

## ABSTRACT

### Teaching Children with Autism Spectrum Disorder to Engage in Reciprocal Conversations Using Text-Message Prompting

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Individuals with autism spectrum disorder (ASD) often have difficulties maintaining conversations. Although there are several established interventions which target initiations and responses to questions made by others, there are fewer interventions which target sustaining conversations with multiple exchanges. A review of the literature revealed that scripting procedures were the most common method to teach individuals to engage in a multi-exchange conversation. However, traditional paper scripts are an intrusive prompting strategy and are inflexible to an everchanging social environment. Text-message prompting via an Apple Watch<sup>®</sup> creates a wearable electronic script that can be prompted from a distance and are malleable to form organic conversations within a social setting.

Teaching Children with Autism Spectrum Disorder to Engage in Reciprocal Conversations Using  
Text-Message Prompting

by

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## DEDICATION

To my mother Louisa Montserrat Eclarinal, your strength, support, and love gives me the fire to be the best I can be.

## CHAPTER ONE

### Introduction

#### *Autism Spectrum Disorder*

The Center for Disease Control and Prevention's Autism and Developmental Disabilities Monitoring Network's surveillance in 2014 reported 1 in 68 children, in the United States, are diagnosed with Autism Spectrum Disorder (ASD; Autism and Developmental Disabilities Monitoring [ADDM], 2014, p.1). These rates are higher in boys, being 4.5 times more likely to be diagnosed, than girls. These rates vary across race and ethnicity, prevalence estimates are higher among non-Hispanic white children compared to non-Hispanic black and Hispanic children. Based on these data, the prevalence of ASD in the United States has increased by 123% from 2002-2010 (ADDM, 2014, p. 10). According to the Diagnostic and Statistical Manual-Fifth Edition (DSM-V) to meet the definition of ASD individuals must display (a) deficits in social communication across multiple contexts and (b) restricted and/or repetitive patterns of behavior, interests or activities. These symptoms must be present in the early developmental period and cause significant impairments (American Psychiatric Association [APA], 2013).

Social communication deficits are further described as deficits in back-and-forth conversational skills, nonverbal communication, and in developing and maintaining social relationships including friendships (APA, 2013). Due to communication deficits, individuals with ASD are less likely to initiate social interactions and engage in fewer

conversational interactions (Jones & Schwartz, 2009). During social interactions, individuals with ASD are less likely to engage in nonverbal behavior (e.g., nodding) as compared to peers (García-Pérez, Lee, & Hobson, 2006).

The failure to develop adequate social communication skills can limit an individual with ASD's ability to engage in social interactions and affect his or her overall quality of life. Orsmond, Krauss, and Seltzer (2004) found that 46% of the adults with ASD that were surveyed reported a lack of reciprocal friendships (p.250). Researchers have found that lack of friendships strongly correlates to self-reported loneliness and peer victimization (Ung et al., 2016). In addition to issues developing peer social relationships, social skill deficits are also correlated with teacher reported conflict within the student teacher relationship (Zeedyk, Cohen, Eisenhower, & Blanch, 2016). Later in life, these deficits often lead to difficulty in obtaining and securing jobs, which therein limits overall independence (Howlin, Lynn, & Rutter, 2000).

Applied behavior analysis (ABA) is the most commonly covered evidence-based intervention covered by insurance companies across the United States (Roane, Fisher, & Carr, 2016). ABA interventions target a wide broad spectrum of skills ranging from joint attention and imitation skills, to complex social interactions (e.g., play, conversations, and emotional sharing).

### *Applied Behavior Analysis*

In the early 1900s the field of psychology was monopolized by the study of introspection. Introspection was the subjective process of examining one's own personal thoughts and emotions by describing sensations and private events (Wolf, 1978). John Watson, in his influential article, "Psychology as the Behaviorist Views It", was the first

to argue for the field of psychology to be based on purely objective behavior, deviating from introspection and described consciousness (Cooper, Heron & Heward, 2007). B. F. Skinner also rejected the mentalistic approach to psychology in his publication of *Science and Human Behavior* (1953). Skinner became the father of experimental behavior analysis and established two classifications of behavior including responded and operant (Morris & Smith, 2005). Skinner defined respondent behavior as reflexive behavior evoked by the immediately preceding stimuli and operant behavior as behavior that is influenced by consequences that immediately follow the behavior. Operant behavior became the central focus of the science of behavior analysis and is illustrated using a three-term contingency consisting of antecedents, behaviors and consequences (Skinner, 1938). The primary goal for experimentation within the field of behavior analysis is to identify and manipulate the variables responsible for behavior change (Cooper et al., 2007). Initially, behavior-analytic research was primarily conducted to identify general behavioral principles with non-human animals (Morris & Smith, 2005). In the 1950s and early 1960s the field shifted as researchers began addressing socially significant issues with human participants, becoming what is known today as ABA.

Early research in the field of ABA was conducted with individuals with disabilities. This research brought a whole new perspective of learning and possibilities for a population who had been rejected by society and largely subjected to institutionalization (Cooper et al., 2007). Researchers found major discoveries to improve the functioning of these individuals by addressing challenging behavior (Dixon, 2012). Currently, ABA treatments target a variety of socially significant behaviors including the reduction of challenging behavior and increase in social communication skills (Cooper et al., 2007).

## *Principles of ABA*

As described above, ABA is based on the same principals defined in experimental behavior analysis. These principles include the three-term contingency consisting of antecedents, behavior, and consequence. Behavior is defined as anything that a living thing does (e.g., waving, eating, and thinking). Antecedents immediately precede behavior and consequences immediately follow behavior (Cooper et al., 2007).

Antecedent interventions manipulate behavior by altering the antecedent stimuli. This can be achieved through the modification of discriminative stimuli ( $S^D$ s) and motivating operations (MOs; Cooper et al., 2007). An  $S^D$  is a stimulus that signals the availability of reinforcement for a specific response. This history of association between the  $S^D$  and the consequence is what allows for the  $S^D$  develop stimulus control over a behavior. For example, an open sign is an  $S^D$  for a customer to enter a restaurant. Only in the presence of the open sign will the customer be served, if the customer tries to enter the restaurant when the open sign is not illuminated he or she will not receive service. Through experience of accessing service in the presence of the open sign, the customer will be more likely to only go to the restaurant if the open sign is illuminated. Stimulus control is demonstrated when the behavior only occurs in the presence of the  $S^D$ . Stimulus control can be established through the use of prompts. Prompts serve as supplementary  $S^D$ s to elicit a correct response after an initial, more natural,  $S^D$  is presented. Prompts are divided into two categories: response prompts and stimulus prompts.

Response prompts are supplementary antecedent stimuli that support a correct response in the presence of an  $S^D$  that will eventually control a behavior (Cooper et al., 2007). Modeling is a type of response prompt in which the desired behavior is

demonstrated, and the participant is expected to imitate the response. For example, the teacher will “say raise your hand like this” and raise her hand above her head, the child is then expected to mirror her movement. Physical guidance is another classification of a response prompt where the instructor will partially or fully physically guide the student’s movements through the entire movement of the response. For example, the teacher will give the instruction to “raise your hand” and will fully guide the students arm to extend above their head. Verbal instructions are also used as a response prompt where the teacher either verbally tells the student the correct answer or through written instructions. For example, if the teacher asks the student “what do you do when you want to ask the teacher a question in class?”, the teacher will say “say raise your hand”.

Stimulus prompts include movement, position, and redundancy as a supplementary  $S^D$  to help evoke the correct response (Cooper et al., 2007). For example, when the teacher is teaching the student to identify a quarter when placed next to a dime, the teacher could use movement by looking at the quarter to indicate the correct selection. The teacher could also use position in this example by placing the quarter closer to the student when they are asked to select it. Redundancy is used when one or more stimulus qualities (color, size, shape) are paired with the correct choice. For example, in selecting the picture of the quarter, the quarter could be placed on a yellow background while the dime is on a plain white background. This exaggerated dimensional change will help the student select the correct stimulus.

Both response and stimulus prompts are eventually faded until only the naturally existing stimuli will evoke the response (Cooper et al., 2007). While teaching a student to raise their hand, the response prompt of physically guiding the students hand to raise

above their head will be gradually faded out to where only when the student only raises their hand when they are asked to answer a question in class. This systematic fading out the physical guidance can be done through most-to-least prompting. Most-to-least prompting initially guides the student through the entire performance, then gradually reduces the amount of physically assistance provided trial by trial. This typically involves moving initially from full physical prompting, visual prompts, instructional prompt, to finally only the natural stimuli.

Stimulus prompts can be faded through stimulus fading, thus gradually returning the exaggerated feature, position, or gesture until the stimulus is back to its original form (Cooper et al., 2007). For example, Krantz and McClannahan (1998) used stimulus fading to fade out a script “look” which was accomplished by removing 1/3 of the script card at a time until the card was finally removed. This left only the natural stimulus to evoke the verbal behavior of saying “look”.

Consequence interventions manipulate behavior by altering the consequence stimuli. This can be achieved through the use of reinforcement. Reinforcement is any stimulus which immediately follows a behavior and increases the future frequency of the behavior in similar conditions (Cooper et al., 2007). For typically developing individuals, conversations can be reinforced through a mere social interaction (e.g., getting a questioned answered). However, this type of interaction may not be adequately motivating for a child with ASD to engage in a conversation. Thus, the social interaction may initially be paired with something that is enjoyable to the child in order to increase the probability of this social behavior happening again in the future. The additional

reinforcer will eventually be faded such that the social interaction itself will become reinforcing.

### *Verbal Behavior*

B. F. Skinner's *Verbal Behavior* (1957) set the precedent for communication interventions in the field of ABA. He applied the same ABA principles to describe how language is learned. He argued that verbal behavior was socially mediated (i.e., reinforced by another individual). Skinner isolated different classifications of verbal behavior by function (i.e., what verbal behavior is used for). These classifications are called operants and include mands, echoics, tacts, and intraverbals.

A mand is verbal behavior which results in fulfillment of a want or need (Skinner, 1957). For example, if an individual is thirsty, says "water, please" and someone provides glass of water, that verbal response would be a mand. An echoic is verbal behavior that exactly matches the previous verbal response (i.e., imitation) and results in social reinforcement (e.g., praise). For example, if a therapist says "cat" and then the child says "cat", which is followed by the therapist saying, "great job saying cat", this verbal response would be an echoic. A tact is verbal behavior evoked by the presence of a nonverbal stimulus (e.g., horse) and results in social reinforcement. For example, if a child sees a horse and says "horse", which is followed by the parent saying, "you're right, that's a horse), this verbal response would be a tact. Intraverbal behavior is verbal behavior that is evoked by a verbal stimulus (e.g., "Hello") and results in social reinforcement (e.g., "Hi"). Conversational language falls into the category of intraverbals. This could be answering questions, filling in the blanks of a statement, or



small talk. For example, a responding the conversational statement of “have a good day” with “thank you” would be an intraverbal response.

DeSouza, Akers, and Fisher (2017) provided an updated literature review of interventions using Skinner’s verbal operants with individuals with ASD. They found that mands and tacts were the most common verbal operant investigated in studies focusing on the acquisition of verbal behavior in children with ASD, followed by echoics and intraverbals. Although the field has progressed beyond only teaching simple question answering, the authors suggest that there is still a great need for procedures that promote more complex intraverbal responses including multi-exchange conversations.

There are several established interventions which target initiating conversations (e.g., script fading; see Akers, Pyle, Higbee, Pyle & Gerencser, 2016); however, the current status of interventions which target sustaining reciprocal, multi-exchange conversations are unknown. Therefore, a systematic review of such interventions is warranted.

## CHAPTER TWO

### Literature Review

#### *Purpose*

We conducted a review of the existing literature on interventions targeting the increase of reciprocal conversations for children with ASD. The identified articles were analyzed to determine the type of intervention implemented, who served as the intervention implementer, the classification of the conversation partner (e.g., typically developing peer), whether the conversation partner was naïve to the purpose of the study, the type of prompts or other components (e.g. reinforcement) used, whether the prompts or other components were completely faded and whether generalization was assessed.

#### *Search Procedures*

An extensive systematic online search was conducted on the following databases: Academic Search Complete, Education Research Complete, Educational Research Information Clearinghouse, PsycArticle, Psychology and Behavioral Science Collection, and PsychInfo. The Search terms “Conversation”, “Eye contact”, “Voice”, “Body Language”, “Facial expression”, were jointly searched with “Autism or Asperger’s”. Boolean operators and truncation were used within the search. The search was limited to peer-reviewed articles published in English. If the inclusion criteria (delineated below) were not evident by the title of the article alone, then the abstract was read to determine inclusion.

After the online database search, we conducted an ancestral search with the articles that met the criteria. No additional articles were found. A hand search of *Research in Autism Spectrum Disorders*, the journal which contained the most identified articles, was conducted between the years of 2007 to 2017. Two additional articles were identified through the hand search

### *Inclusion Criteria*

To be included, articles needed to fit the following criteria: (a) published in a peer-reviewed journal, (b) published in English, (c) participants had a diagnosis of ASD, (d) an intervention was implemented, (e) data were collected while participants were engaged in a conversation, (f) the dependent measure was the appropriate responses the participant made towards a conversation partner, and (g) interventions targeted a reciprocal, multi-exchange conversation.

### *Data Extraction*

Data from the articles were extracted for analysis using the following broad categories: (a) participants, (b) intervention, (d) conversation, and (e) generalization. The following information was extracted for participants: (a) number of participants, (b) sex, (c) age, and (d) diagnosis. The following information was extracted for intervention: (a) type (e.g., social skill group or Behavioral Skills Training [BST]) and (b) the implementer or trainer (e.g., researcher, peer). The following information was extracted from the conversation data: (a) setting in which the conversation occurred, (b) classification of the conversation partner (e.g., peer, caregiver), (c) conversation partner's awareness of the purpose of the study, (d) data collection on conversation partner's

behavior, (c) training components were present during the conversation (i.e. visual prompts, reinforcement), and (d) fading of training components. The following information was extracted regarding the assessment of generalization: (a) was generalization assessed, and (b) what type of generalization was assessed (e.g., across settings)

### *Results*

Seventeen articles met the inclusion criteria and were included in this literature review. The relevant data extracted is summarized below and in table 2.1.

Table 2.1

*Participant and intervention characteristics*

Study	Participants	Intervention(s)	Conversation Partner	Intervention Components in Conversation	Generalization Assessed
Bambara, Cole, Kunsch, Tsia, & Ayad (2016)	2 M, 1 F 14-15 years old	PMI Textual prompt with instruction	Typically developing peer +	Textual prompt	No
Barry et al. (2003)	3 M, 1 F 6-9 years old	BST Social skill group	Typically developing peer +	No	Setting Conversation partner
Charlop & Kelso (2003)	3 M 8-11 years old	Scripting	Researcher	Textual prompt ^ Reinforcement ^	Setting Conversation partner Response
Charlop, Gilmore, & Chang (2008)	2 M 8-9 years old	Scripting Video Modeling	Researcher	No	Setting Conversation partner Response
Davis, Boon, Cihak, Fore (2010)	3 M 16-17 years old	Textual prompt with instruction	Typically developing peer	Textual prompt Verbal prompt	Setting Conversation partner

(Continued)

Study	Participants	Intervention(s)	Conversation Partner	Intervention Components in Conversation	Generalization Assessed
Grosberg & Charlop (2017)	5 M, 1 F 7-11 years old	Scripting	Researcher	Textual prompts ^ Verbal prompts ^	Setting Conversation partner
Hood, Luczynski, & Mitteer (2017)	2 M, 1 F 8-16 years old	BST	Typically developing peer + Researcher+	Textual prompts Faded in 2 of 3 participants Reinforcement Faded in 1 of 3 participants	Conversation partner
Hughes et al. (2013)	3 M, 1 F 16-18 years old	PMI	Typically developing peer +	Textual prompt ^	Conversation partner
Koegel, Ashbaugh, Navab, & Koegel (2015)	3 M 19-26 years old	BST Textual prompt with instruction	Typically developing peer Researcher	Textual prompt ^	Conversation partner Setting
Koegel, Park, & Koegel (2014)	3 M 4-14 years old	Textual prompt with instruction Self- Management	Researcher	Textual prompt ^	Setting

(Continued)

Study	Participants	Intervention(s)	Conversation Partner	Intervention Components in Conversation	Generalization Assessed
Kornacki, Ringdahl, Sjostorm, & Nuernberger (2013)	3 M 21-23 years old	BST	Peer with disabilities*	No	No
Krantz, Land, & McClannahan (1989)	3 M 11-15 years old	PMI	Peer with disabilities +	No	Setting Conversation partner Response
Lawson & Walsh (2007)	2 F 8-9 years old	Social skill group	Peer with disabilities+	Textual prompt Visual prompt Reinforcement	No
Lee & Sturme (2014)	2 M, 1 F 6-11 years old	Scripting	Researcher	Audio prompt ^ Reinforcement	Response
Nuernberger, Ringdahl, Vargo, Crumpecker, Gunnarsson (2013)	2 M, 1 F 19 -23 years old	BST	Peer with disabilities*	No	No

(Continued)

Study	Participants	Intervention(s)	Conversation Partner	Intervention Components in Conversation	Generalization Assessed
Stevenson, Krantz, & McClannahan (2000)	4 M 19-23 years old	Scripting	Researcher	Visual Prompt ^ Audio prompt ^	No
Tetreault & Lerman (2010)	2 M, 1 F 4-8 yeats old	Video modeling	Researcher	No	Response



### *Participants*

Across the 17 studies, 57 individuals served as participants. The majority, 79% (n=45) were male and the other 21% (n= 12) were female. The ages of participants ranged from 4 years old to 26 years old. Of the participants, 46% (n= 26), were in the age range of 6 to 12 years old, followed closely by 30% (n=17) of participants that were in the age range of 13-17 years old. The age group of 18 to 22 years old included 14% (n= 8) of participants, while the other age groups of 3 to 5 years old and above 22 years old each included 5% (n=3) of participants. The majority of participants, 81% (n=46) carried a diagnosis of ASD, while 19% (n=11) of participants had a dual diagnosis of ASD and another related diagnosis (e.g., cerebral palsy).

### *Intervention*

We identified seven different interventions across the studies including BST, social skill groups, scripting, textual prompts with instructions, self-management, video modeling, and peer mediated interventions (PMI). Scripting was used in six of the studies (35%). Studies which used scripting (auditory or textual) to prompt specific statements were included. BST was implemented in 29% (n=5) of the studies. While some of these articles did not report using BST specifically, they were included in this category because they included the components of BST (i.e., instruction, modeling, role-play and feedback). PMI, which consists of training a peer to prompt the child with ASD to engage in a conversation, was implemented in 18% (n=3) of the studies. Textual prompts with instructions, which consists of instructional steps for how to engage in a conversation (e.g., smile at conversation partner), were included in 24% (n=4) of the studies. Social skills groups, which consist of participants learning conversational skills in a group

setting, were implemented in 12% (n=2) of the studies. Video modeling, which consists of the participant watching a video that modeled a conversation, was also implemented in 12% (n=2) of the studies. Self-management strategies, which consisted of the participant monitoring their own conversational behavior, were included in 6% (n=1) of the studies. Five studies (29%) combined more than one intervention. Koegel, Park, and Koegel (2014) used BST in combination with a textual prompt with instruction, Koegel, Ashbaugh, Navd, and Koegel (2016) used a textual prompt in combination with self-management, and Barry et al. (2003) used BST in combination with a social skill group intervention. Charlop, Gilmore and Chang (2008) used scripting in combination with video modeling and Hughes et al. (2013) used peer mediation in combination with scripting.

Many intervention implementers were researchers (76%, n=13). Other intervention implementers included peers (18%, n=3) and an unspecified trainer (6%, n=1).

### *Conversation*

Across the 17 studies, four different conversation settings were used. In the majority of studies researchers collected data on conversations in a research clinic (47%, n=8) or a school (35%, n=6). Other conversation settings included and the client's home (6%, n=1) or a residential facility (12%, n=2).

There were three classifications of conversation partners including typically developing peers, peers with disabilities, and other adults (i.e., researchers, therapists, and graduate students). Adults served as the conversation partner in the majority (47%, n= 9) of the studies. Typically developing peers served as the conversation partner in 32%

(n=6) of the studies and peers with disabilities served as the conversation partner in 21% (n=4) of the studies. Two studies utilized both typically developing peers and other adults throughout their interventions (Hood, Luczynski, & Mitter, 2017; Koegel et al., 2016). Training components were present during the conversation in which data were collected for 65% (n=11) of the studies. Training components included textual prompts, visual prompts, auditory prompts, and artificial reinforcement provided contingent on conversation skill performance. These components were part of the intervention (e.g., a textual prompt in a textual prompt with instruction intervention) or added to increase the likelihood of skill acquisition (e.g. a reinforcer to increase the motivation for the participant to interact with a novel conversation partner in a BST intervention). Of these 11 studies, 64% (n=7) implemented multiple intervention components during conversations in which data was collected. Textual prompts were used in 82% (n=9), reinforcement was used in 37% (n=4), visual prompts were used in 18% (n=2), and audio prompts were used in 18% (n=2) of the 11 reviewed studies that included intervention components in the conversations which included data collection. Textual prompts were faded in 82% (n= 6) of the 9 studies that included textual prompts. Artificial reinforcement contingent upon conversational skill performance, was faded in 50% (n=2) of the 4 studies that included artificial reinforcement (e.g. edible, token economy, access to tangibles etc.). Visual prompts were faded in 50% (n=1) of the 2 studies that utilized visual prompts. Audio prompts were faded in all studies that used this prompting strategy (100%, n=2).

### *Generalization*

Generalization for conversation skills was assessed in 71% (n=12) of the studies. Across these 12 studies, generalization was assessed across multiple conversation partners (69%, n=9), multiple settings (61%, n=8) and multiple responses (53%, n=6). Settings that assessed for generalization were, for the most part, collected in a different room within the same building that the conversation skill training took place (e.g., a different therapy room within the same clinic).

### *Discussion*

#### *Interventions*

Interventions identified in this review included BST, social skill groups, scripting, textual prompts with instructions, self-management, video modeling, and PMI. Scripting was implemented in the majority of the studies

BST was the second most common intervention implemented in the reviewed studies. Some of the studies included in this category were not self-identified as implementing BST but were included in this category because the intervention had the components of role-play and feedback. For example, Barry et al. (2003) was recorded under the category of BST because role play, and feedback were provided within a social group intervention.

Scripting and video modeling were generally used with younger participants. In Lee and Sterumy (2014), all participants exposed to the scripting intervention were under the age of 12. This was also seen in Tetreault and Lerman's (2010), video modeling intervention, all participants were under the age of 9. It is possible that these interventions

are oftentimes used with a younger demographic because younger children require a more intentional intervention (i.e., providing a specific phrase) due to their limited social repertoire as opposed to a more general intervention (e.g., delineating steps of a conversation).

Textual prompt with instructions interventions include instructions or steps on how to hold a conversation, but not scripted statements. These studies included a wide range of participants ages 4 to 26 years old, with Koegel et al. (2014) including the youngest participant (i.e., 4-years-old) and Koegel et al. (2016) including the oldest participant (i.e., 26-year-old). The Koegel et al. (2014) study evaluated a self-management intervention to ensure participants were able to follow the steps of a conversation found on the textual prompt with instructions and the Koegel et al. (2016) study targeted empathic communication skills requiring participants to identify and appropriately respond (i.e., express understanding) to an emotional statement made by a conversation partner. The more advanced social skills required in Koegel's et al. (2016) as compared to Koegel et al (2014) likely explains the large age ranges across the two studies.

### *Conversations*

Across the studies, data were most often collected in a clinical setting (47%). This could be due to logistics of conducting research making a clinic the best option; however, this may impact the extent to which the conversation skills generalize to the natural environment. Generalization to a novel setting was assessed in 47% of the 17 studies. However, most of the settings used to assess generalization remained in the same general

area as those used for treatment. For example, in Barry et al. (2003) generalization was assessed in a different therapy room within the same clinic.

Of the identified articles, nine used a textual prompt within the conversation intervention. Of these interventions, 67% faded these visual prompts (n=6). In Hughes et al. (2013) conversation books with conversation starters were faded in the final follow-up phase. In Hood et al. (2017) a textual prompt with steps of a conversation was faded for two of the three participants. Textual prompt with instructions were faded in Koegel et al. (2016) and Koegel et al. (2014).

### *Conclusions*

A reciprocal conversation requires two conversation partners to engage in the conversation through both verbal and nonverbal communication. Although all 17 studies collected data on the participant's behavior, only five studies recorded the conversation partners' behavior. These five studies included typically developing peers who were aware of the purpose of the study as conversation partners (Bambara et al, 2016; Hood et al, 2017; Hughes et al., 2013; Krantz et al., 1989; Lawson & Walsh, 2007). Neither of the studies in which the conversation partner was naïve to the purpose of the study (Nuernburger et al., 2013; Kornacki et al., 2013) included data on the conversation partner's behavior.

The results of this literature review show that more research needs to be done to evaluate interventions targeting reciprocal, multi-exchange conversations. Specifically, more studies that collect data on the conversation partner's behavior, fully fade all training components, and assess generalized beyond the setting of the intervention (e.g. in a community setting).

### *The Current Study*

With scripting procedures used as the most common intervention used in research on reciprocal conversations, an ideal methodology would include a script modality which is adaptable to a natural social environment, socially acceptable to a conversation partner, and can be flexible to various social interactions. One of the included studies, Grosberg and Charlop (2017), matches this ideal methodology for furthering the research on reciprocal conversations. The researchers evaluated a scripting intervention with text-message prompts on reciprocal play conversations with children with ASD. The use of text messaging technology creates an electronic script that is portable, more socially acceptable compared to printed script, and creates a flexible means of prompting within a fast-paced changing social environment. Text-message prompts were scripted phrases sent from the research assistant to the participant during a live conversation. The research assistant was initially within view of the participant and the proximity was gradually increased until he or she was no longer within view. The text-message scripted phrases were changed based on the topic and flow of the conversation. The text-messages were completely faded for all participants. The conversation partners within the study were typically developing peers, but data were not collected on the conversation partner's behavior. The results showed a significant increase of conversational phrases after the implementation of the intervention.

## CHAPTER THREE

### Methods

#### *Purpose*

The purpose of the current study was to replicate and extend the findings of Grosberg and Charlop (2017) by specifically ensuring the researcher was not visible to the participants during any of the research sessions, collecting data on the conversation partner's behavior, and evaluating the appropriateness of a peer to serve as a conversation partner prior to his or her participation in the study. Specific research questions include:

- (a) To what extent does text-message prompting, in the absence of the researcher, lead to an increase of conversational phrases in children with ASD?
- (b) To what extent does the number of conversational phrases remain elevated following the fading of text-message prompting?

#### *Participants*

##### *Inclusion Criteria*

Three children ages 5 to 10, diagnosed with ASD, were recruited for the study. All participants received a diagnosis from a clinical professional and meet the criteria delineated by the *DSM-V* (APA, 2013). Participants were recruited from the Baylor Center for Developmental Disabilities (BCDD) who (a) were receiving ABA services from the Clinic for Assessment, Research and Education (CARE), (b) used at least 3-word intelligible phrases for engaging in a conversation, and (c) received a 5/10 score on



the reading test developed by the researchers, following the guidelines delineated by Grosberg and Charlop (2017).

India was an 8-year-old Hispanic female diagnosed with ASD. She received services from CARE through a social skills group. India scored a 10/10 on the reading test given by the researcher. Parents and therapist reported India having difficulty sustaining conversations with peers in her class and social group.

Trev was a 7-year old Caucasian male diagnosed with ASD. He was awaiting services from CARE and received services from an unrelated private ABA clinic. Trev scored a 7/10 on the reading test given by the researcher. Parents indicated that Trev struggled to initiate and maintain conversations with his classmates. Trev frequently engaged in vocal stereotypy in the form of repeating lines from TV shows (i.e., *Thomas the Train* and *Peppa Pig*) when interacting with peers and adults.

Leo was an 9- year-old Caucasian male diagnosed with ASD. He received services from CARE through a social skills group. Therapists reported Leo talking to imaginary friends while talking to peers as well as, repeating the phrase “I am sorry” in situations that an apology was not appropriate. Parents reported that Leo’s lack of appropriate social interactions were concerning. Leo scored a 10/10 on the reading test given by the researcher.

Four typically developing peers were recruited to serve as conversation partners for baseline and test phases of the study. Peers were recruited from the Waco area and were assessed for compliance, play skills, and overall appropriateness as a conversation partner. Peers were unfamiliar to the selected participant for whom they served as a conversation partner. Convenience sampling was used to recruit all participants and

peers. We strived to represent the diverse community (e.g. race, ethnicity, and sex). Two Caucasian males, one Caucasian female, and one Hispanic female were recruited to serve as peers.

### *Settings*

All pre-assessments and experimental sessions (baseline, training, and testing) were conducted at CARE, a university-based ABA clinic which provides skill acquisition services to children with ASD. The therapy room where sessions were conducted, contained a small table, three chairs, a sink, and two cabinets containing participants' preferred toys.

### *Materials*

During sessions, participants had access to preferred toys and games. These toys and games were used to promote conversation. Text-message prompts were sent through the iMessage application to an Apple Watch<sup>®</sup>. An Apple Watch<sup>®</sup> was used rather than a mobile phone because the researchers determined a watch may be less intrusive than a mobile phone. The text-message came from a contact saved as "SAY THIS:" Messages received from this contact signaled for the participant to read the message out loud to a conversation partner. In addition to the Apple Watch<sup>®</sup>, an iPad<sup>®</sup> or live stream camera was used for recording sessions for data collection purposes. The researcher reviewed the videos and collected data using data sheets.

### *Data Collection and Dependent Measures*

The primary dependent measure was the number of conversational phrases, both scripted and unscripted. A conversation phrase was defined as statements that was

contextually appropriate and required the participant to be oriented towards the conversation partner when making the comment. For example, if the participant said, “My wheel is broken” while facing his or her conversation partner, and he or she is playing with trains, then the statement was recorded as a conversational phrase. However, if the participant engaged in the response, “My wheel is broken”, while playing with a block tower, the statement was not be coded. If the same conversational phrase was repeated multiple times in a row it was only coded once. If the statement was identified to part of the participants vocal stereotypy (e.g., Trev saying “do you like my Christmas tree?”), it was not be coded as a conversational phrase. Scripted conversational phrases were defined as phrases that matched the prompted phrase in the text-message. Conversational phrases that deviated from the script only in articles, pronouns, or prepositions were not recorded as unscripted. For example, if the text-message read “That game was fun” and the participants said, “The game was fun”, it was scored as a scripted phrase. Unscripted conversational phrases were defined as conversational phrases that were contextually appropriate and did not match the scripted text-messages. For example, if the text-message read “I like Operation” and the participant said, “Let’s play Operation” this was scored as an unscripted conversational phrase.

#### *Interobserver Agreement*

The primary researcher scored all videotaped sessions by manually recording the number of conversational phrases made by the children (i.e., the participant and peer conversation partner). A second observer recorded data independent of the primary researcher to assess interobserver agreement (IOA). IOA was collected for 30% of the sessions across all phases of the study (i.e., baseline, pre-intervention text-message

prompt training, text-message prompt training, testing, and generalization sessions). This was calculated by comparing the number of agreements and disagreements between the two observers. The number of agreements were divided by the number of agreements plus disagreements, between observers, and then multiplied by 100 to obtain a percentage. Agreements were defined as both observers categorizing the same comment as a conversational phrase. Disagreements were defined as only one of the two observers categorizing the same comment as a conversational phrase.

For India baseline IOA were recorded for 33% of the sessions with an average agreement of 100% (range 100%-100%). Text-message IOA sessions were recorded for 33% of the sessions with an average agreement of 83% (80%-86%). Test IOA sessions were recorded for 33% of the sessions with an average agreement of 82% (75-88%). For Trev baseline IOA were recorded for 30% of the sessions with an average agreement of 100% (100%-100%). Text-message IOA sessions were recorded for 30% of the sessions with an average agreement of 89.5% (89% -90%). Test IOA sessions were recorded for 37% of the sessions with an average agreement of 94%(83%-100%). For Leo baseline IOA were recorded for 33% of the sessions with an average agreement of 93.5% (87%-100%). Text-message IOA sessions were recorded for 33% of the sessions with an average agreement of 100% (100%-100%). Test IOA sessions were recorded for 33% of the sessions with an average agreement of 100% (100%-100%).

## *Procedures*

### *Preassessment*

*Reading assessment.* The reading test, adapted from Grosberg and Charlop (2017), was developed to evaluate the reading skills of the participants using words similar to those that were included in the text-message prompts. The assessment consisted of 10 social conversational phrases. The phrases included three questions (e.g., “Want to play Operation?”), three comments (e.g., “Don’t make it buzz”), and four responses (e.g., “Yes, it’s my turn”). During the assessment, the researcher and participant sat across the table from one another. The researcher placed a 7.6 cm by 12.7 cm index card on the table. The index card contained a 3- to 4-word phrase (e.g. “Want to play Operation?”). The child had 3 s to read the phrase out loud after it was presented. If the child did not read the card within 3 s the researcher presented the next card. If the complete phrase was read correctly, the response was scored as correct. If one or more words in the phrase was read incorrectly or the participant did not respond, the response was scored as incorrect. Only children who responded correctly on 5 out of the 10 tested phrases were eligible to participate in the study.

*Peer assessment.* The peer assessment consisted of a 5-min social play session with the researcher. In order to participate in the study, the peer was required to meet the following three criteria: complied with 80% of instructions given, engaged in a non-preferred activity for 80% of the 5-minute session, and emitted at least eight conversational phrases. The peer was assessed for compliance based on instructions given to the peer during a social game. The peer had 3 s to comply with the demand. The researcher placed demands, which pertained to following the rules of the game,

throughout the play session. The peer was eligible to participate in the study if he or she complied with 80% of the demands without engaging in challenging behavior (e.g., crying, whining, throwing items). The researcher assessed the peers' play skills by recoding whether the peer engaged in appropriate play with a non-preferred item or activity. The peer had to attend to the non-preferred activity for 4 out of 5 min of the session in order to be eligible for participation. The researcher assessed the peers' conversation skills by counting the number of conversational phrases the peer made throughout the session. The peer was required to emit at least 8 conversational phrases, within the 5-min session, to participate in the study.

### *General Procedures*

*Baseline.* All sessions were 5-min in length. During baseline, the participant and peer were seated at a table in the therapy room and five preferred toys were placed within reach. The Apple Watch® was not located in the therapy room. At the beginning of the session, the researcher provided the instruction “Have a conversation with your friend while playing [name of toy selected]” The peer was instructed by the researcher to converse with the participant by responding to comments made by the participant while playing. No further instructions or prompts were provided throughout the 5-min session.

*Pre-intervention text-message prompt training.* The training consisted of teaching the participant how to utilize text-message prompts sent to the Apple Watch® by watching an instructional video. The participant was taught to wait for a vibration (signaling that a text-message was received), open the text-message by clicking on the number 1 notification in the message icon, and then read the message out loud to his or

her conversation partner. After watching the video, the Apple Watch<sup>®</sup> was placed on the participant's non dominant wrist. The researcher and participant were seated on opposite sides of the table. The researcher sent random text-messages containing 2-5 words. Least to most prompting with the following hierarchy a (a) verbal prompt of "open the text-message", (b) a verbal prompt and pointing gesture towards the watch, (c) physical guidance of participant to open the text-message, (d) was utilized to prompt the steps provided in the instructional video. For example, if Leo did not open the text after receiving the text-message, the researcher first verbally gave him the instruction "open the text-message", if there is still no response, the researcher repeated the instruction and gestured at his watch. If Leo still did not open the text-message, the researcher stood behind him and physically guided his dominant hand to open the text-message by pressing on the 1 notification on the message icon on the Apple Watch<sup>®</sup>. Once the skill of following the text-message prompts was acquired, as demonstrated by the participant independently opening and reading 8 consecutive text-messages, the participant moved on to the next phase.

*Text-message prompt training.* During this phase, a novel adult served as the conversation partner. The novel adult was instructed to verbally respond with a contextually appropriate conversational phrase (e.g., "I like this game too) each time the participant engaged in a scripted or unscripted conversational phrase. Prior to the start of the session, the researcher provides the instruction "It's time to talk to (name of researcher)." During the session, the researcher sent eight conversational phrases (i.e., text-messages) to the participant, while observing the conversation from a live streaming video in another room. The researcher sent a text-message after every 30 s lag in

conversational phrases between conversation partner and participant. The message prompts continued until the participant was able to independently emit at least 80% of what the average conversational phrase their conversation partner emitted during baseline unscripted conversational phrases directed towards the adult conversational partner within a session. For example, India's conversation partner during baseline averaged of 18 conversational phrases per baseline session, India would be required to emit 14 conversational phrases during to meet the criterion. Once this criterion was met, the Apple Watch® was removed, and the testing phase was initiated.

*Testing.* During testing sessions, the Apple Watch® was removed from the play area and sessions followed the same procedure as described in baseline with the typically developing peer serving as the conversation partner. The researcher set each participants' terminal goal for conversational phrases individually, based on his or her conversation partner's, or a similar conversation partner within the studies, responding during baseline. The goal was set as 80% of the mean number of conversational phrases emitted by the peer during baseline. For example, on average Leo's peer engaged in 18 conversational phrases, thus, the goal for Leo was set as 14 (i.e., 80% of 18). If the participant did not meet these criteria, text-message prompt training was reintroduced.

### *Experimental Design*

A concurrent, multiple-baseline design across participants was used to evaluate the effectiveness of text-message prompts in increasing the number of conversational phrases exchanges.



### *Treatment Fidelity*

A second observer recorded treatment fidelity for 30% of the sessions across all phases of the study. Treatment fidelity was assessed according to the following components: setting (e.g., in therapy room, seated at a table), (b) use of Apple Watch<sup>®</sup> (e.g., location of Apple Watch<sup>®</sup>, Apple Watch<sup>®</sup> is locked), (c) instructions given (e.g., verbal instructions given to peer, instructional video watched) and (d) termination of trial (e.g., opening and reading 3 consecutive text-messages independently) for each phase of the study. The second observer recorded data using the appropriate data sheets, after watching the recorded session.

During India's baseline sessions treatment fidelity was taken for 33% of the sessions with 100% fidelity. During India's text-message prompting sessions, treatment fidelity was taken for 33% of the sessions with 100% fidelity. During India's test sessions treatment fidelity was taken for 33% of the sessions with 100% fidelity.

During Trev's baseline sessions treatment fidelity was taken for 30% of the sessions with 83% fidelity. During Trev's text-message prompting sessions, treatment fidelity was taken for 30% of the sessions with 86% fidelity. During Trev's test sessions treatment fidelity was taken for 37% of the sessions with 83% fidelity.

During Leo's baseline sessions treatment fidelity was taken for 33% of the sessions with 100% fidelity. During Leo's text-message prompting sessions, treatment fidelity was taken for 33% of the sessions with 100% fidelity. During Leo's test sessions treatment fidelity was taken for 33% of the sessions with 100% fidelity.

## CHAPTER FOUR

### Results

#### *India*

##### *Baseline*

India's responding during baseline remained stable. India emitted an average of 8 conversational phrases per session (ranging 5-9). This was significantly lower than her conversation partner Leah, whom emitted an average of 21 conversational phrases per session (range 18-24). Due to India's low responding, text-message prompting was initiated as seen in Figure 4.1.

##### *Text-Message Prompting*

With the introduction of text-message prompting (session 4), India's average conversational phrases increased from baseline, averaging 16 conversational phrases per session (ranging 13 to 17). She averaged 4 scripted conversational phrases per session (ranging 3-5) and 12 unscripted conversational phrases per session (ranging 10-16). India's target frequency of conversational phrases was set at 80% of Leah's average frequency of conversational phrases during baseline which was 16 conversational phrases. India met this target frequency during session 8 and 9 (see *Figure 4.1*).

##### *Test*

India emitted elevated responding during the test phase, in comparison to baseline, averaging 16 conversational phrases per session (range 14-17). Leah emitted

similar responding as in baseline, averaging 19 conversational phrases per session (range 17-23). India's elevated responding demonstrates an immediacy of effect post text-message prompting as seen in Figure 4.1.

### *Trev*

#### *Baseline*

While Trev continuously emitted vocalizations throughout baseline sessions, a majority of these vocalizations were vocal stereotypy. Trev's vocal stereotypy included memorized scenes from TV shows (e.g. Peppa Pig, Thomas the Train) and were not counted toward conversational phrases. Trev emitted an average of two conversational phrases per session (range 0-5). This was lower than his initial conversation partner Simon. Simon emitted an average of 4 conversational phrases per session (range 0-11). Due Trev's low responding text-message prompt training was initiated as seen in *Figure 4.1*.

#### *Text-Message Prompting*

With the introduction of text-message prompting (session 7) Trev's conversational phrases increased from baseline averaging 13 conversational phrases per session (range 8-19). He averaged four scripted conversational phrases per session (range 2-6) and nine unscripted conversational phrases per session (range 5-16). Due to Trev's constant vocal stereotypy during baseline, Simon was given less opportunities to emit conversational phrases, emitting a lower frequency than his other typically developing peers in the study. Therefore, another typically developing peer, Jace, was chosen, based on age and gender, to set Trev's target conversational frequency. Jace emitted an average

of 18 conversational phrases per session, thus Trev's target conversational phrases was set at 14 (80% of Jace's average conversational phrases). Trev met his target conversational phrases during sessions 11, 12, and 13.

### *Test*

Trev emitted an elevated responding in comparison to baseline, but not at his target conversational phrase frequency during the initial session of the test phase (*see figure 4. 1*). He averaged 8.5 conversational phrases a session (range 5-12), which was a decrease from the previous phase. Therefore, we introduced booster sessions to attempt to increase responding.

### *Text-Message Prompting with Peer*

This booster phase followed similar procedures as those of the text-message prompting sessions (i.e., the Apple Watch<sup>®</sup> was present; however, rather than a researcher, a new typically developing peer, Leah, served as a conversation partner. During this booster phase, Trev's responding increased back to target conversational phrase levels, averaging 14 conversational phrases (range 12-15). Trev was returned back to test the subsequent session of reaching his target frequency of conversational phrases.

### *Return to Test*

After Trev's booster sessions, he returned the test phase. His original conversation partner, Simon, was no longer available to attend sessions, thus Leah served as his conversation partner for the remaining sessions. He retained his target frequency of conversational phrases during this phase averaging 16 conversational phrases per session

(range 11-20). Trev's elevated responding demonstrates an immediacy of effect post text-message prompting as seen in Figure 1.

### *Leo*

#### *Baseline*

Leo emitted a variable number of conversational phrases during baseline. Leo would have coherent and on topic conversations with his conversation partner during select sessions (sessions 1, 2, 4, 6 & 7), but would talk to imaginary friends rather than his conversation partner during others (sessions 3, 5, 8 & 9). Talking to imaginary friends was scored as vocal stereotypy and did not count towards conversational phrase frequency. He averaged nine conversational phrases per session (range 3-17), with an overall descending trend as seen in Figure 1. Jace served as Leo's conversation partner. Jace averaged 18 conversational phrases per session. Due to Leo's variable data and significantly lower average of conversational phrases per session text-message prompting was initiated.

#### *Text-Message Prompting*

With the introduction of text-message prompting (session 19), Leo's conversational phrases decreased from baseline. Leo engaged in non-compliance with text-message prompting procedures, he specifically had difficulty reading the text-message prompt to his conversation partner and engaging in a play activity while waiting for the text-message prompt (i.e. Leo repeatedly insisting on checking the apple watch instead of playing with the Jenga blocks). A majority of comments Leo made throughout the session were protests about the Apple Watch<sup>®</sup> and were not counted towards his

conversational phrases. Leo averaged seven conversational phrases per session (range 3-18), with an average of three scripted phrases (range 0 – 6) and an average of eight unscripted phrases (range 1-14). Leo’s target frequency of conversational phrases was set at 80% of Jace’s conversational phrase frequency in baseline. Jace emitted 18 conversational phrases in baseline, thus Leo’s target conversational phrase frequency was set at 14. Leo reached his target frequency during his first text-message prompting session, but failed to do so in subsequent sessions.

### *Test*

With the removal of text-message prompts, Leo emitted elevated responding. He averaged 22 conversational phrases a session (range 19-30). Due to a change in schedule, Leo’s conversation partner was unable to attend test sessions. Sasha, a Hispanic female of similar age was recruited for the last sessions. Sasha emitted similar responding Jace’s to baseline, averaging 18 conversational phrases a session (range 16-20). Leo’s elevated responding represents an immediacy of effect post-treatment as seen in *Figure 4.1*.

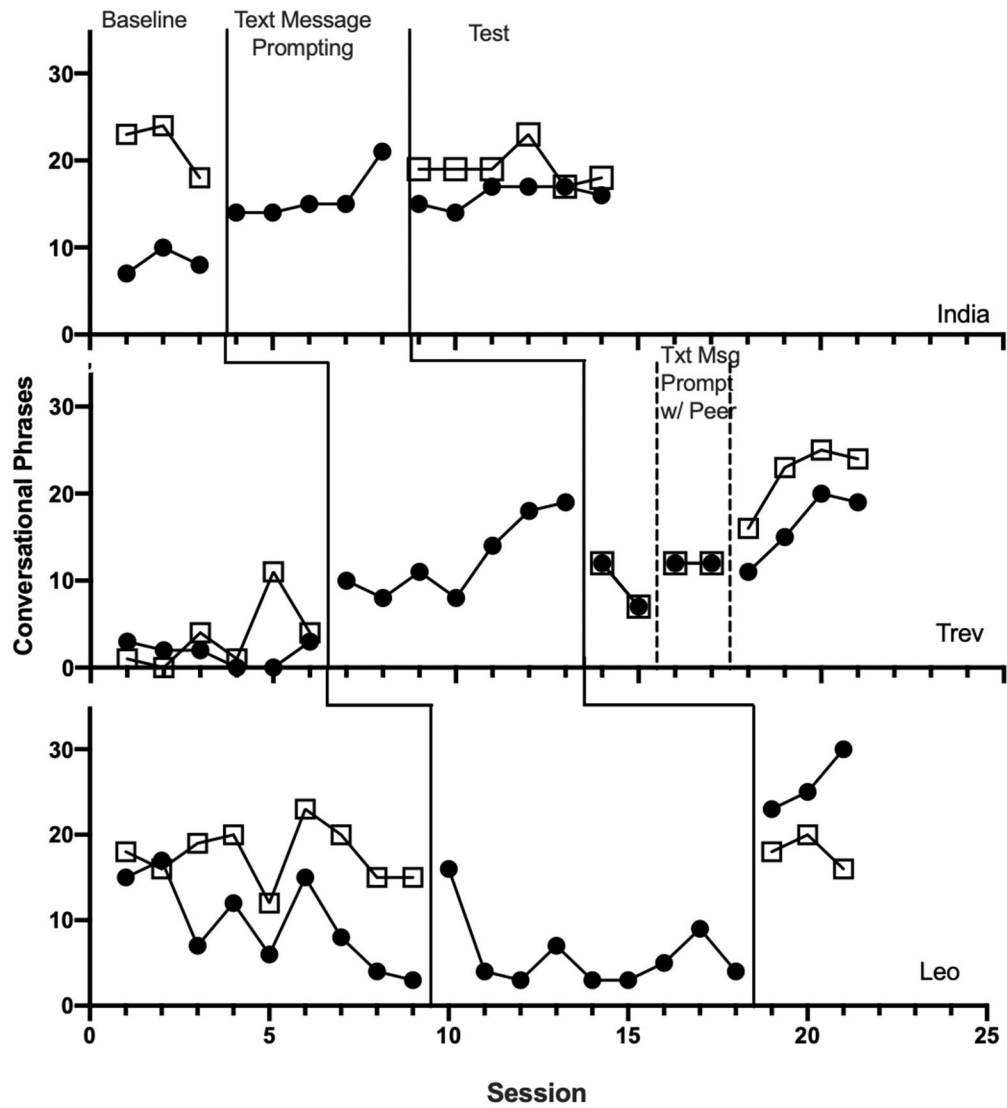


Figure 4.1. India, Trev, and Leo multiple baseline graph. Peer conversation partner conversational phrase are represented by the open square data path while participants are represented by the closed markers.

## CHAPTER FIVE

### Discussion

#### *Conclusions and Implications for Practice*

Following the use of text-message prompting, all participants demonstrated an increase in conversational phrases with their typically developing peer conversation partners. Target frequencies of conversational phrases, based on the typically developing conversation partners' behaviors, were also met by all participants. These findings suggest that text-message prompting is an effective way to teach conversation skills to children with ASD.

Text-message prompts created a means for prompting conversational phrases in a less intrusive manner than a traditional paper script. Only one participant, Trev, exposed to text-message prompting in the presence of his typically developing conversation partner. During these sessions, text-message prompts allowed the researcher to prompt novel and organic conversations that developed between Trev and his typically developing peer by adapting and editing the prompt to fit the live and fast-changing conversation. The peer did not draw attention to the text-message prompts creating a relaxed environment for Trev to simultaneously engage in a play activity and have a conversation with his peer, without distraction from the discretely texted prompts. The Apple Watch<sup>®</sup> increased the level of interest of the conversation partner. On several occasions, after the session, the typically developing peer asked to try on or wear the Apple Watch<sup>®</sup>. It could be argued that wearing an Apple Watch<sup>®</sup> within the participants



community (e.g. school, park, extracurricular activities) could potentially be a conversation starter with their peers.

The results of the current study were similar to those of Grosberg and Charlop (2017). Participants in both studies had elevated responding following the implementation of the text-message prompting intervention. Both interventions successfully integrated text-messaging technology in their procedures to teach participants how to engage in a reciprocal conversation. Within the systematic literature review portion of the current study, it was found that a majority of script training procedures included a researcher as the conversation partner rather than a peer. It could be argued that having a peer serve as a conversation partner is more socially valid. Children with ASD have more opportunities to interact and engage with their peers in the natural environment compared to engaging in conversations with adults (i.e. school, extracurricular activities, etc.). Thus, utilizing peers in an intervention to increase reciprocal conversations can lead to more successful generalization within their natural environment.

Based on the findings of the current study, practitioners should consider using new technology such as text-message prompting within their teaching practices. These methods may provide a less intrusive and more socially acceptable prompting strategy as compared to traditional paper scripts. In addition, practitioners may consider implementing these procedures during social or play activities when children with ASD could benefit from prompts to promote active engagement.

### *Limitations*

Although preemptive measures were taken during the pre-assessment phase of this study for the suitability of the Apple Watch<sup>®</sup> (e.g. wearability, screen size for reading) not all aspects, such as tactile prompting (the vibration) were tested. Tactile prompting has been established as an effective method to increase social interactions between children diagnoses with ASD and their typically developing peers (Shabani et al., 2002; Tzanakaki et al., 2014). However, in this study tactile prompting created an aversive physical stimulus for Leo. Leo emitted whines when the watch vibrated and repeatedly asked for the watch to be removed from his wrist. Averse reactions to tactile prompting can be tested before implementing text-message prompting via Apple Watch<sup>®</sup> in future research.

Another limitation is the cost effectiveness of this treatment package. While smart home security systems including live video streaming technology (Nest, D-link, Ring etc.) are more prevalent within homes in the United States and Apple Watches<sup>®</sup> being leading product in Americas wearable band market buying new technology can be costly (Smart Home Security Global Market Outlook, 2019; Amin, 2019). Compared to traditional paper scripts, live streaming technology and the name brand of an Apple Watch<sup>®</sup> can be seen as an unreasonable expense.

Technical difficulties with live streaming technology and including video delay, video freezing occurred throughout sessions. Although the live streaming technology allowed for the researcher to less intrusive by staying out of the therapy room, these technical difficulties led to text-message prompts being sent and read after the conversation had already moved on to another topic. For example, during India's text-

message session 4, the researcher prompted the text-message “I finished my minion” however before the message was received on the Apple Watch<sup>®</sup>, India’s conversation partner moved on to the next activity by asking “what do you want to do next?”. India read the text-message prompt after the topic change.

### *Future Research*

The current study extended the findings of Grosberg and Charlop (2017) through a less intrusive prompting by increasing distance and reducing visibility of the text-message prompter to the participants during text-message prompting sessions, data collection on the conversation partner’s behavior, the evaluation of appropriateness of a peer to serve as a conversation partner prior to their participation in the study. Future research can extend this study by teaching participants to discriminate between text-messages and text-message prompts. The current study sent text-message prompts through the saved contact of “SAY THIS:”. While participants were given the instruction to only to say text-messages from this contact, they were not explicitly trained to do so. During text-message prompting sessions a few text-messages were received from other contacts and were read out loud like text-message prompts during sessions. For example during a text-message session a text was received on the Apple Watch<sup>®</sup> from the contact “Batman” during the session. The Text of “Hi” was read during the session. Future research can teach participants to discriminate between text-message prompts and text - messages during their training. For example, during training participants would receive text-messages from a variety of contacts including “SAY THIS:” participants will be given the instruction to only read messages from “SAY THIS:”. Participants would then be reinforced with a preferred edible by reading the text-message from “SAY THIS” and

not reinforced for reading a text-message from a different contact such as “MOM”. This procedure be implemented until the participant successful read 100% of the messages from “SAY THIS:” and ignored 100% of the messages from “MOM”.

Due to time constraints the current study only assessed text-message prompting via an Apple Watch® in one clinical setting, one population, and during play activity conversations. Future research should assess this treatment within the community more naturalistic settings, or with a different population (typically developing individuals, adult individuals’ with ASD), or a different conversation (job interviews, customer service interactions, etc.).

### *Conclusions*

This study suggests that text-message prompting is an effective methodology to teach children with ASD to maintain a reciprocal conversation with typically developing peers. All participants demonstrated an increase in conversational phrases with their typically developing peer conversation partners. Target frequencies of conversational phrases, based on the typically developing conversation partners’ behaviors, were also met by all participants. These findings replicate the results produced by Grosberg & Charlop (2017), as well as extending their methodology through the utilization of an Apple Watch®. By receiving text-message prompts on an Apple Watch® the researcher was able to increase the distance of prompting, this allowed the researcher to remain out of sight during text-message prompting sessions, thus creating a less intrusive strategy for prompting reciprocal conversations.

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