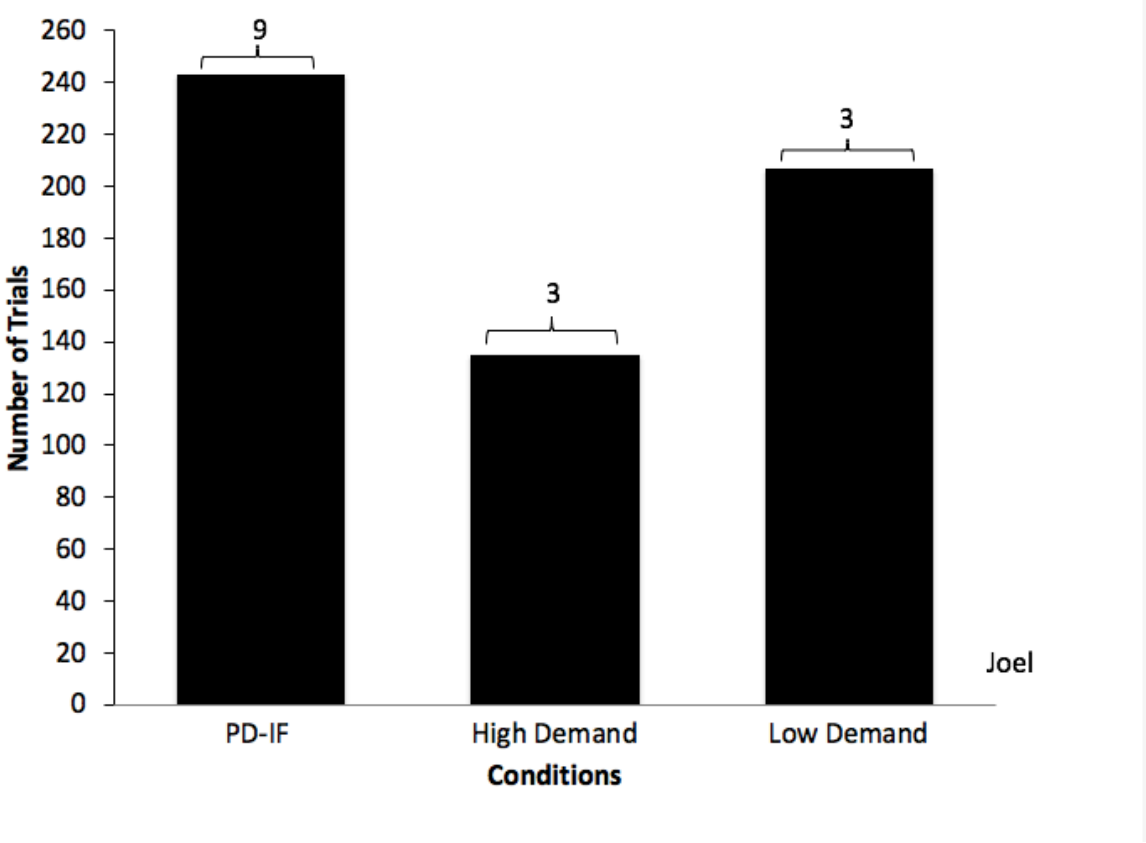


Figure 21. This graph depicts the total number of trials to mastery for each condition for Joel.

Probes of generalization to with intraverbals without visual stimuli with the primary therapist were conducted two weeks following mastery of the relevant target set. These data are displayed in Figure 22. During these probes, Joel had 70.37% correct responding to primary targets. His responding to secondary targets during post-test varied from 29.63% correct responding to 88.89% correct responding. He had the highest correct responding in the PD-IF set 2 and low demand conditions. Recall that both of these sets were first exposed to treatment (i.e., instructive feedback) before being moved to training.

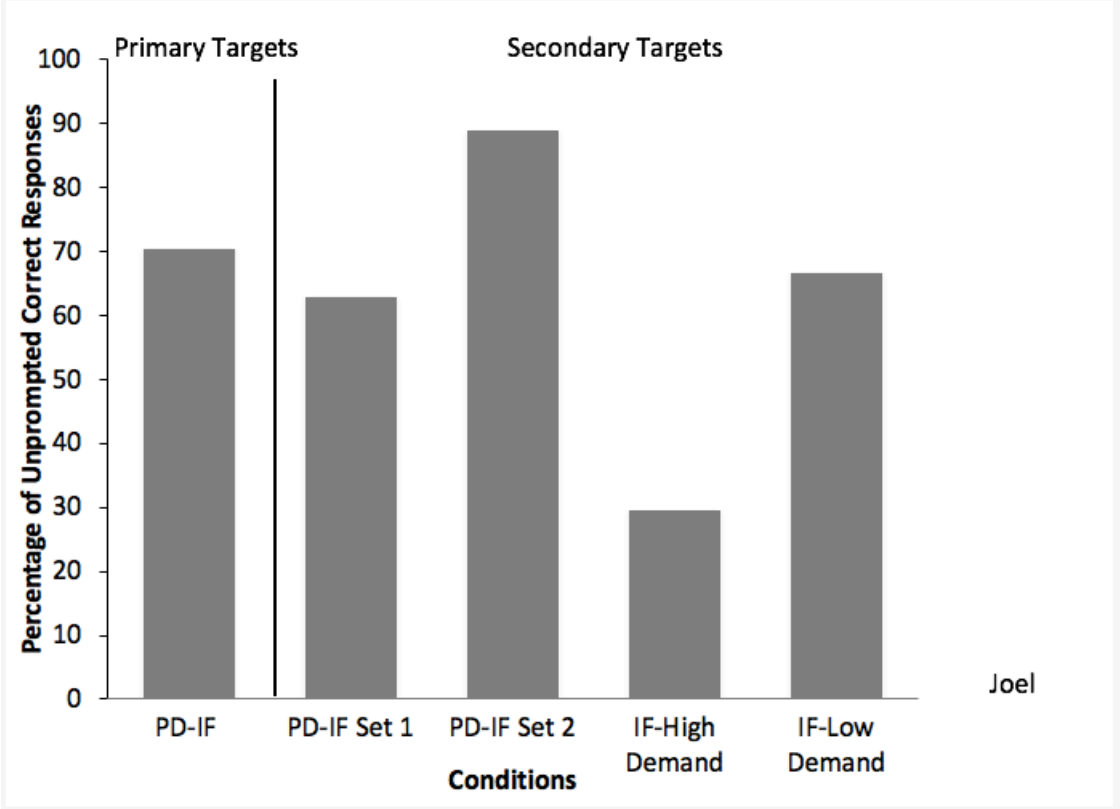


Figure 22. This graph depicts the percentage of unprompted correct responses to targets without a visual present for Joel.

Pre- and post-test comparisons of generalization to untrained Wh-questions with a primary therapist are displayed in Figure 23. Joel had no correct responding to during pre-test (i.e., baseline). During post-test, Joel had 62.96% correct responding to primary targets. His responding to secondary targets during post-test varied from 11.11% correct responding to 88.89% correct responding. He had the highest generalization in the PD-IF set 2 and low demand conditions. Recall that both of these sets were first exposed to treatment (i.e., instructive feedback) before being moved to training.

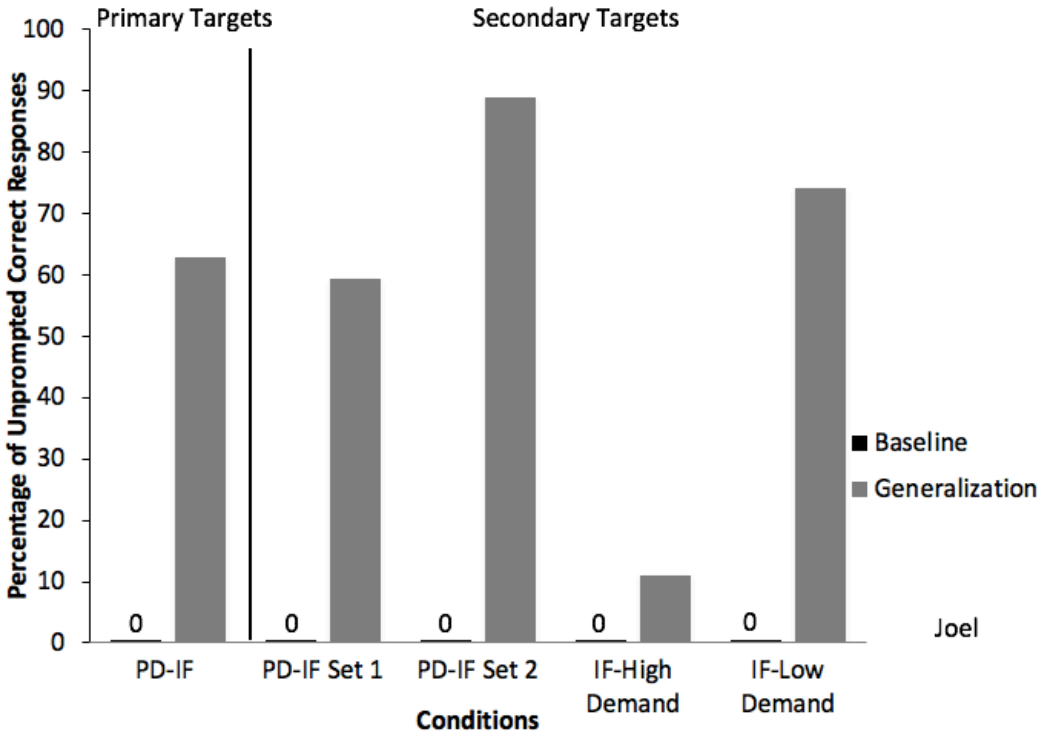


Figure 23. This graph depicts the percentage of unprompted correct responses to untrained Wh-questions for Joel.

Pre- and post-test comparisons of generalization to untrained Wh-questions with a novel therapist are displayed in Figure 24. Joel had no correct responding to during pre-test (i.e., baseline). During post-test, Eric had 40.74% correct responding to primary targets. His responding to secondary targets during post-test varied from 51.85% correct responding to 92.59% correct responding. He had the highest generalization in the PD-IF set 2.

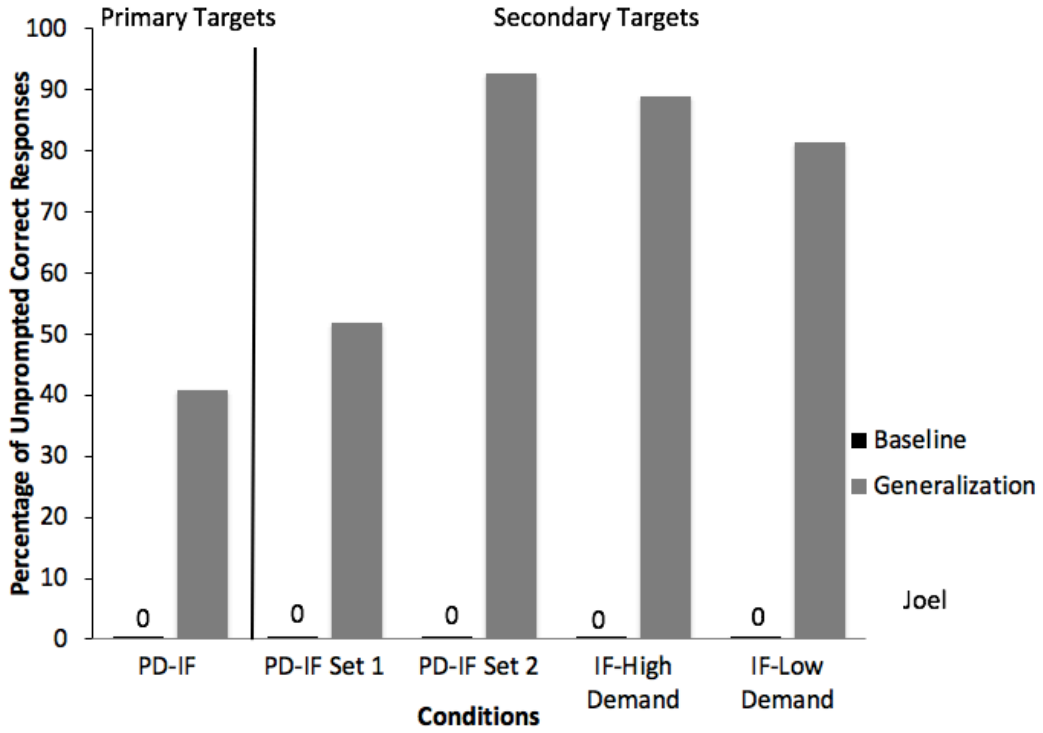


Figure 24. This graph depicts the percentage of unprompted correct responses to untrained Wh-questions presented by a novel experimenter for Joel.

Pre- and post-test comparisons maintenance of primary and secondary targets approximately two and four weeks post-mastery is displayed in Figure 25. During probes conducted two weeks following mastery, correct responding to primary targets was 85.71% correct responding. Correct responding to secondary targets varied from 33.33% correct responding to 88.89% correct responding. There were decreases in correct responding during probes conducted four weeks post-mastery for secondary targets in the PD-IF condition from 88.88 % correct responding to 77.78% correct responding. Increases in correct responding were observed for primary targets in the PD-IF condition and secondary targets in the high demand condition. However, correct responding to PD-IF secondary set 2 and secondary targets in the low demand condition remained stable.

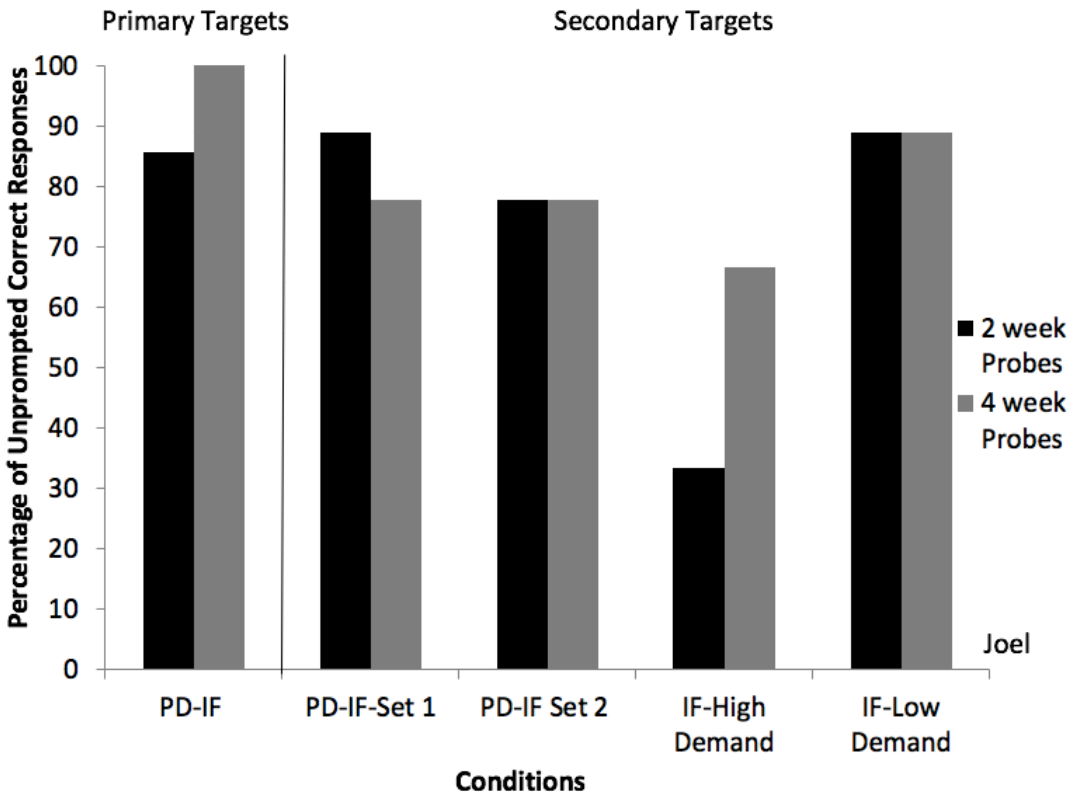


Figure 25. This graph depicts the percentage of unprompted correct responses to primary and secondary targets two and four weeks post-mastery for Joel.

Pre- and post-test comparisons maintenance of untrained Wh-questions approximately two and four weeks post-mastery is displayed in Figure 26. During probes conducted two weeks following mastery, correct responding to primary targets was 44.44% correct responding. Correct responding to secondary targets varied from 0.00% correct responding to 100% correct responding. There was a decrease in correct responding during probes four weeks post-mastery for secondary targets in the low demand condition only. Correct responding to primary targets in the PD-IF condition and in the high demand condition increased. Correct responding remained stable across two and four week probes for secondary target set 1 and set 2 in the PD-IF condition.

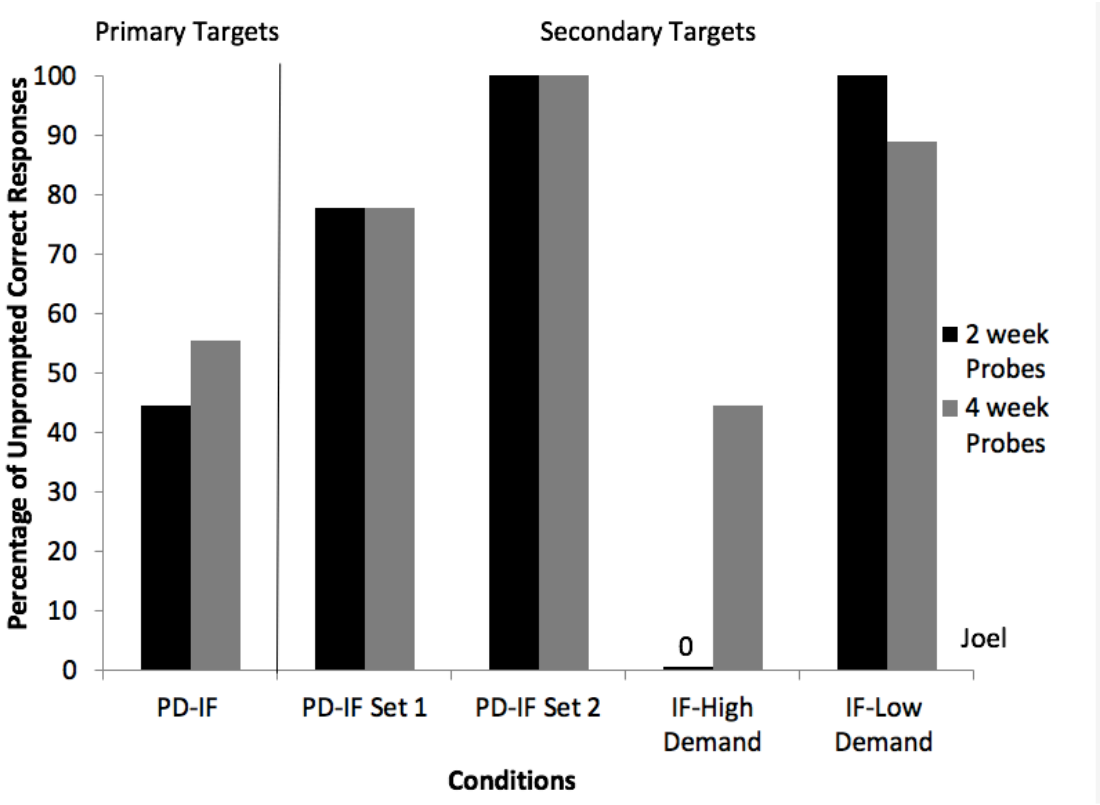


Figure 26. This graph depicts the percentage of unprompted correct responses untrained Wh-question two and four weeks post-mastery for Joel.

Gary

Gary's results from treatment are depicted in Figure 27. During baseline, Gary did not respond correctly to any items. There was a two week gap due to illness and a family trip between the first set of 0 s time delay and the second set of 0 s time delay. During the first session of 5 s time delay for the PD-IF, Gary repeated the entire discriminative stimulus combined with the target response. He also engaged in problem behaviors (e.g., crying, yelling, crawling under the table, requesting the experimenter to present a different word for him to echo) when prompted to provide the target response only. After about 9 minutes of continued problem behavior, the experimenter presented three unrelated vocal models for him to imitate, praised his compliance with the task, and gave

him a break from the table. In a separate area, the experimenter provided a brief model showing a video of the experimenter presenting an antecedent verbal stimulus unrelated to study targets (e.g., "You drive a _____) followed by modeling the target response live (e.g., car). The experimenter then represented these same antecedent verbal stimuli to Gary live (about 3-5 trials), to ensure that the task expectations were clear. During this training, she used the verbal rule "Just say" before stating the target response. In subsequent sessions, if Gary had more than 2-3 repetitions of error correction before engaging in an independent correct response, the examiner repeated the rule "Just say" before providing the echoic prompt.

He met the mastery criterion for secondary targets in the PD-IF condition, following 7 sessions. In order to continue running the PD-IF condition, a new set of secondary target stimuli (PD-IF secondary set 2) was introduced in baseline. He did not engage in correct responding in baseline to targets in the PD-IF secondary set 2 and these items were subsequently introduced into treatment for the PD-IF condition. He met the mastery criterion for primary targets in the PD-IF condition following 15 sessions. In order to continue running the PD-IF condition, a new set of primary target stimuli (PD-IF primary set 2) was introduced in baseline. He did not engage in correct responding in baseline to targets in the PD-IF primary set 2 and these items were subsequently introduced into treatment for the PD-IF condition. He mastered the PD-IF primary set 2 following 4 sessions. All remaining secondary targets were moved to a 5-s constant prompt delay with error correction. An error was made PD-IF secondary set 2 was omitted for two appointments before being reintroduced into training. He mastered PD-IF secondary set 2 following 4 sessions of direct training. He mastered the secondary targets

in the low and high demand conditions following 6 and 8 sessions of direct training respectively. Thus, he did not master any secondary targets in the absence of either primary targets (PD-IF) or direct training (e.g., low and high demand conditions)

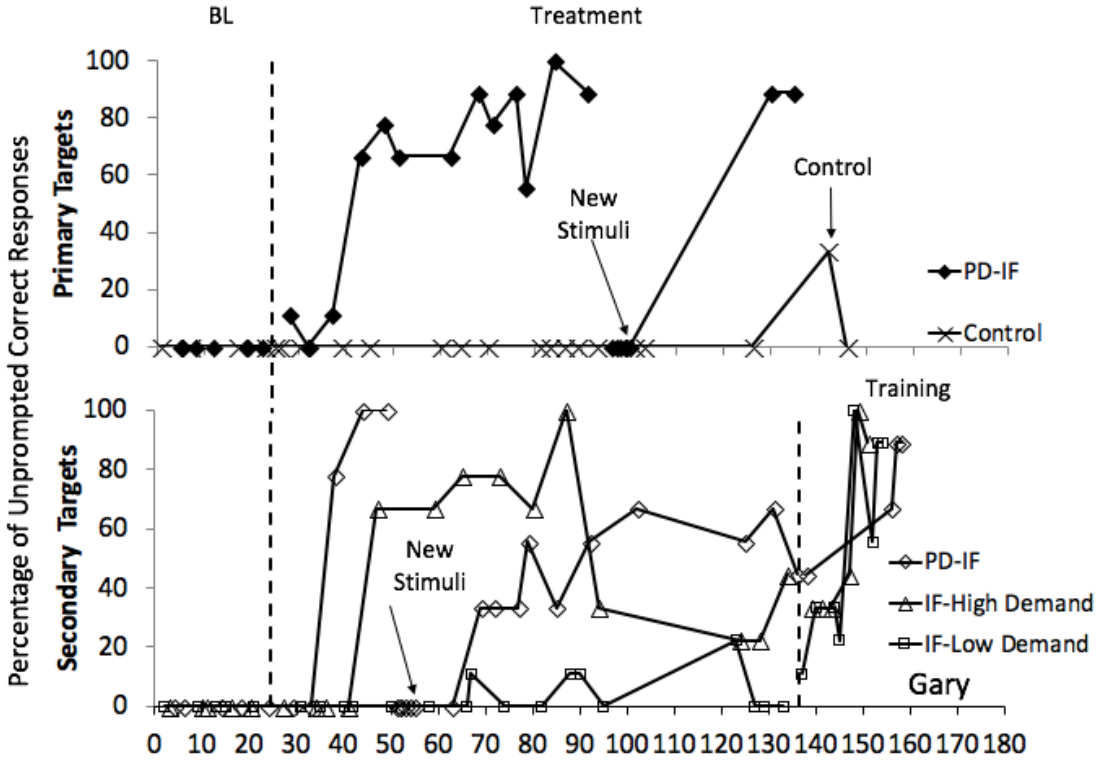


Figure 27. This graph depicts the percentage of unprompted correct responses to primary, secondary, and control stimuli for Gary.

Echoic behavior across conditions for Gary is displayed in Table 7. His echoic behavior varied across conditions. He had the highest mean echoic behavior during PD-IF secondary set 1 and PD-IF secondary set 2 – 46.03% and 17.49%. He had similarly low levels of echoic behavior for secondary targets in the high and low demand conditions – 8.33% and 8.19%.

Condition	Minimum	Maximum	Average
PD-IF Set 1	0.00%	88.89%	46.03%
PD-IF Set 2	0.00%	55.56%	17.59%
High Demand	0.00%	33.33%	8.33%
Low Demand	0.00%	44.44%	8.19%

Table 7. Minimum, maximum, and mean levels of echoic responding during instructive feedback sessions for Gary.

Gary sessions to mastery are displayed in Figure 28. For Gary, the PD-IF condition was the most efficient on this measure. He reached the mastery criterion for PD-IF primary set 2 in 4 sessions and PD-IF primary set 1 in 7 sessions. He met the mastery criterion of PD-IF primary set 1 in 15 sessions. Recall that PD-IF secondary set 2 and secondary targets in both high and low demand conditions were moved to direct training. He mastered PD-IF secondary set 2 in a total of 15 sessions, including 11 sessions of treatment and 4 sessions of training. He mastered secondary targets in the high demand condition in a total of 22 sessions, including 16 sessions of treatment and 6 sessions of training. He mastered secondary targets in the low demand condition following a total of 27 sessions, including 19 sessions of treatment and 8 sessions of training.

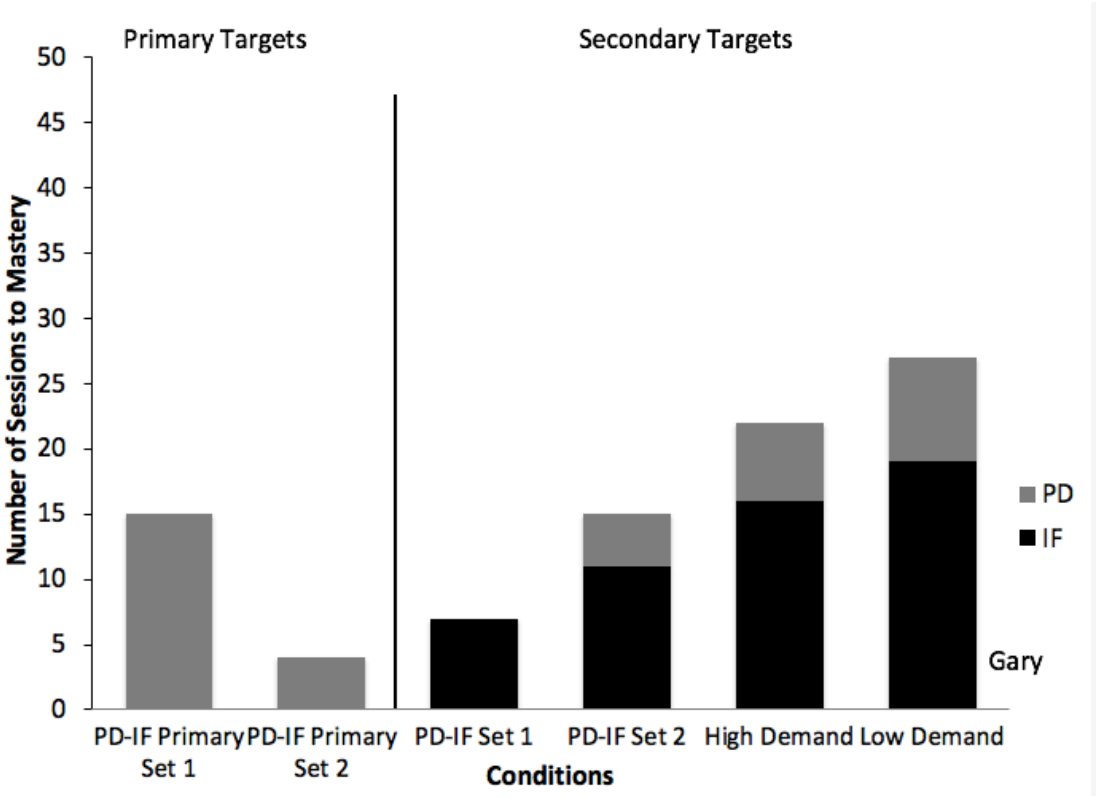


Figure 28. This graph depicts the number of sessions to mastery for each condition for Gary. The gray portion of columns represents the number of sessions that were conducted utilizing a 5s constant prompt delay with error correction.

Gary's number of exposures to target stimuli are displayed in Figure 29. For Gary, PD-IF primary set one required the fewest exposures to mastery, a total of 45 exposures. This was closely followed by the PD-IF secondary set 1 and secondary set 2, which required a total of 63 and 134 exposures, respectively. High demand required 190 exposures and low demand required 228 exposures. PD-IF primary set 1 required the greatest number of exposures to reach mastery, which was a total of 233 exposures.

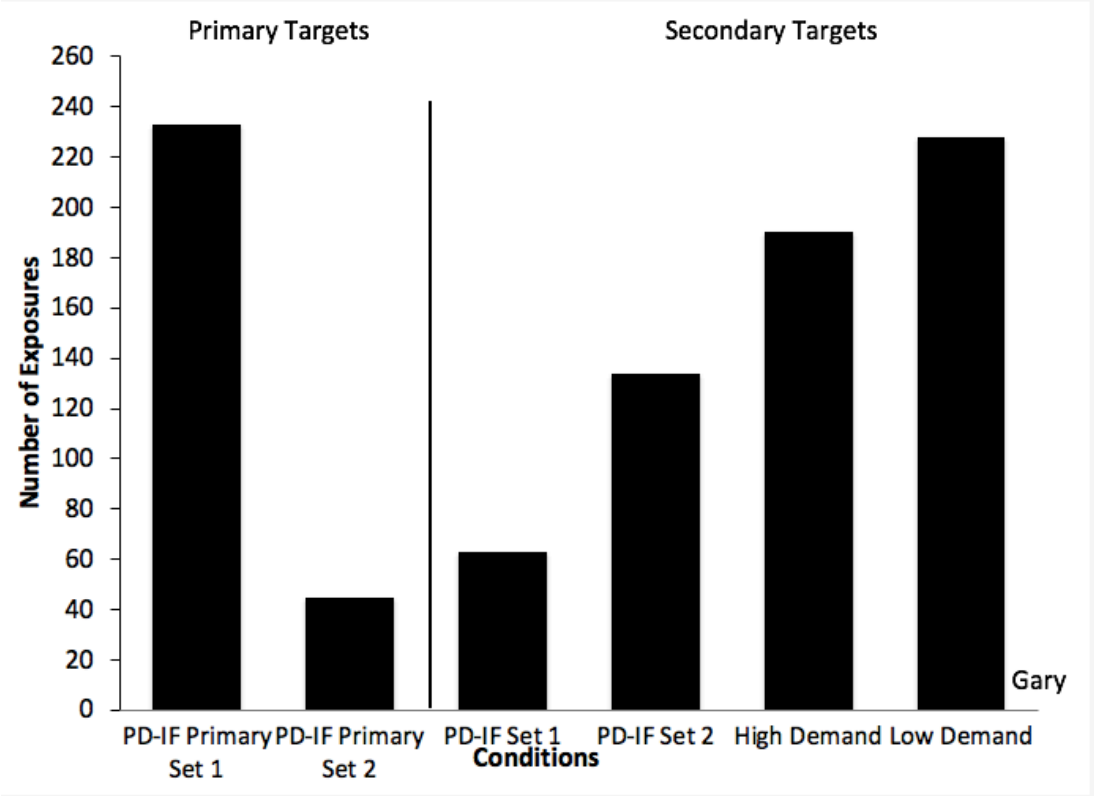


Figure 29. This graph depicts the total number of exposures to each target involving a model of the correct response for Gary.

Gary's session duration data are displayed in Figure 30. For Gary, the high demand condition required the least amount of time. He met the mastery criterion for secondary targets in the high demand condition in about 89 min. He met the mastery criterion for secondary targets in the low demand condition in about 110 minutes. He met the mastery criterion for primary and secondary targets in the PD-IF condition in about 147 minutes. However, if we consider time per target, the PD-IF condition was the most efficient for Gary. He acquired 12 targets in the PD-IF condition, compared to 3 targets in the IF only conditions (high and low demand).

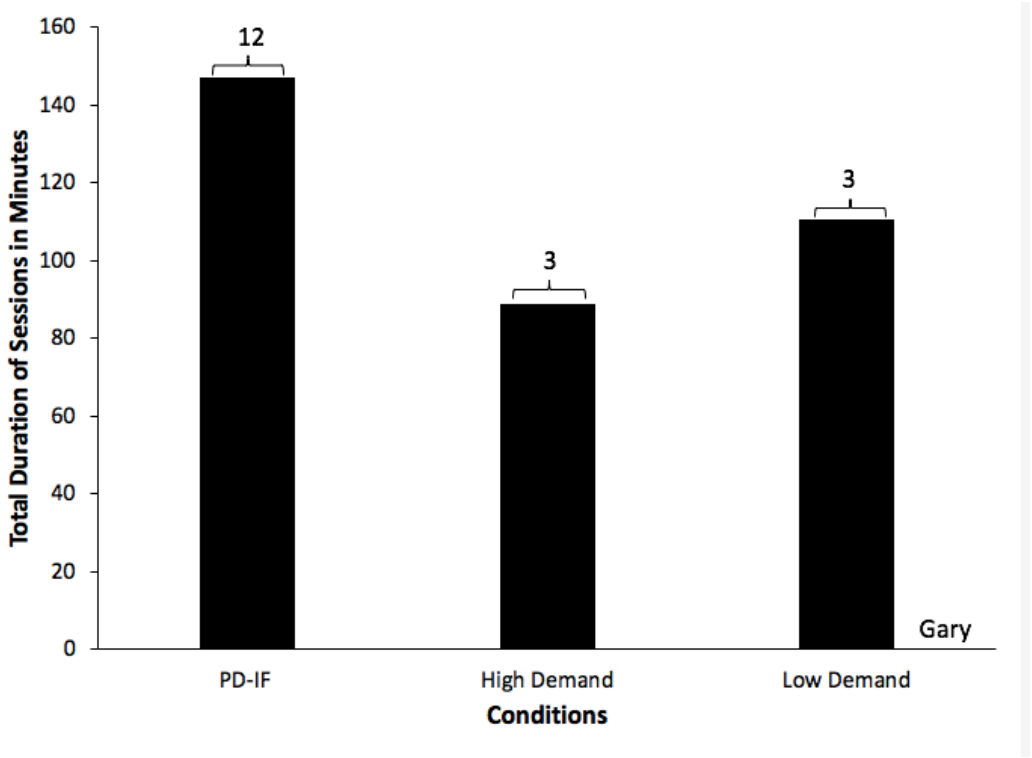


Figure 30. This graph depicts total session duration for each condition for Gary.

Gary's trials to mastery are displayed in Figure 31. Gary met the mastery criterion in the fewest number of trials in the high demand condition – 198 trials. He met the mastery criterion in the fewest number of trials in the low demand condition – 243 trials. He met the mastery criterion for primary and secondary targets in the PD-IF condition 513 trials. If we consider the number of trials per target, then PD-IF condition was the most efficient. He acquired 12 targets in the PD-IF condition, compared to 3 targets in the IF only conditions (high and low demand).

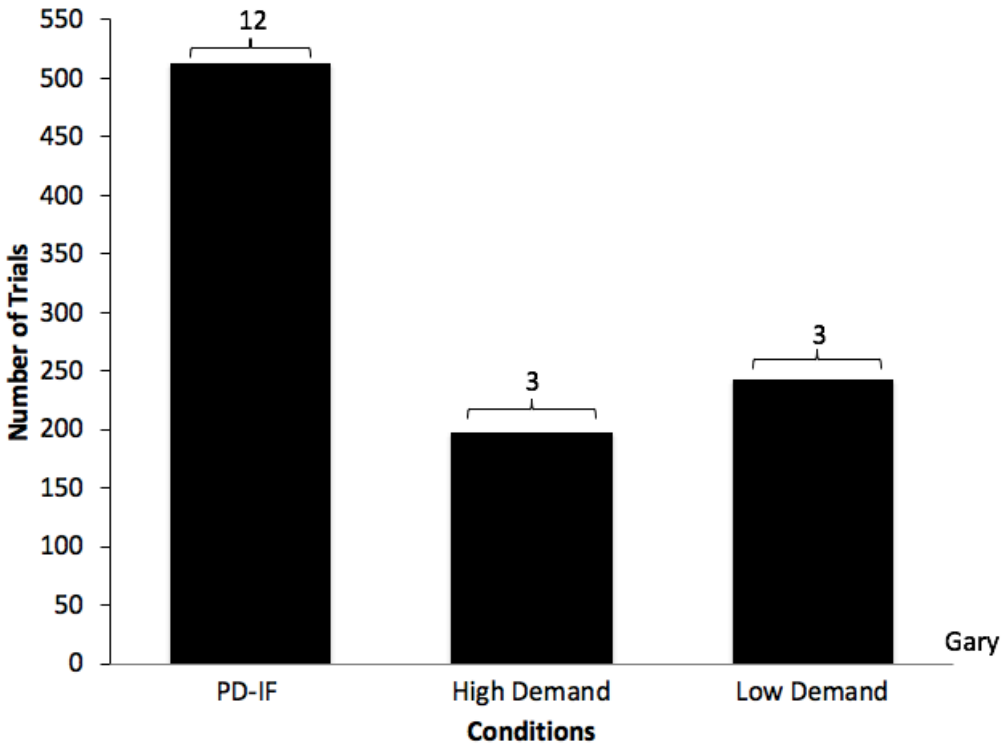


Figure 31. This graph depicts the total number of trials to mastery for each condition for Gary.

Pre- and post-test comparisons of generalization to untrained Wh-questions with a primary therapist are displayed in Figure 32. Gary had no correct responding to during pre-test (i.e., baseline). During post-test, Gary had 88.89% correct responding to PD-IF primary target set 1 and 55.56% correct responding to PD-IF primary targets set 2. His responding to secondary targets during post-test varied from 29.63 correct responding to 81.43% correct responding.

He had the highest generalization in PD-IF primary target set 1 and PD-IF secondary set 1. He had the lowest correct responding to secondary targets in the low demand condition – 29.63% correct responding.

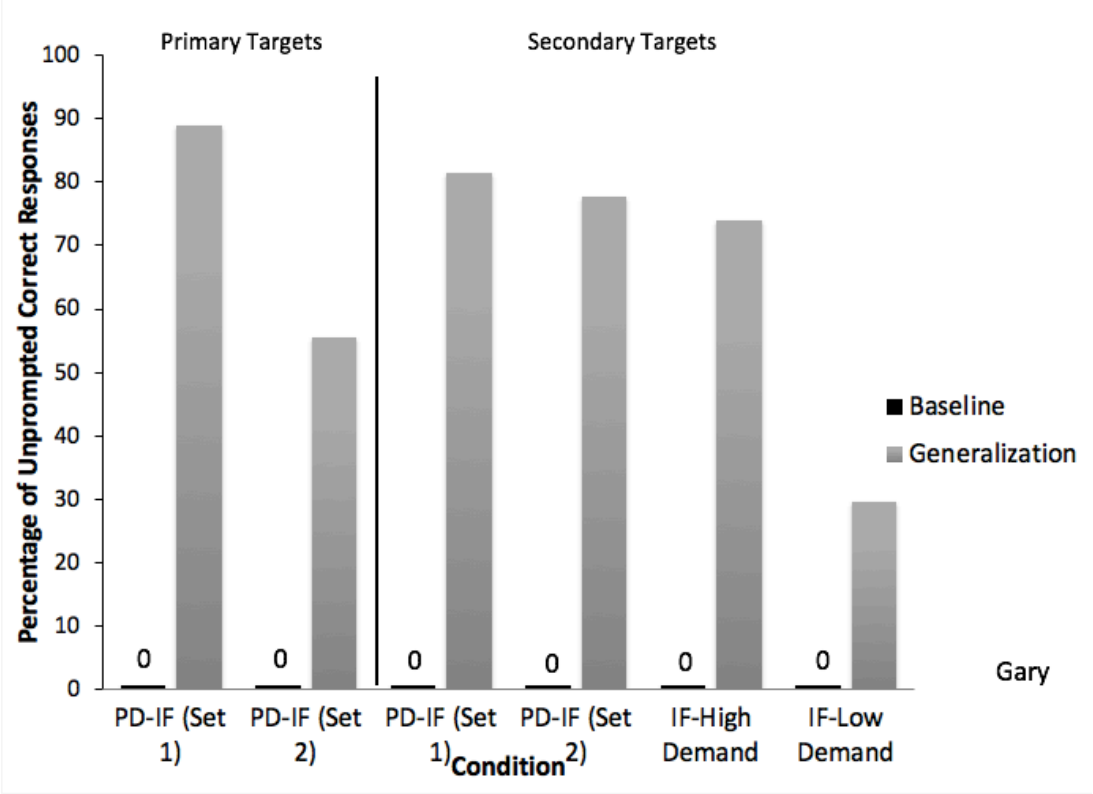


Figure 32. This graph depicts the percentage of unprompted correct responses to untrained Wh-questions for Gary.

Pre- and post-test comparisons of generalization to untrained Wh-questions with a novel therapist are displayed in Figure 33. Gary had no correct responding to during pre-test (i.e., baseline). During post-test, Gary had 81.48% correct responding to PD-IF primary target set 1 and 59.26% correct responding to PD-IF primary set 2. His responding to secondary targets during post-test varied from 51.85% correct responding to 88.89% correct responding. He had the highest generalization in the PD-IF set 2.

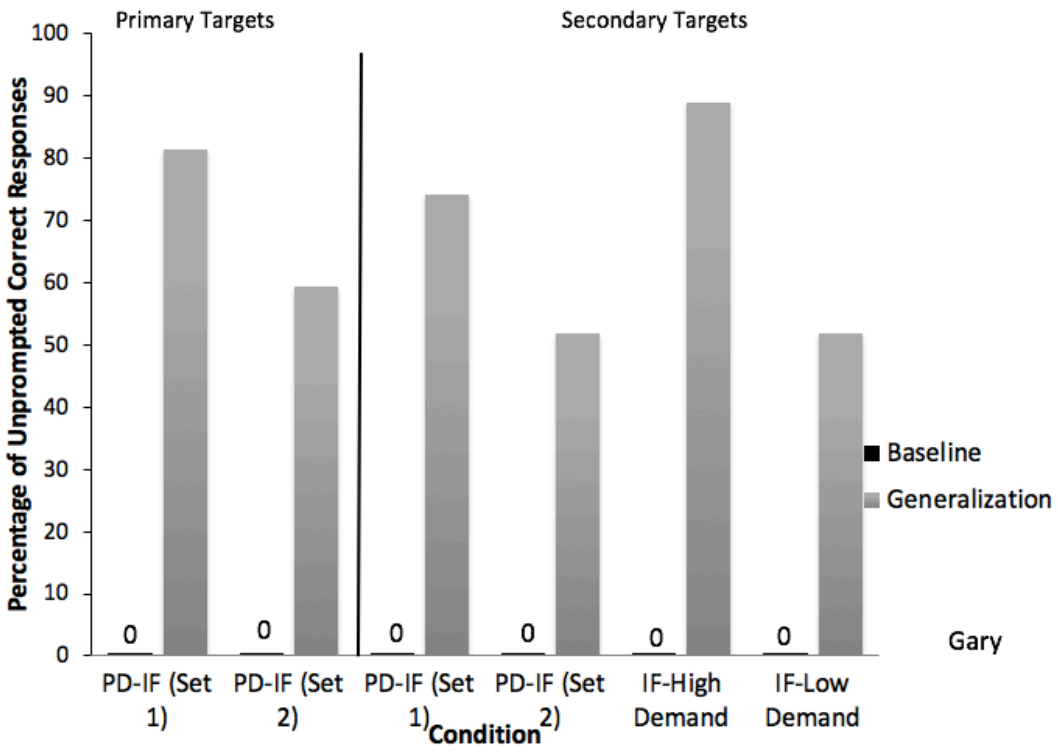


Figure 33. This graph depicts the percentage of unprompted correct responses to untrained Wh-questions presented by a novel experimenter for Gary.

Pre- and post-test comparisons maintenance of primary and secondary targets approximately two and four weeks post-mastery is displayed in Figure 34. During probes conducted two weeks following mastery, correct responding to PD-IF primary targets set 1 was 88.89% and 66.67% for PD-IF primary set 2. Correct responding to secondary targets varied from 33.33% correct responding to 100% correct responding; however, correct responding was somewhat higher for the IF only conditions (high and low demand conditions). There were decreases in correct responding during probes conducted four weeks post-mastery for PD-IF primary target set 1, PD-IF secondary set 1, and secondary targets in the low demand condition. There were increases in correct

responding during four week probes for PD-IF primary set 2 and PD-IF secondary set 2. Correct responding remained stable in the high demand condition.

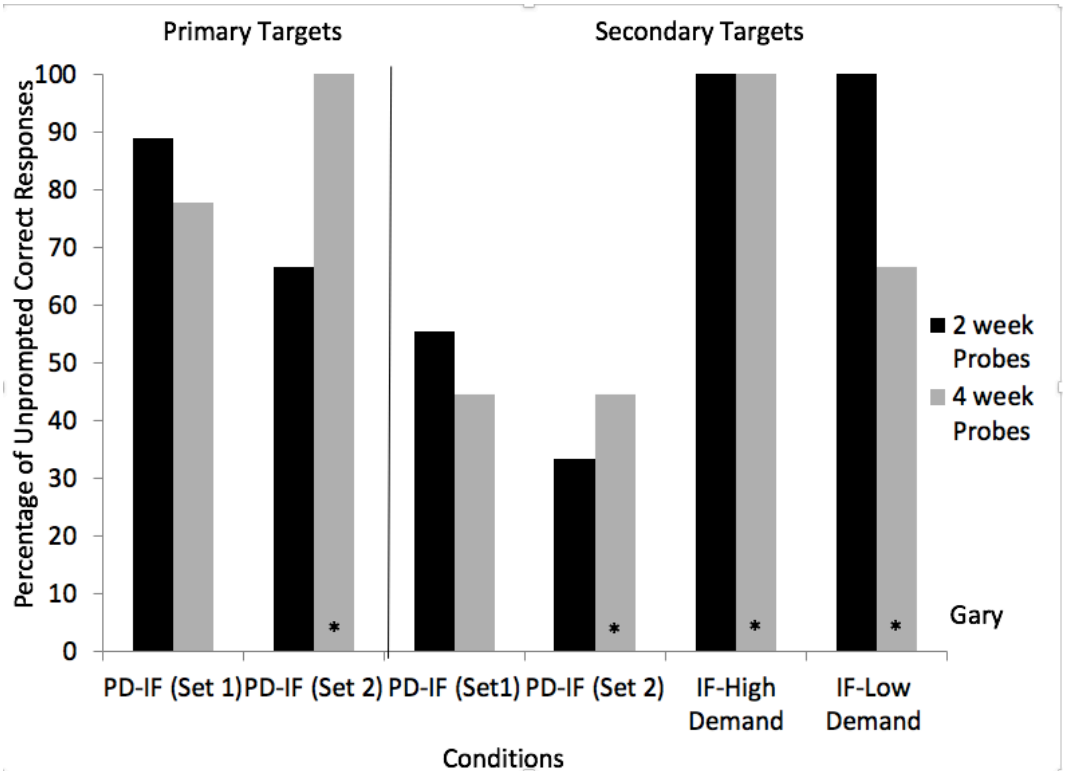


Figure 34. This graph depicts the percentage of unprompted correct responses to primary and secondary targets two and four weeks post-mastery for Gary. * Denote sessions that were probed by a familiar therapist other than the primary therapist.

Pre- and post-test comparisons maintenance of untrained Wh-questions approximately two and four weeks post-mastery is displayed in Figure 35. During probes conducted two weeks following mastery, correct responding to PD-IF primary set 1 was 100% and correct responding was 55.56% to PD-IF primary set 2. Correct responding to secondary targets varied from 22.22% correct responding to 100% correct responding. There was a decrease in correct responding during probes four weeks post-mastery for

PD-IF primary set 1 and secondary targets in the low demand condition. Correct responding to PD-IF primary set 2 and PD-IF secondary set 2 increased during probes conducted at 4 weeks post-mastery. Correct responding remained stable across two and four week probes for PD-IF secondary set 1 and secondary targets in the high demand. and set 2 in the PD-IF condition.

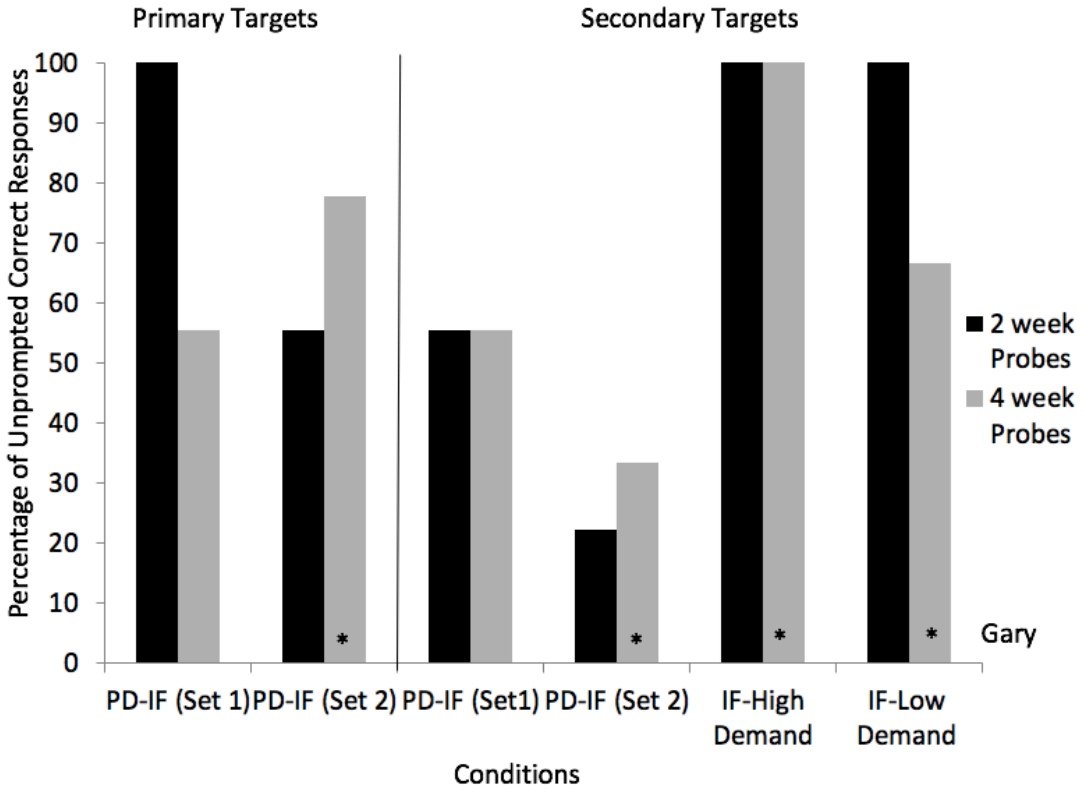


Figure 35. This graph depicts the percentage of unprompted correct responses untrained Wh-question two and four weeks post-mastery for Gary. * Denote sessions that were probed by a familiar therapist other than the primary therapist.

Summary of results for experimental questions

To answer the first three experimental questions, adapted alternating treatments designs were utilized for each participant. Supplemental measures of efficiency for each participant for the following dimensions were also gathered and displayed: number of sessions to mastery, number of exposures to stimuli, total session duration in minutes, and number of trials to mastery. Measures of echoic behavior were gathered and displayed in a table.

Research question one. *Is there a difference in the effectiveness of instructive feedback on the acquisition of secondary targets in a high demand versus a low demand context for individuals with ASD?* All participants acquired at least one set of secondary targets without direct training when they were embedded within instruction for primary targets. However, individual differences in participants emerged in terms of the effectiveness of the instructive feedback only conditions – high and low demand. Without direct training and in the absence of instruction for primary targets, only Eric and Joel acquired secondary targets. However, Eric acquired secondary targets in the low demand condition, while Joel acquired secondary targets in the high demand condition. Gary did not acquire any secondary targets without direct training and in the absence of instruction for primary targets. However, he did acquire secondary targets when they were embedded within instruction for primary targets.

Research question two: *What condition is the most efficient procedure for producing acquisition of targets?*

While all participants achieved the mastery criterion for all stimulus sets introduced, the efficiency of treatment and training procedures required to reach mastery

varied for participants and by the condition. For Eric, the low demand condition was the most efficient in terms of all measures of efficiency. For Joel, either the PD-IF condition or the high demand condition were the most efficient condition. However, if we consider the number of targets acquired in relation to efficiency measures, then the PD-IF condition was the most efficient. A similar pattern emerged for Gary as well. That is, while either the PD-IF condition or the high demand condition were the most efficient conditions, when we consider the number of targets in relation to efficiency, the PD-IF condition was the most efficient.

Research question three. *Does echoic behavior vary by condition?* In general, echoic behavior was moderately to highly variable across conditions and participants. For Eric, the low demand condition was the most effective and efficient. While echoic behavior was most consistent in this condition, mean echoic behavior was actually higher for PD-IF set 2, followed closely by the high demand condition, and then by PD-IF secondary set 1. Recall that the high demand condition was not effective for Eric and he required direct training to acquire this set. For Joel, he had the highest mean echoic behavior during PD-IF secondary sets 1 and 2, and the lowest mean echoic behavior during the low demand condition. For Joel, the low demand condition was not effective and the PD-IF conditions were the most effective and efficient. Gary had very low mean echoic behavior in both the high and low demand conditions, which were not effective for him. PD-IF secondary set 1 and secondary set 2 had the highest mean echoic behavior for Gary. Recall that the PD-IF condition was effective and the most efficient for Gary.

Summary of results for generalization and maintenance

To answer the first four non-experimental questions regarding generalization and maintenance of responding, post-test, as well as pre- and posttest comparisons were utilized and displayed in bar graphs.

Research question one. How well do primary and secondary targets generalize to untrained Wh-questions? All three participants showed generalized responding to untrained Wh-questions across all stimulus sets. Recall that Eric and Joel both acquired a set of secondary targets in the absence of direct training and primary targets – low demand and high demand conditions, respectively. However, generalized responding was the lowest for these respective conditions for both Eric and Joel. Generalized responding to secondary targets for Eric and Joel was higher for those secondary targets that were first exposed to instructive feedback followed by direct training. Gary's responding to untrained Wh-questions for all targets was relatively high across all sets, except for targets that were included in the low demand condition.

For Joel, we also probed intraverbals without the visual stimulus present to assess for generalization of responding to the intraverbal frames only. Generalized responding was relatively high across all stimulus sets, except for the high demand condition. Recall that he acquired stimuli in this condition without direct training.

Research question two. How well do primary and secondary targets generalize to untrained Wh-questions presented by a novel experimenter? All three participants had some generalized responding to untrained Wh-questions presented by a novel experimenter. However, Eric did not engage in any generalized responding to PD-IF secondary set 1 and had relatively low responding to primary targets. While he had

relatively moderate to high levels of generalized responding across all stimulus sets, he had very low levels of generalized responding for secondary targets in the high demand condition. Again, for both Joel and Eric, relatively low generalized responding was observed for the secondary targets that were presented in the absence of primary targets and direct training. Gary had generally moderate to high generalized responding to untrained Wh-questions presented by a novel experimenter. No clear patterns of responding for Gary emerged.

Research question three. How well do primary and secondary targets maintain 2 to 4 weeks post-mastery? All participants maintained responding across probes conducted 2 and 4 weeks post-mastery. For the most part, mild to moderate increases or decreases in responding were observed across probes, with some sets maintaining over time. Eric had generally moderate levels of generalized responding. However, decreases in responding at four weeks were not observed for secondary targets in the low and high demand conditions. Joel had somewhat lower generalized responding for high demand targets, and a moderate decrease in responding for this condition was observed at four weeks, while responding was relatively stable across 2 and 4 week probes for other stimulus sets. Gary's responding at 2 and 4 weeks post-mastery was moderate to high but responding was relatively lower for the PD-IF secondary set 1 and secondary set 2.

Research question four. How well do generalization targets maintain 2 and 4 weeks post-mastery? All participants had maintained some generalized responding across probes conducted across 2 and four weeks post-mastery. For Eric and Joel, their responding generalization targets was somewhat lower and also more variable when to responding to primary and secondary targets. This was not the case for Gary, who's

responding was fairly consistent across stimulus sets regardless of whether they were primary, secondary targets, or generalization targets. Eric and Joel both had lower responding to the instructive feedback only conditions that did not require direct training. Specifically, Eric did not have any generalized responding to secondary targets in the low demand, while had no responding to secondary targets in the high demand condition at 2 weeks but had some responding during probes conducted at 4 weeks. Joel's responding across 2 and 4 week probes was fairly stable. In contrast, Eric's responding was more variable, especially for primary targets where a substantial decrease in responding was observed between 2 and 4 week probes.

Social Validity

Social validity ratings are depicted in table 8. First, caregivers completed the TARF-R for each procedure following a brief description of the procedure and watching a video clip of their child during each procedure. Mean ratings indicated that caregivers found the procedures moderately acceptable and effective, with relevantly few disadvantages overall. The mean rating for acceptability of PD-IF was 3.94 (range = 3.83 to 4.17). The mean ratings for effectiveness of PD-IF was 3.11 (range = 2.33 to 3.67). The mean ratings for disadvantages of PD-IF 3.31 (range = 2.67 to 4.25). The mean rating for acceptability of high demand was 4.39 (range = 4.00 to 4.67). The mean ratings for effectiveness of high demand was 4.22 (range = 3.67 to 4.67). The mean ratings for disadvantages of high demand 3.92 (range = 3 to 4.75). The mean rating for acceptability of low demand was 3.78 (range = 3.33 to 4.50). The mean ratings for effectiveness of low demand was 3.66 (range = 3.33 to 4.33). The mean ratings for disadvantages of low demand 3.83 (range = 3.25 to 4.25).

After being given information about how their child responded to procedures, mean ratings indicated that caregivers continued to find the procedures moderately acceptable and effective, with relatively few disadvantages overall. The mean rating for acceptability of PD-IF was 4.28 (range = 4.00 to 4.83). The mean ratings for effectiveness of PD-IF was 3.89 (range = 2.33 to 3.67). The mean ratings for disadvantages of PD-IF 3.56 (range = 2.33 to 4.67). The mean rating for acceptability of high demand was 4.05 (range = 3.83 to 4.50). The mean ratings for effectiveness of high demand was 4.00 (range = 3.33 to 4.67). The mean ratings for disadvantages of high demand 4.08 (range = 3.75 to 4.50). The mean rating for acceptability of low demand was 4.05 (range = 3.83 to 4.50). The mean ratings for effectiveness of low demand was 3.89 (range = 2.33 to 5.0). The mean ratings for disadvantages of low demand 4.0 (range = 3.25 to 5.00).

Some individual differences emerged for ratings provided by caregivers for each child. After reviewing data showing Eric's response to study procedures, Sheila's ratings of the low demand condition increased for acceptability and effectiveness, and she also rated the low demand condition as having fewer disadvantages. Recall that the low demand condition was the most efficient on all efficiency measures for Eric. Her ratings of acceptability of the PD-IF condition increased, but she rated it has being less effective and having greater disadvantages than prior to seeing Eric's data. Her acceptability and effectiveness for the high demand condition decreased slightly, while she rated it as having fewer disadvantages.

After reviewing data showing Joel's response to study procedures, Abby's ratings of acceptability and effectiveness increased for both the PD-IF and low demand

conditions, and she rated the PD-IF condition as having fewer disadvantages. Recall that the PD-IF condition was the most efficient for Joel, followed by high demand on most measures, with the low demand condition being the least efficient. Her ratings for high demand in terms of acceptability, decreased.

After reviewing data showing Gary's response to study procedures, Anne's ratings of acceptability and effectiveness increased for the PD-IF condition, and she rated this condition as having fewer disadvantages. Recall that this was the most efficient condition for Gary across all measures of efficiency. Her ratings overall for the two instructive feedback only conditions decreased, except that acceptability of the low demand condition slightly increased.

	Eric		Joel		Gary	
PD-IF	Pre	Post	Pre	Post	Pre	Post
Acceptability	3.83	4.00	4.17	4.83	3.83	4.00
Effectiveness	3.33	233	3.67	4.67	2.33	4.67
Disadvantages	4.25	3.75	3.0	3.25	2.67	3.67
High Demand	Pre	Post	Pre	Post	Pre	Post
Acceptability	4.67	4.50	4.5	4.0	4.0	3.33
Effectiveness	4.33	4.00	4.67	4.67	3.67	3.33
Disadvantages	3.00	4.50	4.0	4.0	4.75	3.75
Low Demand	Pre	Post	Pre	Post	Pre	Post
Acceptability	4.50	4.50	3.5	3.83	3.33	3.83
Effectiveness	4.33	5.00	3.33	4.33	3.33	2.33
Disadvantages	4.00	5.00	3.25	3.25	4.25	3.75

Table 8. Social validity ratings provided by caregivers

Summary of Results for Social Validity

Two non-experimental questions regarding social validity were also evaluated.

Research question one. *What condition do caregivers rate as most socially valid?*

Overall, caregivers tended to rate the high demand condition as most socially valid across all dimensions of social validity – acceptability, effectives, and disadvantages. Eric's caregiver's ratings of effectiveness were tied for the high and low demand conditions; however, she indicated that she thought the PD-IF condition would be the most effective.

Research question two. *Will caregivers' social validity ratings change following the receipt of information regarding their child's response to each condition?* Caregivers' social validity ratings did change across most dimensions of social validity for each condition. Following a review of their child's individual responding to each condition, caregiver's social validity ratings increased across all dimensions for the procedures that were most effective and efficient for their child.

CHAPTER IV.

DISCUSSION

The present study sought to add to the current body of literature by evaluating the effect of context on acquisition of secondary targets. In addition, no research to date in the area of instructive feedback has included multiple measures of efficiency, very few studies have included systematic evaluations of generalization and maintenance of responding, and no studies have included measures of social validity.

Summary of Findings

We evaluated the effect of context on the acquisition of secondary targets for three young children with ASD when utilizing instructive feedback. While all participants acquired secondary targets when presented in the context of instruction for primary targets, only two participants acquired secondary targets in the absence of primary targets and direct training. However, one participant acquired secondary targets in an instructional setting (high demand) and another in a novel setting (low demand). Any secondary target sets not acquired through instructive feedback were subsequently acquired following direct training. For two participants, the PD-IF condition was the most efficient, and for a third participant the low demand condition was the most efficient. These results are consistent with prior research (i.e., Jones et al., 2017), and suggest that a number of variables may impacts participants' response to instructive feedback procedures, resulting in the idiosyncratic responding observed in the present study.

All participants had some generalized responding to untrained Wh-questions when presented by the primary therapist, but this was not the case for all participants when these same Wh-questions were presented by a novel experimenter. Responding to

primary, secondary, and generalization targets maintained, albeit to varying degrees, across probes conducted at 2 weeks and 4 weeks post-mastery. These results suggest that both traditional teaching procedures (PD-IF) and IF only procedures can produce generalization and maintenance of responding. One procedure did not appear to be clearly better than another.

All caregivers were presented with descriptions of study procedures combined with videos of these procedures being implemented with their children. Following this exposure, caregivers rated the high demand condition overall as the most socially valid. Next caregivers were shown the results of how their individual child responded to study procedures. Following the receipt of this information, caregivers' ratings increased across for the procedure that was most effective and efficient for their child. Thus, caregivers may be more accepting of procedures, if the procedures are actually beneficial to their child.

Effect of Context

Consistent with prior research that has evaluated effect of instructive feedback on acquisition, it was an effective and efficient procedure (e.g., Carroll & Kodak, 2015; Delmolino, Hansford, Bamond, Fiske, & LaRue; 2013; Grow, Kodak, & Clements, 2017; Vladescu & Kodak, 2013). Specifically, all participants acquired at least one set of secondary targets when they were included within instruction for primary targets (PD-IF condition). It was also the most efficient condition across all measures of efficiency for two participants (Joel and Gary), while the low demand was most efficient for Eric. The purpose of the PD-IF condition was to develop a learning history in the instructional settings, specifically, providing a history of prompting and reinforcement for responding.

Further, given prior research it was expected that participants would acquire targets during this condition.

Recall that the high demand condition occurred in the same area in which the PD-IF condition occurred, while the low demand occurred in a separate area in which the participants did not have a history of receiving prompting or reinforcement for responding. In fact, participants were blocked from entering the area in which the low demand condition occurred until the condition was actually being implemented with them. The high and low demand conditions were designed to be directly comparable. That is, the procedures were identical but the location (i.e., context) of the procedures were different. The findings with regard to context were mixed across all participants but somewhat consistent with the only other study (Jones et al., 2017) that attempted to evaluate the effect of context on the acquisition of secondary targets known by the present author. Specifically, they found that acquisition of secondary targets was the most effective and efficient in their low demand condition (i.e., play) for one participant and most effective and efficient in their high demand condition (i.e., table) for another participant. Their third participant, did not acquire secondary targets in any of their conditions, including their PD-IF condition, without direct training.

Although our findings suggest that context had an effect on the acquisition of secondary targets for two out of our three participants, it is unclear what aspect or aspects of these conditions produced differences in responding for Eric and Joel. It was anticipated that the high demand condition would be more effective given that it was performed in a setting in which participants had a learning history of prompting and reinforcement. However, this was not the case for Eric, who acquired secondary targets in

the low demand condition without direct training. Prior learning histories may have played a role in participants' responding. Although Eric had received early intervention services, his most recent instruction occurred primarily in an English Language Development classroom and primarily involved small group instruction. Thus, Eric may have been used to learning under less tightly controlled conditions, such as those utilized in the IF only procedures, and in the absence of error correction and direct reinforcement for correct unprompted responding. Eric's lack of recent exposure to discrete trial instruction may have also placed him at a disadvantage compared to Joel, as he may have required greater exposure to learn contingencies present during the PD-IF condition; specifically, that correct unprompted responses resulted in access to a preferred item. On the other hand, Joel had previously received center-based 1:1 ABA services, which included discrete trial instruction at a table. Thus, he likely had a history of exposure to prompting and reinforcement strategies similar to those utilized at the red table. So, the contingencies present during the PD-IF condition may have more clear for Joel. Although Gary received clinic based 1:1 ABA services, these services primarily included naturalistic language interventions that occurred within the context of play, rather than discrete trial instruction. He responded best in the PD-IF condition, even though he displayed emotional responding (e.g., crying, yelling, crawling under the table, requesting the experimenter to present a different word for him to echo) during this condition when the error correction procedures were implemented for primary targets. This could also be related to his use of stereotyped speech and history of repeating discriminative stimuli.

A number of behavioral mechanisms, such as attending and echoic behavior, may impact the efficacy of instructive feedback for learners (e.g., Haq et al., 2017;

Nottingham et al., 2015). It is likely that many variables play a role, interacting to result in the idiosyncratic responses observed in the literature (e.g., Haq et al., 2017) to instructive feedback procedures. Echoic behavior is one behavioral mechanism that has been proposed to contribute to the efficacy of instructive feedback for learners (e.g., Haq et al., 2017; Nottingham et al., 2015). All learners in this study had strong echoic repertoires according to their VB-MAPP results. Anecdotally, only one of the participants regularly engaged in echoic behavior without prompting (Gary) outside the context of the study. However, Eric and Joel had relatively high levels of echoic behavior across all conditions; whereas, Gary's mean echoic behavior was very low (i.e., about 8%) during the instructive feedback only conditions (high and low demand). He did not acquire any secondary targets in these conditions without direct training. However, he did acquire a secondary set of targets in the PD-IF condition without direct training, and his mean echoic behavior was approximately 74% for those targets. Thus, echoic behavior may have played a role in Gary's response to instructive feedback procedures. Echoic behavior may also be indicative of attending, especially for Gary and Eric who did not have antecedent visual stimuli. That is, low echoic behavior might suggest that the learner was not attending to the relevant auditory discriminative stimuli of the secondary target. Recall that toys were present during the IF only conditions, and some of these toys. Anecdotally, Gary often commented on what he was doing with the toys. Thus, even though the toys utilized in his IF only conditions did not make sounds, his own vocal verbal behavior could have impacted his ability to hear the presentation of the secondary targets.

Generalization and Maintenance

Relatively few studies evaluating instructive feedback have included systematic measures of generalization and maintenance. Overall, participants demonstrated generalized responding to untrained Wh-questions when administered by a primary therapist and novel therapist across all stimulus sets. No consistent patterns emerged across participants in terms of differences in responding between primary and secondary generalization targets. However, Eric and Joel displayed the lowest levels of responding to generalization targets in the IF only conditions that were effective for them and did not require direct training. This suggests that direct training, or at least presentation within the context of instruction for primary targets, may enhance generalization of secondary targets.

Overall, participants maintained responding across probes conducted 2 and 4 weeks post-mastery, albeit to varying degrees. However, responses to generalization targets were more variable and somewhat lower than responding to primary and secondary targets for Eric and Joel. This was not the case for Gary, whose responding was fairly similar regardless of whether it was to primary, secondary, or generalization targets.

Social Validity

To date, measures of social validity have not been included in any of literature regarding instructive feedback. This study sought to gather social validity ratings from caregivers. Initially, caregivers rated the high demand condition as most socially valid overall. However, ratings changed after caregivers were given information about their child's response to study procedures. Specifically, social validity ratings for the

procedure that was the most effective for their child improved following receipt of this information.

Limitations and Future Directions

Although this study added to the body of literature regarding the effect of context on acquisition of secondary targets, there are several limitations. Efforts were made to ensure that the high and low demand contexts were identical except for the actual context (i.e., location). The types of toys included within each condition were different in order to increase the likelihood that the contexts were discriminable and to minimize the likelihood that toys would serve as common stimuli, inadvertently influencing responding. While efforts were made to assign toys of equal preference, size, and number to high and low demand conditions, less emphasis was placed on assigning toys of similar types (i.e., auditory, visual, or tactile features). These differences in toy features could have contributed to differences in responding. For example, noise from toys in one condition could impacts participants' ability to hear antecedent auditory stimuli, while visual stimuli from toys in another condition could interfere with participants' attending to antecedent visual stimuli. Future researchers interested in examining the effect of context using similar procedures to this study should consider using identical toys in each condition but ensure that they are different in a salient way, such as color.

Another unanticipated source of differences among the conditions relates to participants' mands for physical attention. Recall that modeling was provided to teach Gary and Joel to engage in appropriate mands for physical attention following instances in which they attempted to gain access to physical attention inappropriately (e.g., hopping into the experimenter's lap). Although a decision rule was made that physical attention

would be provided following any mand for physical attention, the participants never engaged in mands for physical attention during the instructive feedback only conditions (high and low demand condition). It is unclear whether responding to these mands impacted responding during the PD-IF condition, or participants' responding in the other conditions.

Another limitation pertains to data collection. First, although data were gathered on whether echoic behavior occurred in response to the presentation of secondary targets, we did not collect data about other vocal behaviors that occurred. Specifically, Gary often echoed errors in addition to echoing secondary targets. For example, for the secondary target "You hammer nails," Gary would often echo "nail" and then state something like "No, you hammer a man" a few seconds later. Recall that Gary had a history of stereotyped speech. A similar type of responding occurred at times for Eric, who would echo part of the antecedent verbal discriminative stimulus, along with some other words, before then echoing the secondary target. It is unclear how this type of echoic behavior might negatively impact acquisition over time. It is an important consideration when using IF, because in this procedure participants are not exposed to error correction, which might allow participants to engage in a greater number of errors that may be challenging to remediate if targets are moved to direct training. Further, data were not collected on problem behaviors, the frequency and types of prompts needed to ensure ready behavior, and the use of behavior momentum. Anecdotally, problem behavior did not occur during the IF only conditions, and occurred most frequently during the PD-IF condition.

For Gary, an error was made when all secondary targets were moved to training. Specifically, PD-IF secondary set 2 was initially included within training but then was

not included in training for two appointments. It was mistakenly marked off as mastered when it was not yet mastered. Once the error was identified, it was included within training until it was mastered. It's unclear how this could have impacted Gary's responding to this stimulus set, or his acquisition of the other two stimulus sets in training at this time.

Due to scheduling and the availability of novel experimenters, conducting generalization and maintenance probes was challenging. All generalization probes were conducted within two weeks of mastery. Two weeks represents a large window when it comes to assessment, especially considering that maintenance probes were conducted using two-week intervals. Unfortunately, generalization probes with novel therapists required scheduling with novel therapists. This was particularly challenging for Gary, who had been receiving services at the clinic for about one year. Thus, some of his novel probes were conducted by a therapist with whom he had a history. Specifically, this therapist had supervised some of his sessions with his current therapist that he saw at the clinic for clinical services. For Joel, we also conducted probes of the intraverbal frames without the presence of the auditory discriminative stimulus. This could be considered a type of generalization or a probe of multiple control. That is, these probes demonstrated that responding was also under the control of the antecedent discriminative verbal stimulus. A stronger way to evaluate this type of generalization would have been to probe this skill in baseline before treatment. However, because we do not have baseline data for this skill, it is possible that Joel had this skill the entire time.

Maintenance probes were conducted from one day before scheduled to five days after scheduled. The decision was made to probe early when not probing early would

result in a greater than a week's delay in probing. Again, while these represent relatively small differences in probing, there are differences nevertheless. For Gary, the final four sets of maintenance probes for primary and secondary targets, as well as for generalization targets, were completed by a familiar therapist besides his primary therapists who implemented the stud procedures with him. At the time, the primary therapist had moved out of state, so there was no way for the primary therapist to complete probes. It is unclear how this impacted his responding to these probes. Despite the challenges associated with conducting generalization and maintenance probes, these are still important outcomes of learning, especially for leaners with ASD who may struggle to maintain and generalize items (e.g., NAC, 2015; NRC, 2001)

Social validity was assessed through use of a questionnaires administered to caregivers, along with videos and information about how their individual children responded to study procedures. Due to a recording error, the only vides of Joel receiving instruction using the PD-IF procedure were the sessions in which a 0 s time delay was utilized. However, a 0 s time delay was only utilized for two sessions before being moved to a 5 s constant time delay with error correction. Thus, it's unclear whether social validity ratings would have been similar if Joel's caregiver had seen the procedure at the 5 s constant prompt delay with error correction. Although caregivers rated these procedures overall as socially valid, and these ratings appeared to change once caregivers saw their individual child's response to study procedures, we did not gather social validity ratings from providers who might use these procedures in practice. Nor did we gather social validity measures from child participants. Future researcher should gather social validity measures from a wide range or practitioners who might use instructive

feedback procedures, such as behavior analysts, special education teachers, and early intervention service providers in general. As suggested by Jones and colleagues (2017), a concurrent chains arrangement would also allow for the assessment of child preference for study procedures, including context as an indicator of social validity. In the future, perhaps social validity measures, including child preference could be taken into consideration in conjunction with measures of effectiveness and efficiency, when selecting procedures.

Implications for Practice

Consistent with previous IF literature, participants responded differentially to the procedures. As identified previously (Nottingham et al., 2017), a number of behavioral mechanisms may impact learners' responses to IF procedures including attending and echoic behavior. Although participants in the present study had strong echoic repertoires according to the EESA, their echoic behavior in response to secondary targets varied. If echoic behavior in response to the presentation of secondary targets does contribute to learning, as some have suggested (Haq et al., 2017) an initial decision-making step to determine the potential benefit of IF procedures might include a brief language sample assessing a learner's spontaneous echoic behavior.

Another consideration when determining whether IF procedures are appropriate for learners relates to problem behavior. Specifically, if learners engage in problem behavior during traditional table top instruction, but not in other settings, then IF only procedures might be an alternative to traditional table top instruction until problem behaviors can be effectively managed. IF only procedures may also be particularly user friendly for caregivers, especially in the face of child problem behavior. That is,

caregivers can be trained to embed feasible IF procedures in natural family routines where children display low levels or no child challenging behavior (e.g., playtime, trips to the park), which could build families' capacity and parental self-efficacy for promoting child learning and development. This could decrease the parental stress associated with implementing complex procedures in the presence of child challenging behavior and aligns with best practices for early intervention (Division for Early Childhood, 2014).

When IF is implemented alone (i.e., without primary targets), it is similar to a descriptive commenting procedure (McIntyre & Phaneuf, 2008). However, descriptive commenting typically pertains to activities that are occurring naturally in the environment, while IF uses secondary targets that do not directly relate to the ongoing activities in which these secondary targets are being presented (e.g., Jones et al., 2017). Secondary targets presented within IF-only conditions could be designed to highlight the features, functions, and classes of language targets within a natural family routine, similar to a descriptive commenting approach, yet more systematic. For example, if a parent is teaching their child to label the word "car," a secondary target could be something such as "A car is a vehicle" (class) or "Cars have wheels," (feature) while the child plays with a car set. A logical step then, in deciding whether caregivers should be trained to implement IF feedback only procedures might involve a recording of the caregiver interacting with their child to assess their present level of descriptive commenting with their child. If they do not or this occurs infrequently, then the interventionist could help caregivers identify preferred play activities, some secondary targets related to the playsets (e.g., a bunny hops, it has fur, and a tail) to model while their child engages with that item.

Although the use of an AATD was effective in identifying efficient and effective methods for the participants included in the study, the procedures utilized were time intensive and would likely be challenging to implement in a clinical setting. The frequency of probing involved to monitor acquisition of the secondary targets was particularly time consuming. However, clinicians considering evaluating different types of IF procedures might consider either reducing the frequency with which they probe secondary targets (e.g., after every 2-4 treatment sessions) or utilizing brief experimental analysis procedures (See Daly, Martens, Hamler, Dool, & Eckert, 2013) rather than completing a full AATD for each participant, as was the case in this study.

Concluding Remarks

The present evaluated the effect of context on acquisition of secondary targets. Multiple measures of efficiency were gathered, along with generalization and maintenance probes, and caregiver ratings of social validity. Although all participants acquired secondary targets within the PD-IF condition without direct training, only two participants acquired secondary targets in the instructive feedback only conditions without direct training. Overall, responding generalization to untrained Wh-questions and to untrained Wh-questions presented by a novel experimenter. Further, responding maintained across 2 and 4 week probes. In general, caregivers rated the procedures as socially valid, and their ratings increased for the procedures that were most effective for their child. Although the findings of this study were mixed, it does add to the body of literature regarding instructive feedback. Specifically, no published literature to date has evaluated the effects of context on acquisition of secondary targets taught through

instructive feedback and no studies have evaluated social validity for instructive feedback procedures. In addition, few studies have systematically evaluated generalization and maintenance of responding to targets taught through instructive feedback.

APPENDIX A

DEMOGRAPHIC AND EDUCATIONAL SERVICES QUESTIONNAIRE

First, we'll talk a little bit about your child:

1. What is your child's name?

   _____
   (first)

   (last)

2. What is your child's date of birth? _____/_____/_____

3. What is your child's gender?
   - o Male
   - o Female
   - o Other (Please describe)_____

4. What's your child's race/ethnicity_____?
   - ☐ White/ Caucasian
   - ☐ Black/ African American
   - ☐ Hispanic/Latino
   - ☐ Asian
   - ☐ Native American
   - ☐ Pacific Islander
   - ☐ Other

5. Does your child currently have special education services?
   - ☐ No
   - ☐ Yes. If yes, under what eligibility category/categories are they receiving services under?
     - ☐ Autism
     - ☐ Communication disorder
     - ☐ Intellectual disability
     - ☐ Other Health Impairment
     - ☐ Other. _____

6. Does your child have a medical diagnosis of an autism spectrum disorder, educational eligibility of autism, or both?
   - ☐ Medical diagnosis of an autism spectrum disorder
   - ☐ Educational eligibility of autism

7. Does your child have a secondary condition?
   - ☐ Communication disorder
   - ☐ Intellectual disability
   - ☐ ADHD

- ☐ Seizure disorder
- ☐ Other:_____

8. Is your child currently enrolled in a school program?
   - o No
   - o Yes
9. What grade level?
   - o K
   - o 1st
   - o 2nd
   - o 3rd
   - o 4th

10. What is the setting where your child receives education services?
    - o Regular class with no special education or related services provided
    - o 80% or more of day - Regular class
    - o 40 to 79% of day - Regular Class (previously known as Resource Room)
    - o Less than 40% of day - Regular Class (previously known as Separate Class or self-contained)
    - o Public separate school for children with disabilities
    - o Private separate school for children with disabilities (e.g., Bridgeway House)
    - o Public residential facility
    - o Private residential facility
    - o Correctional facility
    - o Homebound
    - o Parentally placed home school
    - o Parentally placed private school

11. In the last 6 months has your child received any of the following services?

In the last 6 months:

Speech therapy	☐ Yes	☐ No	Number of sessions per month	
Occupational therapy	☐ Yes	☐ No	Number of sessions per month	
Sensory integration combined with OT or with other therapy (e.g., use of weighted vests, brushing, swinging, body sock, joint compression, sensory table, sensory diet, etc.)	☐ Yes	☐ No	Number of sessions per month	
Physical Therapy	☐ Yes	☐ No	Number of sessions per month	

Behavioral Programming (e.g., ABA)	☐ Yes	☐ No	Number of sessions per month		
Adaptive Physical Education	☐ Yes	☐ No	Number of sessions per month		
Play Therapy	☐ Yes	☐ No	Number of sessions per month		
Music Therapy	☐ Yes	☐ No	Number of sessions per month		
Therapeutic Listening	☐ Yes	☐ No	Number of sessions per month		
1:1 aide	☐ Yes	☐ No	Number of sessions per month		
Other_____	☐ Yes	☐ No	Number of sessions per month		

12. Has your child received ever received early intervention services?
    - Yes. Please describe._____
    - No

13. Has your child ever received or is currently receiving ABA services?
    - Yes. Please describe._____
    - No

Now we'll talk a little about you:

1. What is your child's name?

   _____
   (first) (last)

2. What is your native language?

3. What is your child's date of birth? _____/_____/_____

4. What's your child's race/ethnicity
   - ☐ White/ Caucasian
   - ☐ Black/ African American
   - ☐ Hispanic/Latino
   - ☐ Asian
   - ☐ Native American

- ☐ Pacific Islander
- ☐ Other

5. What is your relationship to the child?
   - ☐ Biological parent
   - ☐ Step parent
   - ☐ Foster parent
   - ☐ Adoptive parent
   - ☐ Other (please describe):_____

6. What is the last level of formal education **you** completed?
   a. No formal schooling
   b. 7th grade or less
   c. Junior high completed
   d. Partial high school (at least one year)
   e. High school graduate/GED certificate
   f. Partial college (at least one year)
   g. Specialized treatment
   h. Junior college/Associates degree (2 years)
   i. Standard college or university graduation (4 years)
   j. Graduate professional treatment, graduate degree

7. List degrees earned if g-j are selected above, including area(s) of focus (e.g., B.S. Early Childhood Education).
   _____

8. What is your current employment status?
   - ☐ Self-employed
   - ☐ Full time employment
   - ☐ Part time employment
   - ☐ Seasonal
   - ☐ Unemployed
   - ☐ Disabled
   - ☐ Temporary layoff
   - ☐ Full time homemaker
   - ☐ Retired
   - ☐ Student (not working)
   - ☐ Other (describe)

9. What is your current job title? _____

10. What is your total household income _____
- ☐ $4,999 or less
- ☐ $5,000-$9,999

- ☐ $10,000-$14,999
- ☐ $15,000-$19,999
- ☐ $20,000-$24,999
- ☐ $25,000-$29,999
- ☐ $30,000-$39,999
- ☐ $40,000-$49,999
- ☐ $50,000-$59,999
- ☐ $60,000-$69,999
- ☐ $70,000-$79,999
- ☐ $80,000-$89,999
- ☐ $90,000 or more

11. How much money does your family have?
- ☐ Not enough to get by
- ☐ Just enough to get by
- ☐ We only have to worry about money for fun or extras
- ☐ We never worry about money

12. How many children are you currently supporting?_____

APPENDIX B

SOCIAL VALIDITY SURVEY – ADAPTED TREATMENT RATING FORM REVISED

(Adapted from the TREATMENT ACCEPTABILITY RATING FORM—REVISED; TARF-R, Reimers & Wacker, 1988)

Please score each item by circling the number that best indicates how you feel about the strategy you just viewed.

1. How clear is your understanding of this teaching strategy?

1	2	3	4	5
Not at all clear		Neutral		Very clear

2. How acceptable do you find this teaching strategies?

1	2	3	4	5
Not at all acceptable		Neutral		Very acceptable

3. How willing are you to carry out this teaching strategy?

1	2	3	4	5
Not at all willing		Neutral		Very willing

4. To what extent do you think there might be disadvantages in following this teaching strategy?

1	2	3	4	5
None likely		Neutral		Many likely

5. How much time do you think it would take for you to learn to use this teaching strategy?

1	2	3	4	5
Little time will be needed		Neutral		Much time will be needed

6. How confident are you that this is an effective teaching strategy for your child?

1	2	3	4	5
Not at all		Neutral		Very confident

7. How likely do you think that this teaching strategy will result in long-term improvements in the skills taught to your child?

1	2	3	4	5
Unlikely		Neutral		Very likely

8. How disruptive would it be to carry out this strategy at home?

1	2	3	4	5
Not at all disruptive		Neutral		Very disruptive

9. How much do you like this teaching strategy?

1	2	3	4	5
Do not like it at all		Neutral		Like it very much

10. How willing would you be to use this strategy with your child?

1	2	3	4	5
Not at all willing		Neutral		Very willing

11. How much discomfort is your child likely to experience when being exposed to this teaching strategy?

1	2	3	4	5
No discomfort at all		Neutral		Very much discomfort

12. How well would using this teaching strategy fit into your existing routines at home?

1	2	3	4	5
Not at all well		Neutral		Very well

13. How effective do you think this strategy was in teaching your child language?

1	2	3	4	5
Not at all effective		Neutral		Very effective

14. Please let us know any thoughts or feeling you have about this study.

APPENDIX C

DATA SHEETS

Date________Condition: <u>Pre-test</u> Session: _____Data Collector: ___ Therapist or Reliability									
Item	**Trial**	**Independent**	**Integrity**	**Trial**	**Independent**	**Integrity**	**Trial**	**Independent**	**Integrity**
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -
	1	+ -	+ -	2	+ -	+ -	3	+ -	+ -

Date_____Condition: Baseline Session: ___Data Collector: ___ Therapist or Reliability				
Item	**Trial #**	**Initial S^D**	**VR2 SR+ for session behavior**	**Integrity**
	1	+ -	+	+ -
	2	+ -	+	+ -
	3	+ -	+	+ -
	4	+ -	+	+ -
	5	+ -	+	+ -
	6	+ -	+	+ -
	7	+ -	+	+ -
	8	+ -	+	+ -
	9	+ -	+	+ -

Date_____ Condition: PD-IF Prompting: 5-s Prompt Delay Session: Data Collector: ___ Therapist or Reliability Session duration_____							
Item	**Trial #**	**Indep.**	**Model**	**EC**	**Partial Echo**	**Full echo**	**Integrity**
	1	+ E NR	+ E NR	+ E NR	[redacted]	[redacted]	+ -
[redacted]	[redacted]		[redacted]	[redacted]	+ -	+ -	
	2	+ E NR	+ E NR	+ E NR	[redacted]	[redacted]	+ -
[redacted]	[redacted]		[redacted]	[redacted]	+ -	+ -	
	3	+ E NR	+ E NR	+ E NR	[redacted]	[redacted]	+ -
[redacted]	[redacted]		[redacted]	[redacted]	+ -	+ -	
	4	+ E NR	+ E NR	+ E NR	[redacted]	[redacted]	+ -
[redacted]	[redacted]		[redacted]	[redacted]	+ -	+ -	
	5	+ E NR	+ E NR	+ E NR	[redacted]	[redacted]	+ -
[redacted]	[redacted]		[redacted]	[redacted]	+ -	+ -	
	6	+ E NR	+ E NR	+ E NR	[redacted]	[redacted]	+ -
[redacted]	[redacted]		[redacted]	[redacted]	+ -	+ -	
	7	+ E NR	+ E NR	+ E NR	[redacted]	[redacted]	+ -
[redacted]	[redacted]		[redacted]	[redacted]	+ -	+ -	
	8	+ E NR	+ E NR	+ E NR	[redacted]	[redacted]	+ -
[redacted]	[redacted]		[redacted]	[redacted]	+ -	+ -	
	9	+ E NR	+ E NR	+ E NR	[redacted]	[redacted]	+ -
[redacted]	[redacted]		[redacted]	[redacted]	+ -	+ -	

Date_____Condition: Low Demand_Session: _____ Data Collector: ___ Therapist or Reliability Session duration_____						
Item	**Trial #**	**Partial Echo**	**Full echo**	**Experimenter Play**	**VR2 SR+ for session behavior**	**Integrity**
	1	+ -	+ -	+	+	+ -
	2	+ -	+ -	+	+	+ -
	3	+ -	+ -	+	+	+ -
	4	+ -	+ -	+	+	+ -
	5	+ -	+ -	+	+	+ -
	6	+ -	+ -	+	+	+ -
	7	+ -	+ -	+	+	+ -
	8	+ -	+ -	+	+	+ -
	9	+ -	+ -	+	+	+ -

Date_____Condition: High Demand_Session: _____ Data Collector: ___ Therapist or Reliability Session duration_____						
Item	**Trial #**	**Partial Echo**	**Full echo**	**Experimenter Play**	**VR2 SR+ for session behavior**	**Integrity**
	1	+ -	+ -	+	+	+ -
	2	+ -	+ -	+	+	+ -
	3	+ -	+ -	+	+	+ -
	4	+ -	+ -	+	+	+ -
	5	+ -	+ -	+	+	+ -
	6	+ -	+ -	+	+	+ -
	7	+ -	+ -	+	+	+ -
	8	+ -	+ -	+	+	+ -
	9	+ -	+ -	+	+	+ -

Date_____Condition: Secondary Target Probe__Session: _____ Data Collector: ___ Therapist or Reliability				
Item	**Trial #**	**Initial S^D**	**VR2 SR+ for session behavior**	**Integrity**
	1	+ -	+	+ -
	2	+ -	+	+ -
	3	+ -	+	+ -
	4	+ -	+	+ -
	5	+ -	+	+ -
	6	+ -	+	+ -
	7	+ -	+	+ -
	8	+ -	+	+ -
	9	+ -	+	+ -

Date_____Condition: Control _Session: _____ Data Collector: ___ Therapist or Reliability				
Item	**Trial #**	**Initial S^D**	**VR2 SR+ for session behavior**	**Integrity**
	1	+ -	+	+ -
	2	+ -	+	+ -
	3	+ -	+	+ -
	4	+ -	+	+ -
	5	+ -	+	+ -
	6	+ -	+	+ -
	7	+ -	+	+ -
	8	+ -	+	+ -
	9	+ -	+	+ -

Date_____Condition: Generalization/ Maintenance _____ Session: _____Data Collector: ___ Therapist or Reliability				
Item	**Trial #**	**Initial S^D**	**VR2 SR+ for session behavior**	**Integrity**
	1	+ -	+	+ -
	2	+ -	+	+ -
	3	+ -	+	+ -
	4	+ -	+	+ -
	5	+ -	+	+ -
	6	+ -	+	+ -
	7	+ -	+	+ -
	8	+ -	+	+ -
	9	+ -	+	+ -

APPENDIX D

TARGET LIST

Participant	Condition	Targets		
Eric	PD-Primary Set 1	Geologists study (the earth)	The endocrine system manages (hormones)	The spleen (filters blood)
	PD-IF Secondary Set 1	Paleontologists study (fossils)	The nervous system controls (the body)	The large intestine (removes waste)
	PD-IF Secondary Set 2	The bladder stores (urine)	The immune system (stops sickness)	Anthropologists study (cultures)
	High Demand	Archaeologists study (artifacts)	The skeletal system supports (movement)	The pancreas secretes (enzymes)
	Low Demand	Entomologists study (insects)	The thymus (makes t-cells)	The lungs support (breathing)
	Control	Zoologists study (animals)	The respiratory system transports (air)	All sounds come from (vibrations)
Joel	PD-Primary Set 1	A vacuum has a (hose)	A candle has a (wick)	A flower has a (petal)
	PD-IF Secondary Set 1	A watch has a (face)	A TV has a (screen)	An ice skate has a (blade)
	PD-IF Secondary Set 2	A belt has a (buckle)	A tire has a (rim)	A necklace has a (clasp)
	High Demand	A camel has a (hump)	A shoe has a (sole)	An iron has a (plate)
	Low Demand	A pencil has a (point)	A camera has a (lens)	A hammer has a (head)
	Control	An avocado has a (pit)	A bike has a (seat)	A mushroom has a (cap)

Participant	Condition	Targets		
Gary	PD-Primary Set 1	You toast (bread)	You vacuum (carpet)	You mash (potatoes)
	PD-Primary Set 2	You water a (garden)	You staple (paper)	You sharpen a (pencil)
	PD-IF Secondary Set 1	You hammer (nails)	You blend (smoothies)	You peel (bananas)
	PD-IF Secondary Set 2	You lick a (lollipop)	You grate (cheese)	You write in a (notebook)
	High Demand	You tie (shoes)	You frame (pictures)	You roast (marshmallows)
	Low Demand	You fry (eggs)	You spread (butter)	You freeze (popsicles)
	Control	You mold (clay)	You mail (letters)	You zest (oranges)

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