The Effects of a Peer-Mediated Intervention on Intraverbal Behavior of Children with Autism Spectrum Disorder

THESIS

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Abstract

Individuals with Autism Spectrum Disorder (ASD) often have deficits in social and communication skills. These skills can include verbal behavior such as tacting, manding, and intraverbal behavior. Research suggests that intraverbal behavior can be taught using echoic to intraverbal transfer-of-control procedures. Researchers have demonstrated that peer-mediated interventions can be successfully used to teach students with ASD social and communication skills. This study used a multiple probe across participants design to determine if a peer with ASD could be trained to implement an echoic to intraverbal transfer-of-control intervention, and if that intervention would be effective in increasing intraverbal behavior in students with ASD. Results indicate that the peer effectively implemented the intervention, and that the target students learned and maintained intraverbal behavior. The paper will also discuss implications and direction for future research, including testing for generalization of skills, additional intraverbal interventions that can be implemented, and using peers to teach more complex intraverbal skills.
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Chapter 1: Introduction

Autism is a pervasive developmental disorder that affects social and communication skills and can lead to significant challenges with behavior, language, and social interactions (Centers for Disease Control and Prevention, 2016). According to the American Psychiatric Association's Diagnostic and Statistical Manual, Fifth Edition (DSM-5), 1 in every 68 children is diagnosed with Autism Spectrum Disorder (ASD). The diagnostic criteria for ASD include deficits in social communication, such as difficulty engaging in “normal back-and-forth conversation” (Centers for Disease Control and Prevention, 2016). Communication difficulties and deficits have been the focus of numerous research projects and interventions for children with ASD as professionals seek to increase communication skills for this population (Cihon, 2007; Peters-Scheffer, Didden, Korzilius, & Sturmey, 2011). Much of this research has focused on vocal verbal behavior with instruction primarily provided by adults.

Paraprofessionals or teachers typically implement the majority of classroom interventions for children with ASD. Although interventions mediated by paraprofessionals are effective, many children with ASD are already more likely to interact with adults than with peers. Due to this, communication skills learned through adult implemented interventions may not be as easily generalized to peer interactions (McCurdy & Cole, 2014; Owen-DeSchryver, Carr, Cale, & Blakeley-Smith, 2008). A
more beneficial way to improve communication for individuals with ASD may be through peer-mediated interventions, rather than social and communication interventions conducted solely by paraprofessionals and other adults. Peer-mediated interventions may help children with ASD to become more comfortable with peers their own age. This could lead to an increase in their abilities to develop friendships and engage in socially appropriate behaviors both in school and community settings (Katz & Giarlometto, 2013; Owen-DeSchryver, Carr, Cale, & Blakely-Smith, 2008). Peer-mediated interventions for children with ASD have been used in a variety of contexts (e.g., for increasing academic skills, social interactions, and class participation), and the research demonstrates that peer-mediation leads to an increase in positive social interactions and skills for children with ASD (Banda, Hart, & Liu-Gitz, 2010; Harper, Symon, & Frea, 2008; Koegel, et al., 2012). Further, children with autism who are targeted in peer-mediated interventions are not the only beneficiaries; typical peers can become more sensitive and compassionate through interventions with children with ASD, promoting positive relationships (Hoff & Robinson, 2002). Most importantly, peer-mediated social and communication skill interventions have been effective in teaching students on varying levels of the autism spectrum how to appropriately communicate and behave in a variety of settings, increasing their prosocial interactions (Cihon, 2007; McCurdy & Cole, 2014; Trembath, Balandin, Togher, & Stancliffe, 2009).

Children who struggle with verbal communication face challenges that can persist throughout their lives; this is especially true for individuals with an autism diagnosis (Steinhausen, Mohr Jensen, & Lauritsen, 2016). Verbal communication is important for
engagement in academics, social skills, and daily functioning. For instance, poor verbal communication skills often lead to difficulty with social communication, which can be disadvantageous to forming positive relationships with peers (Howlin, 2003). According to Roy and Chiat (2014), individuals with social communication deficits often display characteristics of autism (even those without a diagnosis) as well as social, emotional and behavioral difficulties. The researchers also found a correlation between language impairment and hyperactivity. Such difficulties can be extremely detrimental in a school environment leading to poor academic progress and disciplinary problems. Therefore, interventions that target and improve verbal behavior can have significant implications for daily functioning, academics and social interactions.

**Verbal Behavior**

According to B.F. Skinner, verbal behavior is “…behavior shaped and maintained by mediated consequences” (Skinner, 1957). Specifically, these mediated consequences include social consequences (i.e., the continuation of a conversation) or consequences that have a direct effect on the environment (i.e., receiving an item immediately after verbally requesting it). Verbal behavior can include verbal operants such as mands, tacts, and intraverbals. Much of the research in verbal behavior focuses on teaching children with ASD manding and tacting (Kobari-Wright & Miguel, 2014; Lorah & Hineline, 2014; Valentino & Shillingsburg, 2011). Individuals’ abilities to appropriately request (i.e., mand) and identify objects and events (i.e., tact) are essential and basic communication skills. According to Skinner (1957), intraverbal behavior includes responding to questions, holding conversations, and making small-talk. Most of our day-
to-day social interactions can be categorized as intraverbal behavior; however, intraverbal behavior is more complex and can be more difficult to instruct than other verbal operants (Cihon, 2007).

Tacting can be defined as the ability to label and or describe items and events. Typically, a repertoire of tacts and/or mands is needed before a child can successfully begin to build an intraverbal repertoire. Using a multiple baseline design across behaviors, Bloh (2008) compared two types of echoic transfer of control procedures to teach tacts to five individuals with ASD. An echoic refers to a verbal prompt that is given to a student, that the student is to repeat (i.e., echo). Tacts were taught to participants using the receptive-echoic-tact (r-e-t) and echoic-tact (e-t) transfer procedures. Using r-e-t procedures, participants were asked to touch a particular picture from an array of three; this step targeted the receptive communication of participants. A participant was told “Say (name of the picture)”; this step involved echoic prompting. After the student echoed the prompt, he or she was asked to tact the picture when prompted with the question “Right, what is it?” For e-t training, receptive communication was not targeted. Instead, a participant was shown one picture at a time and told “Say (name of picture)”. After echoing this prompt, the student was asked “Right, what is it?” Most-to-least prompting and whole word prompts were used to ensure that the student touched the correct picture and echoed the verbal prompt from the onset of the intervention. Researchers determined that both r-e-t and e-t procedures were equally effective for teaching tacts to students with ASD and limited verbal behavior (Bloh, 2008). Similarly, Kodak and Clements (2009) used echoic procedures to teach tacts to a child with ASD.
The researchers examined the efficacy of using combined procedures to aid in the acquisition of tacts and mands for a 4-year old child with ASD. The design of this study was a reversal embedded in a multiple baseline across verbal operants design. The methods of this study included using echoic training in combination with either mand or tact training. Kodak and Clements found that the combination of procedures, rather than singular tact, mand, or echoic training, resulted in increased independent (unprompted) tacts and mands.

Manding can be defined as the ability to request. Strasberger and Ferreri (2013) trained peers to teach students with ASD how to use speech-generating devices to mand and respond to “what do you want?” and “what is your name?” After peers were trained in assisting communication and the intervention was implemented, independent manding and responding increased for three out of the four target participants in the study. Marion, Martin, Yu, Buhler, and Kerr (2012) focused on teaching three 3-5 year olds with ASD to mand “Where?” Using a modified multiple baseline across participants design, researchers taught the students to mand “Where?” by contriving a conditioned motivating operation (e.g., hiding a preferred toy while playing with a participant), prompting a child to ask “Where?”, and reinforcing the child’s mand with the preferred toy. Two out of the three participants were able to generalize and maintain the mand “Where?” without any additional procedures; one participant required additional training before generalizing the newly learned mand.

Intraverbals. Intraverbal behavior includes responding to questions, holding conversations, and making small-talk. An example of an intraverbal would be responding
the question “What is your name?” with “My name is Bob”. The absence of this type of conversational communication is cited in the criteria for ASD diagnosis (American Psychiatric Association, 2013). One tactic to increase intraverbal behavior in students with ASD involves a transfer of stimulus control (using an already existing repertoire of tacts) and prompting procedures (Ingvarsson, Cammilleri, & Macias, 2012; Vedora, Meunier, & Mackay, 2009).

**Intraverbal research.** Vedora et al. (2009) compared echoic prompting and textual prompting procedures for teaching intraverbal behavior to children with ASD. For this study, two 7-year old boys with ASD were taught intraverbal behavior. The boys had repertoires of 50-100 sight words and spoke in simple sentences. Textual prompting procedures and echoic prompting procedures were both used to teach the students intraverbals. During the textual prompting condition, the boys were asked functional questions (i.e., “What do you do with a book?”) and then shown the answer in written form on a 5”x5” laminated card. During the echoic prompt condition, researchers verbally prompted the students with the answer after posing a question, and did not show the answer in written form. Vedora and colleagues found that textual prompting led to faster acquisition of intraverbals, and was therefore more effective than using echoic prompting alone. Both boys did acquire intraverbal skills in the echoic condition, but they required more intervention sessions than during the textual prompt condition. One participant required textual prompts in combination with echoic prompts before he could reach mastery criterion.
Ingvarsson, Cammilleri, and Macias (2012) effectively used echoic to intraverbal transfer-of-control procedures to teach students intraverbal behavior before examining emergent listener behavior as a result of the intervention. Using a non-concurrent multiple baseline across participants design, Ingvarsson et al., taught four 4-10 year olds with ASD intraverbal behavior. The procedures consisted of asking a participant a question (i.e., “What is the state bird of Ohio?”) and verbally prompting them with the answer, which the student would then echo (i.e., “Cardinal”). If the student did not echo the prompt, the researcher would next prompt the student with “Say, ‘Cardinal’”. All participants acquired independent intraverbal behavior following the echoic to intraverbal transfer-of-control procedures. In a similar study, Kodak and colleagues (2012) compared using echoic and tact prompts and cue-point pause (CPP) to teach intraverbal behavior. The participants for this study were two young boys with ASD. Both had an extensive repertoire of mands and tacts, and would both echo parts of questions during intraverbal training. Researchers found that echoic prompting with error correction was most effective for teaching intraverbal behavior, while CPP was least effective.

Kamps and colleagues (2002) described a peer intervention that was used to increase social communication in students with ASD; however, this study was not described in behavior analytic terms, and the term “social communication” was used in place of “intraverbal behavior”. This study demonstrated that peer training in an elementary school setting was beneficial in aiding social interactions and communication for students with ASD. The studies that used behavioral language and target intraverbal behavior did not use peer-mediated interventions; rather, a researcher or an adult in a
classroom implemented the intervention (Kodak, Fuchtman, & Paden, 2012; Vedora et al., 2009).

**Transfer of control procedures.** Transfer of control procedures are often used in verbal behavior intervention, particularly in interventions that target intraverbals (Ingvarsson, Cammilleri, & Macias, 2012; Vedora, Meunier, & Mackay, 2009). In these interventions, a question is typically asked (i.e., “What is the state bird of Ohio?”) and then either a verbal or textual prompt of the answer is provided (i.e., a researcher would either say “Cardinal” for a participant to echo, or show the participant the word Cardinal written out on a piece of paper). Eventually, if the procedures are effective, the participant will begin to answer the question independently, before the prompt is provided. This newly learned intraverbal skill would then hopefully maintain in an individual’s repertoire after the intervention, and generalize to novel settings and individuals. If this happens, then it can be said that transfer of control occurred.

**Peer mediated research.** According to Chan et al., (2009), peer mediated intervention “…is a treatment approach in which peers (e.g., classmates) are trained to act as the intervention agents, implementing instructional programs, behavioral interventions, and facilitating social interactions” (p. 877). A particular area that children with ASD struggle with is appropriate interactions with peers. In a school setting, students with ASD are more likely to interact with adults than with peers. The communication skills learned through interactions with adults are not always easily generalized to peer-to-peer interactions (McCurdy & Cole, 2014; Owen-DeSchryver, Carr, Cale, & Blakeley-Smith, 2008). Interventions using peer-mediation are effective when implemented correctly, and
have also been shown to promote maintenance and generalization of social communication skills outside of the initial training environment for children with ASD (Kamps, et al., 2014; Strasberger & Ferreri, 2014).

Lorah, Gilroy, and Hineline (2013) demonstrated that peer-mediated interventions using participants with ASD are effective in increasing manding in students with autism. This study used a multiple baseline across participants design and included six students with ASD. These students were separated into peer dyads. Reciprocal peer tutoring was implemented with participants playing both listener and speaker roles within each dyad. The participants were directed to complete a puzzle; the listener in the dyad had a missing puzzle piece, and the speaker was taught to mand for the puzzle piece, using least to most prompting. All students in the study increased in peer manding and listener responding. McCurdy and Cole (2014) chose to examine what effect peer interventions could have on disruptive, off-task behavior of students with ASD. The off-task behavior of three students was targeted in the study. Off-task behavior was defined differently for each student, based on each participant’s classroom behavior. Peers were trained to nonvocally redirect off-task students, and to provide nonverbal positive reinforcement to on-task students (e.g., thumbs up). The peers were then paired with the students for intervention sessions during a class period and asked to use intervention techniques learned during training; all participants displayed a decrease in off-task behavior. In addition, teachers reported an increase in the completion of work for the three participants with ASD.
Peer-mediation has also been shown to be an effective intervention to improve social communication. For example, Katz and Girolametto (2013) extended previous work regarding the efficacy of peer interventions for preschool children with ASD by asking two questions: (1) After training and intervention, did both groups in the study (i.e., typical peers and children with ASD) continue to engage in social interactions more often and a for longer amount of time, and (2) Was the intervention valid, as measured by (a) if it could be truly implemented in a daycare center setting and (b) if others outside of the study observed increases in amount and length of social interactions among study participants. There were four different stages of the study’s intervention program. The first involved a training session for the three educators, the second was the teaching of peer-interventionist skills by a co-author of the study and an educator, the third was the implementation of the intervention by the educator across twelve 20-minute play sessions, and the fourth stage was follow-up sessions with the educators. The social skills of the three participants with ASD improved significantly after implementation of the intervention. That is, educators observed post-intervention that all three displayed significantly longer and more social interactions than pre-intervention.

Banda, Hart, and Liu-Gitz (2010) studied what effect peer interventions could have on social skills that are utilized during center time activities. The study included two 6-year-old children with ASD, and two to three typically developing peers per child with ASD. Peers and participants were trained together; a researcher modeled appropriate social initiations and responses, and had students practice these initiations and responses. Intervention training occurred in 4-5 minute sessions before data collection, and
researchers also verbally prompted participants and peers during data collection. The study found that social skills, as measured by peer-to-peer initiations and responses during center time, increased for both participants with ASD after intervention training. These results indicate that including typically developing peers in academic activities (i.e., center time) can help to improve social and communication skills of children with ASD. The present study targets academic intraverbal behavior that is specific to Ohio’s Mathematics Standards for students in Kindergarten-1st grade. The academic language targeted in this study is identification of shapes. This study will combine transfer-of-control methods along with peer training and peer-mediated intervention, drawing on previous research that has been done in the areas of intraverbal behavior and peer mediation.

**Statement of Purpose**

The purpose of this study was to analyze the effects of a peer-mediated intervention designed to increase intraverbal behavior of children with autism spectrum disorder. Much of the peer-mediated intraverbal studies target conversational language and academic language in older students (Cihon, 2007; Emmick, Cihon & Eshleman, 2010; Kamps, et al., 2002). This study will instead examine the effectiveness of peer-mediated interventions in increasing emergent academic intraverbals in younger students with ASD using echoic to intraverbal transfer-of-control.
Research Questions

1. Can a peer with ASD be trained to implement a verbal behavior intervention?

2. When implemented by a peer, will echoic to intraverbal transfer-of-control procedures increase academic intraverbal behavior in students with ASD?

3. Will the intraverbals be maintained in the students’ verbal repertoires post-study?
Chapter 2: Method

Participants

Participants for this study were four children with ASD diagnoses, including one elementary-aged model peer and three target participants. All of the participants attended a special school designed for children with ASD or cognitive disabilities. The model peer, Ben, was 7 years old at the start of the study and had an ASD and ADHD dual diagnoses. Prior to the study, Ben was assessed using the Pragmatics Profile from the Clinical Evaluation of Language Fundamentals 5th edition (CELF-5). It was noted that Ben had strong verbal skills in the areas of taking turns during conversation, reasoning, and understanding and explaining feelings and situations. Despite these noted strengths, Ben’s receptive knowledge of language concepts and his expressive language skills were below average when compared to typical peers. He was able to successfully tact triangle, square, and circle, as well as display correct intraverbal responding (i.e., answers) to the following questions: Which shape has three sides? (Answer: Triangle); What shape has four sides? (Answer: Square); What shape is round? (Answer: Circle).

The three target students (i.e., tutees), Luke, Tony, and Matthew were between ages 6-7 years old and had ASD diagnoses. Students were recommended for the study by

1 All children names have been changed.
the principal of the school. Luke was 6 years old at the start of the study, and had an ASD diagnosis. Based on results from the Woodcock Johnson Test (administered prior to the start of this study), Luke was reading well above grade level. It was noted by a teacher that Luke “does not interact with peers verbally”. He would, however, interact with peers and take turns when prompted. Luke’s language skills were assessed using the CELF-5; his scores for this assessment were: Core Language Standard Score= 45, Receptive Language Index=57, Expressive Language Index= 50, Language Content Index= 63, Language Structure Index= 49. All of these scores were in the well below average range on the CELF-5.

Tony turned 7 years old just prior to the start of the study. Tony had multiple diagnoses, including ASD and disruptive behavior disorder Not Otherwise Specified, due to oppositional and aggressive behavior. Prior to the start of the study, Tony was assessed using the Battelle Developmental Inventory 2nd Edition (BDI-2); results from this assessment indicated that he had significant delays in communication skills. While it was reported that Tony had mastered responding to verbal and gestural commands, following 3 or more familiar commands, and using 3 word utterances, he had not yet mastered spontaneous utterances and understanding more complex demands.

Matthew was 6 years old at the start of the study and had been diagnosed with ASD. Prior to the start of the study, Matthew was assessed using the Stanford-Binet Intelligence Scales, Fifth Edition (SB5). Matthew’s scores on the SB5 were as follows: Nonverbal Intelligence Quotient 56, Verbal Intelligence Quotient 56, and Full Scale Intelligence Quotient 54. All of these scores indicated that Matthew fell within the
impaired range of cognitive functioning. Matthew also scored 72 on the Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4), which falls in the borderline impaired range, and a 68 on the Expressive Vocabulary Test, Second Edition (EVT-2), which falls in the mildly impaired range. It was noted that Matthew was working on identifying common objects and following multi-step directions.

All participants in the study were selected based on their tactual and intraverbal repertoires; these skills were assessed by the experimenter, after gaining parental permission. All four participants had also had instruction in shapes (i.e., identifying shapes and characteristics of shapes). Despite this instruction, however, the three target students had not acquired the skill of responding to specific questions about shapes. Assessments included asking each participant to tact a square, triangle, and circle when shown pictures, and to answer the questions; “What shape has four sides?”, “What shape has three sides?” and “What shape is round?”. The model peer and all three target students had the ability to correctly tact each shape. Target students displayed no correct responding to the questions; however, the peer was able to correctly answer all three questions. Target students and the peer were all able to echo the shape names “Square”, “Triangle”, and “Circle” when given an echoic prompt.

Setting

Training and intervention took place in two separate classrooms for elementary-aged students with ASD. The elementary school was a section of the larger center that provides service to children ages 5-22 years, with ASD or cognitive disabilities. The center served approximately 300 students throughout the state. Training and intervention
were done at a table in the back of a classroom, while regular classroom activities were occurring. The classroom where intervention typically took place had four male students and a teacher to student ratio of 1:2. The sessions for this study typically took place during “specials” time, so the rest of the class was participating in art or gym while students were pulled for the study. This time was also used as time for students to go to speech therapy, occupational therapy, or physical therapy. Throughout the school day, students participated in academic classes, computer class, daily hygiene routines, and fluency training. There was a school-wide token system designed to promote positive behavior. The participants’ familiarity with a token system allowed for an easy transition to the study’s use of reinforcers during sessions. Other students and teachers were usually present during study sessions; occasionally, however, no other students were present and the classroom was quiet.

**Materials**

Materials included: peer training forms (*Appendix A*), data collection sheets (*Appendix B*), and procedural integrity checklist (*Appendix C*). Materials for this study also included edible reinforcers determined by teacher reports.

**Independent Variable**

The independent variable in this study was an intervention package consisting of peer training and echoic to intraverbal transfer-of-control procedures.

**Peer training.** The researcher taught the model peer how to implement intervention procedures. The peer was instructed on the transfer-of-control procedures through scripted instruction, modeling, and role-play. See Appendix A for the form and
script used to teach and assess peer verbal intervention skills. Once the model peer correctly demonstrated the procedures for echoic prompting with 100% accuracy during 2 consecutive trials, intervention began. The peer was trained just prior to the first target student entering intervention.

The peer used echoic prompting to begin the transfer-of-control procedures. For echoic prompting procedures, the peer waited for a predetermined amount of time (i.e., 0-3 s) and then stated the answer after repeating the question. The peer paused allowing the target student to echo the answer. If the student did not echo the answer, the peer then stated, “Say, ‘(answer)’” and again waited for a response from the student. This procedure was repeated until the target student was consistently echoing the prompt. In order to determine if echoic to intraverbal transfer-of-control occurred, the peer asked the same questions post-intervention, but without providing an echoic prompt. Instead, the peer waited for the student to independently and correctly respond to the question, thus demonstrating intraverbal skill.

**Echoic-to-intraverbal.** For this study, echoic to intraverbal transfer-of-control procedures were implemented by a peer. The echoic to intraverbal transfer-of-control procedures involved delivering a verbal echoic prompt after the controlling stimulus (i.e., the question “What shape has four sides?”) was delivered. In the first three sessions of intervention, no time delay was implemented before the first verbal echoic prompt was given. After a student echoed the first prompts for 80% of trials, a time delay (i.e., 3 s) was implemented before the verbal prompt was delivered. If the target student echoed the verbal prompt, verbal feedback was delivered (i.e., “That’s right, a square has four
sides!”). If the target student did not echo the first prompt within 3 s, then the peer continued with “Say, ‘(answer)’”. This procedure was continued until the target student responded at 80% above baseline scores by correctly echoing the verbal prompt, or responding correctly before the verbal prompt was delivered. Maintenance for each target student was assessed 1.5 weeks post-intervention by asking the questions with no verbal prompt to determine if intraverbal behavior had been acquired and maintained. If the student responded correctly in 5 s after the question was asked, intraverbal transfer-of-control occurred.

**Dependent Variable**

The target behaviors that were measured were target students’ verbal responses of “Square” “Triangle” or “Circle” in response to the peer-posed questions, “What shape has four sides?” “What shape has three sides?” and “What shape is round?” Students had to give the specific verbal responses listed above to the posed questions for a trial to be marked as correct. Any answer other than the corresponding verbal responses to a specific question listed above was marked as incorrect. For example, if a student responded “Triangle” to the question “What shape has four sides?” this answer was marked as incorrect. If a student did not respond at all, the answer was marked as incorrect. During intervention, each of the three questions was asked four times, in a random order, for a total of 12 trials per session.

**Experimental Design**

This study was a multiple probe across participants design. All three target students began baseline at the same time and the introduction to intervention conditions
was staggered across the three students (one student moved onto intervention sessions first; after steady state baseline responding was achieved, the next student moved into intervention after the first student demonstrated an experimental effect. This pattern continued until all students were in the intervention phase) (Cooper, Heron, & Heward, 2007). After target students displayed steady baseline levels for 4 baseline sessions, each participant was probed before entering intervention. Two students moved on to the maintenance phase once they reached mastery criterion. One student (Luke) moved on to the maintenance phase after a steady increasing trend was observed. Mastery criterion was set at accurately responding 80% above baseline response levels across three consecutive sessions.

Social Validity

Social validity was assessed using an interview given to the model peer. The interview consisted of questions regarding the peer’s acceptance of the methods he used with the target students. An example of the interview can be seen in Appendix D. Social validity was also based on comments from the classroom teacher and staff during and after the intervention.

Maintenance

Maintenance probes were conducted 1.5 weeks post-intervention. The model peer sat a table across from each target student. The peer asked the three questions, “What shape has four sides?” “What shape has three sides?” and “What shape is round?” Each question was repeated twice in a random order. The target student was not prompted at all during maintenance. The target student was given 5 s to respond, and then responses were
recorded. The students’ responses were marked as correct or incorrect; non-responses were marked as incorrect. Descriptive praise was delivered for correct responses (e.g., “Great job! A square does have four sides”).

**Interobserver Agreement and Procedural Integrity**

Procedural integrity and interobserver agreement was assessed for 33% of all trials. Procedural integrity was recorded at 96.1%, assessed using the checklist found in Appendix C. Interobserver data accounted for 33% of sessions in baseline, intervention, maintenance. Interobserver agreement was 85% across all sessions.

**Prebaseline**

Reinforcer information was collected for all target students prior to baseline. Teachers and classroom staff were asked for a list of 4-5 potential reinforcers for each student. Before each session, students were given a choice of 2-3 items from their list, and asked “What do you want to work for?” The item the student chose was used as the reinforcer for that session. Upon completion of 6 trials during a session, two of the three target students were given access to their preferred reinforcers. Initially, Matthew struggled to maintain focus during sessions. He was given a reinforcer after every trial for the first three sessions in order to increase his attention during sessions. By the fourth session, Matthew’s schedule of reinforcement was thinned to every 6 trials. Verbal behavior of the model peer and the target students were assessed based on methods used by Ingvarsson and colleagues (2012). Tact and echoic pretests, as well as intraverbal pretests, were conducted to assess current verbal behavior skills. For the tact pretests, a student was shown a picture of a shape and asked “What is this?”. If he could correctly
name (tact) all shapes with 100% accuracy, he moved on to the next phase. For the echoic pretest, a student was told, “Say ‘(shape)’. If he could echo all three shape names, the student moved on to the next phase. Intraverbal pretests were conducted with the peer and target students. During these pretests, each target student was asked the following questions, “What shape has four sides?” “What shape has three sides?” “What shape is round?” The model peer responded to all of these questions with 100% accuracy. If the model peer had not responded to all questions with 100% accuracy, the echoic to intraverbal transfer-of-control procedures used in this study would have been used to train him prior to the start of intervention. The peer and all target students met the 100% mastery for tacting; however, if they had not, additional tact training would have been implemented.

**Tact training.** If a participant (i.e., target student and/or peer) was not able to tact shapes at 100% accuracy he would have undergone additional tact training. All participants met the 100% criteria.

Tact training would have consisted of participants being shown a laminated piece of construction paper cut into a triangle, square, or circle. An experimenter would hold up the laminated shape and ask “What is this?” The experimenter would wait 3s for the participant to respond. If the participant did not respond within this time frame, the experimenter would deliver the echoic prompt of “Square”, “Circle”, or “Triangle”. If the participant did not repeat the echoic prompt after 3 s, the experimenter would repeat the prompt and add “say” before the prompt (i.e., “Say, ‘Circle’”). Each shape would be presented at least four times, in a random order. Tact training would continue until all
target students and the peer were able to tact each shape within 3 s after the initial presentation of the shape. Target students would have to correctly tact every shape in two consecutive trials to reach mastery. Tact training was not needed for any of the participants in the present study.

**Baseline**

For baseline, the model peer sat at a table across from each target student. The peer asked the three questions: “What shape has four sides?”, “What shape has three sides?” and “What shape is round?” Each question was repeated two times in a random order (i.e., 6 opportunities to respond), and students were given 5 seconds to respond. Students’ responses were marked as correct or incorrect. No prompts were given after questions were posed, and responses were not praised or otherwise acknowledged.

**Intervention**

For intervention, the peer sat at a table across from the student. The peer asked the three questions: “What shape has four sides?” “What shape has three sides?” and “What shape is round?” Each question was repeated 4 times in a random order. During the first session, the peer immediately gave an echoic prompt (either, “square”, “circle”, or “triangle”) after posing the question. During subsequent sessions, the peer waited 3 s between asking the question and delivering the first prompt. If the students did not give the correct response 3 seconds after the first prompt was delivered, the peer provided a second prompt of “Say, (‘square’/ ‘triangle’/ ‘circle’)”. The target student was again given three seconds to respond. Students’ responses were marked as correct/ 1 prompt (only first verbal prompt used); correct/ 2 prompts (first and second prompts used);
incorrect/prompted; correct/unprompted (no error correction or prompts). The student was given descriptive praise for each correct response (i.e., “That’s right! A square does have four sides!”). Mastery criterion for target students was responding at 80% above baseline. Two of the target students and the peer were given a preferred reinforcer (e.g., a small piece of candy or access to a book for 1 minute) halfway through a session (i.e. after 6 trials. One target student, Matthew, was at first given a reinforcer after every trial for sessions 1-3. The reinforcer (e.g., a small candy bar) was placed in front of Matthew, which helped to maintain his attention. By the fourth session, the schedule of reinforcement was thinned so that Matthew received reinforcement after 6 trials, similar to the other students. The reinforcer remained placed within his view.

If target students did not begin to emit unprompted intraverbal responding (i.e. responding to the question prior to the 3 s delay), an echoic prompting with no time delay and fading procedures were used. During these procedures, an immediate verbal prompt was presented after the target verbal stimulus. After a target student showed steady echoic responding (i.e., responding at 80% or above for three consecutive sessions), a 3 s delay between the target verbal stimulus and the echoic prompt was again used. All target students received at least 3 sessions of intervention with no time delay between the question and first prompt.
Chapter 3: Results

This chapter presents the results of the study. Data are presented on interobserver agreement (IOA), procedural integrity, social validity, and verbal behavior dependent variables.

**Tacting and Intraverbal Assessments**

**Luke.** When respectively shown pictures of a triangle, square, and circle, Luke was able to tact all three shapes with 100% accuracy across 6 opportunities (see Figure 1). Luke had a mean of 0.0 correct responses during the intraverbal assessment, across 6 opportunities. For the intraverbal assessment, Luke was unable to correctly answer the questions “What shape has four sides?”; “What shape has three sides?”; and “What shape is wrong?”. To assess if he was able to echo a verbal prompt, the researcher told Luke “Say, ‘Square’”; “Say, ‘Circle’”; and “Say, ‘Triangle’”. The student was able to echo all three verbal prompts with 100% accuracy across 6 opportunities.

**Tony.** When respectively shown pictures of a triangle, square, and circle, Tony was able to tact all three shapes with 100% accuracy across 6 opportunities (see Figure 1). Tony had a mean of 0.0 correct responses during the intraverbal assessment, across 6 opportunities. For the intraverbal assessment, Tony was unable to correctly answer to questions “What shape has four sides?”; “What shape has three sides?”; and “What shape is wrong?”. To assess if he was able to echo a verbal prompt, the researcher told Tony
“Say, ‘Square’”; “Say, ‘Circle’”; and “Say, ‘Triangle’”. The student was able to echo all three verbal prompts with 100% accuracy across 6 opportunities.

**Matthew.** When respectively shown pictures of a triangle, square, and circle, Matthew was able to tact all three shapes with 100% accuracy across 6 opportunities (see Figure 1). Matthew had a mean of 0.0 correct responses during the intraverbal assessment, across 6 opportunities. He was unable to correctly answer intraverbal assessment questions “What shape has four sides?”; “What shape has three sides?”; and “What shape is wrong?”. The researcher assessed if he was able to echo a verbal prompt, the researcher told Matthew “Say, ‘Square’”; “Say, ‘Circle’”; and “Say, ‘Triangle’”. The student was able to echo all three verbal prompts with 100% accuracy across 6 opportunities.

**Ben (peer).** When respectively shown pictures of a triangle, square, and circle, Ben was able to tact all three shapes with 100% accuracy across 6 opportunities (see Figure 1). Ben had a mean of 6 correct responses during the intraverbal assessment, across 6 opportunities. For the intraverbal assessment, Ben correctly answered with 100% accuracy across 6 opportunities the questions “What shape has four sides?”; “What shape has three sides?”; and “What shape is wrong?”. To assess if he was able to echo a verbal prompt, the researcher told Ben “Say, ‘Square’”; “Say, ‘Circle’”; and “Say, ‘Triangle’”. The peer was able to echo all three verbal prompts with 100% accuracy across 6 opportunities.
**Intervention**

**Luke.** Results for Luke are shown in Figure 1. During baseline, Luke gave the correct intraverbal response for 0% of trials for all 4 sessions. During the first session of intervention, Luke gave the correct intraverbal response for 4 out of 12 trials for 33% accuracy. Intervention included prompting by a peer; Figure 2 displays Luke’s responding broken down by the prompts that were required to elicit correct responding. During the first intervention session, Luke independently responded correctly 1 out of 12 trials or 8% accuracy, he required one prompt 2 out of the 12 trials or 17%, two prompts 1 out of 12 trials or 8%, and gave no response or an incorrect response for 9 out of 12 trials or 67%. By the last session of intervention, Luke responded correctly for 7 of 10 trials or 70% accuracy. Luke had no independent responding for this last session of intervention. He required one prompt for 5 of 10 trials or 50%, required 2 prompts for 2 of 10 trials or 20%, and gave no response or an incorrect response for 3 of 10 trials or 30%. Luke’s average percent and range of percentages for independent responding are shown in Table 1.

**Tony.** Results for Tony are shown in Figure 1. During baseline, Tony gave the correct intraverbal response for 0% of 6 trials. During the first session of intervention, Tony gave the correct intraverbal response for 10 of 12 trials for 83% accuracy. Figure 2 shows Tony’s responding broken down by prompts required to elicit correct responding. For the first session of intervention, Tony required one prompt for 9 of 12 trials or 75%, required two prompts for 1 of 12 trials or 8%, and gave an incorrect or no response after two prompts for 2 of 12 trials or 17%. By the last session of intervention, Tony gave the
correct response for 11 of 11 trials for 100% accuracy. For this last session, Tony independently gave the correct response for 3 of 11 trials for 27% accuracy, required 1 prompt for 6 of 11 trials or 55%, and required 2 prompts for 2 of 11 trials or 18%. Tony had no incorrect responses or non-responses during the last sessions. Tony’s average percent and range of percentages for independent responding are shown in Table 1.

Matthew. Results for Matthew are shown in Figure 1. During baseline, Matthew gave the correct intraverbal response for 0% of trials for all 7 baseline sessions. During the first session of intervention, Matthew gave the correct intraverbal response for 10 of the 12 trials for 83% accuracy. Intervention included prompting by a peer; Figure 2 displays Matthew’s responding broken down by the prompts that were required to elicit that responding. For the first session of intervention, Matthew required one prompt for 7 of the 12 trials for 58% accuracy, two prompts for 3 of 12 trials or 25%, and gave no response or an incorrect response for 2 of 12 trials or 17%; he did not display independent responding (correct responding with no prompts) during session one of intervention. By the last session of intervention, Matthew responded correctly for 12 of 12 trials for 100% accuracy. He responded independently for 7 of 12 trials for 58% accuracy in this last session, and required one prompt before responding for 5 of the 12 trials or 42%. Matthew did not need a second prompt to correctly respond during the trials of the last intervention session. Tony’s average percent and range of percentages for independent responding are shown in Table 1.
**Maintenance**

All maintenance trials were conducted without verbal prompts from the peer. Therefore, only independent responses were marked as correct.

**Luke.** Maintenance data for Luke were collected 1.5 weeks post-intervention. The same questions asked during intervention and baseline conditions were asked during maintenance. There were a total of five maintenance sessions for Luke. No prompts were given during maintenance trials. During the first three sessions of maintenance, Luke correctly responded for 0% of 6 trials. For the fourth session of maintenance, Luke’s correct responding increased to 2 of 6 trials or 33% accuracy. For the fifth session of maintenance, Luke’s correct responding increased to 3 of 6 trials or 50% accuracy. Luke’s average percent correct and range of correct percentages during maintenance are shown in Table 1.

**Tony.** Maintenance data for Tony were collected 1.5 weeks post-intervention. The same questions asked during intervention and baseline conditions were asked during maintenance. There were a total of five maintenance sessions for Tony. No prompts were given during maintenance trials. For the first session of maintenance, Tony correctly responded for 2 of 6 trials for 33% accuracy. For the second maintenance session, Tony correctly responded for 4 of 6 trials for 67% accuracy. For the third and fourth sessions of maintenance, Tony’s correct responding decreased to 2 of 6 trials for 33% accuracy. For the fifth sessions of maintenance, Tony’s correct responding increased to 4 of 6 trials for 67% accuracy. Tony’s average percent correct and range of correct percentages during maintenance are shown in Table 1.
Matthew. Maintenance data for Matthew were collected 1.5 weeks post-intervention. The same questions asked during intervention and baseline conditions were asked during maintenance. There were a total of five maintenance sessions for Matthew. No prompts were given during maintenance trials. For the first two sessions of maintenance, Matthew correctly responded for 6 of 6 trials for 100% accuracy. For the third session of maintenance, Matthew’s correct responding decreased to 4 of 6 trials for 67% accuracy. For the fourth and fifth sessions of maintenance, Matthew’s correct responding increased and remained at 5 of 6 trials or 83% accuracy. Matthew’s average percent correct and range of correct percentages during maintenance are shown in Table 1.

<table>
<thead>
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<th></th>
<th>Baseline</th>
<th>Intervention</th>
<th>Maintenance</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>M</td>
<td>M</td>
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</tr>
<tr>
<td></td>
<td>Range</td>
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<td>67-100%</td>
</tr>
</tbody>
</table>

Table 1. Average percent and range of independent response percentages across conditions.
Figure 1. Percentage of correct intraverbal responses.
Figure 2. Responding during intervention broken down by independent responding, 1 prompt needed, 2 prompts needed, and incorrect/non-response.
Social Validity

At the end of the intervention, a social validity survey was given to the peer. The survey questions were read to the peer, and his answers were recorded. The peer’s answers indicated that he was satisfied with teaching his fellow students about shapes, and that he would want to participate in such a study in the future (that is, he would want to continue teaching his friends). The peer also indicated that he sometimes enjoyed taking his own data while working with other students. This data was in addition to data that the researchers took, and included marking an “X” under a “Yes” column if the target student answered a question correctly.

The students’ teacher also indicated her approval of the intervention via verbal comments. She reported that she found the intervention to be effective, and that it appeared that her students were learning and maintaining intraverbal behavior in their repertoires. Social validity was not formally assessed for target students. However, the students all exhibited a willingness and excitement to work throughout the study. This included students pulling up their chairs to the area where sessions took place without prompts, asking to participate in a session first, and completing all trials in a session.
Chapter 4: Discussion

Can a peer with ASD be trained to implement a verbal behavior intervention?

The data from this study support the training of peers with ASD to implement a verbal behavior intervention. All target students showed at least a 50% increase in responding from baseline to the maintenance sessions that were conducted 1.5 weeks post-intervention. However, the peer did require prompting from a researcher throughout the intervention (e.g., an experimenter would whisper “Four sides” to a peer to prompt him to ask a target student, “What shape has four sides?”). This indicates that peer instructors (especially those with disabilities) made need adult support to consistently implement an intervention. Based on the procedural integrity data, the peer consistently and correctly implemented the echoic prompt and correctly gave the second prompt to the student. The peer did not consistently give descriptive praise after a correct answer, however. For instance, after a target student would respond “Square” to the question, “What shape has four sides?”, the peer was supposed to respond with “That’s right, a square does have four sides?” Despite the initial training and reminders of this step, the peer did not often provide the praise after a correct response.

The results of this study support previous research involving peer-mediated verbal behavior interventions. Peer-mediated research suggests that peers can be trained to effectively implement interventions for students with disabilities. These include
interventions that target social and verbal behavior skills (Banda, Hart, & Liu-Gitz, 2010; Katz & Girolametto, 2013; Lorah, Gilroy, & Hineline, 2013). This study extended peer-mediated literature in that it trained peers to use a prompting procedure, echoic-to-intraverbal transfer-of-control, which had not been previously used in peer-mediated studies. This study also specifically targeted a younger group of students, while much of the previous research on using peers for intraverbal interventions has used older students as participants (Cihon, 2007; Emmick, Cihon & Eshleman, 2010; Kamps, et al., 2002). Additional studies should be conducted involving typical peers and peers with ASD as instructors.

**When implemented by a peer, will echoic to intraverbal transfer-of-control procedures increase academic intraverbal behavior in students with ASD?**

Peer training focused on using only echoic to intraverbal transfer-of-control procedures for this intervention. The data from this study support the use of peer implemented echoic to intraverbal transfer-of-control procedures to increase academic intraverbal behavior in students with ASD. Each of the students improved their ability to engage in intraverbal behavior after intervention. However, none of the students were able to demonstrate complete independence in their intraverbal behavior (i.e., consistently responding at 100% without prompts). Further, although the target students made improvements in their ability to engage in intraverbal behavior (i.e., back and forth verbal interaction) the response repertoire was limited to shape names and number of sides per shape. This improvement in intraverbal behavior is important and set a
foundation for future verbal growth, but the current level of responding is only an initial step in the typical back and forth of conversations.

Throughout intervention, Luke’s data was variable. He initially had a steady and steep increase across the first three sessions, followed by a slight decrease for one session, then another steady increase. The next five sessions of intervention were variable, ranging from 100% correct responding to 50% correct responding. The variability and steepest decrease in responding (going from 83% correct at session 7 of intervention to 50% correct by his 8th session of intervention) occurred after spring break and a string of consecutive absences. This gap between intervention sessions could have contributed to Luke’s variable data.

Despite his variability, Luke was the first student to display independent responding. This occurred during his first session of intervention for 8% of trials. By his fifth session of intervention, Luke was responding independently for 50% of trials. Luke’s independent responding steadily decreased after this spike, again possibly due to the gap between intervention sessions.

Due to time constraints, Luke was moved into the maintenance phase before he reached mastery, but after he displayed an increasing trend in correct responding. During his first three maintenance sessions, Luke did not correctly and independently respond to any of the questions posed; that is, it appeared that he had not maintained the intraverbal behavior in his repertoire. However, researchers noted that during these first three sessions, Luke was extremely distracted; he would not look at the researchers or peer, and would instead look towards the area of the classroom where the computer was. He would
begin to recite computer error messages and continually point to and ask for the computer. He was told “You are working for the computer. You may play on it when you are done talking with Ben”. For the next two sessions of maintenance, the computer screen was turned off so as to be less of a distraction. For these last two sessions, Luke responded correctly and independently for 33% of trials and then 50% of trials. These data support the claim that Luke at least maintained some of the intraverbal behavior in his repertoire. His ability to access this information seemed contingent upon levels of distraction in the classroom and his own motivation.

Tony’s responding during intervention had a mostly steady level and flat trend. He ranged from correct responding in 83% to 100% of trials. However, the most independent responding he had during intervention was independent correct responses for 33% of trials; the rest of his responses required one or two prompts. Tony was generally able to attend to the peer trainer; the peer would sometimes have to prompt him with “Please, look at me” before beginning a trial. After such a prompt, Tony would look at and repeat what the peer said.

During maintenance trials, Tony had three sessions with correct responding in 33% of trials and two sessions with correct independent responding for 67% of trials. For all three sessions where he answered correctly for 33% of trials, Tony answered all questions with the same response (i.e., he would respond “square” to all six questions posed). Since all three questions were asked twice, Tony was guaranteed to answer at least two questions correctly when using this tactic. He received reinforcement at the end of a session regardless of how many questions he answered correctly, so it was not
immediately clear why he chose to answer all questions the same. He would switch his answer from session to session; one day it would be “square”, the next day he would answer all questions with “circle”. Despite this, he showed that he understood the question and maintained intraverbal skills in the sessions where he answered correctly for 67% of trials. Across these two sessions, he answered each of the three questions correctly at least three times, and did not use the same answer for each trial. He would occasionally self correct (i.e., first answering “square” to the question “What shape is round?”, and then quickly saying “circle” after his initial response). Tony also once yelled out a correct answer while another student was in a maintenance session that he could hear; unfortunately, due to the size of the classroom, sessions would not be conducted in a private setting where other students could not hear the sessions.

At the beginning of intervention, reinforcement (a small edible) was required after every trial for Matthew to respond to a question. Matthew’s inattention could have been due to the other distractions in the classroom, and the initial novelty of the procedures. At the last intervention session, Matthew was only responding independently for 58% of trials. For the other trials, he required 1-2 prompts. However, during the first two maintenance trials, Matthew responded independently for 100% of trials. This could be due to Matthew needing a longer time to respond between the question and the initial response; perhaps if we would have implemented a longer delay, such as 5-7 seconds, Matthew would have responded to more questions independently.

In maintenance trials, Matthew would occasionally repeat the last two words of a question before answering (i.e., when asked “What shape has four sides?” he would
respond “four sides” and then say “Square”). These responses were always marked as correct, as he independently corrected himself and stated the correct answer. Matthew’s data show that he maintained intraverbal skills post-study. These results suggest that the modifications and methods used for his trials were effective, and that similar modification could be used for students who struggle with attention.

These results add to the results of earlier studies that demonstrated the effectiveness of echoic to intraverbal transfer-of-control procedures for students with ASD. However, most of the implementation of the intervention in previous studies was done by researchers or adults, and not peers (Ingvarsson, Cammilleri, & Macias, 2012; Kodak, Fuchtman, & Paden, 2012; Vedora, Meunier, & Mackay, 2009). This study differed from previous research, therefore, in that it used similar methods, but peers implemented the interventions rather than adults. The findings of this study also differ from the results of Vedora, Meunier, and Mackay (2009). Vedora and colleagues found that one participant in their study required textual prompting in addition to echoic prompting before he emitted independent responding. None of the students in this study, however, required prompting other than the echoic prompts before emitting independent responses.

**Will the intraverbals be maintained in the students’ verbal repertoires post-study?**

During intervention, students displayed intraverbal behavior that was not present during baseline sessions. When tested post-intervention, the intraverbals instructed in this study were maintained in the students’ repertoires. Based on the maintenance data, it appears that the intraverbals remained in the students’ repertoires post-study. However,
these data were only collected 1.5 weeks post-study; it is unknown if the intraverbals maintained past that time. Ideally, teachers would continue to instruct students in the development of conversational skills building on the current progress.

The maintenance of the intraverbals is significant for a number of reasons. Firstly, it indicates that these methods can be used to teach students more complex academic skills that would maintain in their repertoires. This could lead to increased academic achievement, which is especially significant for students who may be functioning below grade level. The methods could also be used to teach students more socially significant verbal behavior, rather than only academic. The maintenance of a skill that requires responding in a conversation is already socially significant, in that it allows the students to more fully and appropriately interact with their peers and others around them.

**Limitations**

One limitation was that the peer required prompts throughout the study from a researcher to ask each question (e.g., the experimenter would whisper to the peer “Ask him, ‘What shape has four sides’, and tell him the answer when I point to you”). This could have allowed for the other students to inadvertently hear the questions and therefore have more exposure to the questions than was reported by the data. This could have skewed the results in a way that made it seem like the intervention was effective after a lower number of trials than were actually required for independent responding to occur. Future researchers could address this limitation by using visual prompts for the peer, not within the target students’ view (e.g., a sheet of paper that lists the order of the questions for each session). Another way to address this problem could be to provide
booster training sessions for the peer throughout the study. These booster sessions could be conducted before the beginning of the first session of the day, and would include repeated the peer training procedures listed in the methods section of this paper. Such sessions would hopefully limit the amount of prompting needed by the peer.

A second limitation was that all intervention and maintenance sessions took place in a corner of a classroom while all target students were present. This means that while other classroom instruction was occurring, researchers and the peer would work separately with one target student at a time. This could have allowed for other students in the study to hear questions, prompts, and responses outside of their individual sessions. This exposure again could have led to the study appearing to be more effective after a lower number of trials than were actually required for independent responding to emerge. It was also difficult to control for distractions in the classroom setting. Target students, and occasionally the peer, would become distracted by books on a nearby shelf, the computer turning on and off, staff and students entering and leaving the room, and noise levels in the classroom. This affected students’ responding in that they often needed a second prompt when distractions were present, and would sometimes not respond at all (non-responses were recorded as incorrect). It was not possible to move the sessions out of the classroom into a quiet and private setting, due to lack of extra space in the school. However, for future researchers, it would be beneficial to attempt to run sessions in a secluded area. The data collected from such a study could be compared to the data from this study to determine if the results could be replicated in the same number of sessions.
A third limitation was that while social validity was recorded for the peer and classroom teacher, it was not formally assessed for target students. This decision was made prior to recruitment of the target students, when their verbal skills and levels of functioning were unknown. Therefore, the only measure of social validity that was recorded was the target students’ willingness to participate. Future researchers could address this problem by creating a very basic social validity rating scale, such as a number of faces displaying emotions (i.e., a laughing face, a smiling face, a sad face) and asking students to choose how they felt after a session. The students in this study were able to respond to yes and no questions, so perhaps future researchers could also verbally ask target students to respond to “yes and no” social validity questions (i.e., “Did you like learning about shapes from your friend?”).

Another limitation with the study was the lack of generalization measures. Due to the lack of these measures, it is unknown whether the intraverbals acquired by the target students would have generalized to novel peers, adults, or in new settings. Possible generalization measures are discussed in the next section.

**Future Research**

In their study, Vedora, Meunier, and Mackay (2009) noted that textual prompting procedures were more effective than echoic prompting procedures for intraverbal training. Future researchers could expand on this study and the research of Vedora, et al. by training peers to implement textual prompting procedures. A study could also be done that compares the use of peers in textual vs. echoic prompting procedures, to determine if
one is more effective than the other when using peer-mediated interventions to teach intraverbal behavior.

Another suggestion for future researchers is to replicate this study and add generalization measures. For instance, researchers could use a novel peer post intervention and maintenance sessions to determine if the intraverbal behavior would generalize to new and untrained peers. Teachers and other classroom staff could also ask the questions after intervention and maintenance sessions, to determine if newly learned intraverbals would also generalize to adults, and not only peers. Lastly, as an additional generalization measurement, students could be asked the questions from the study in a setting outside of the training environment, such as on the playground or in a different classroom.

Future research could also be done using the procedures in this study, but instructing more complex intraverbal responses. For this study, students were only required to repeat one word responses (i.e., “Square”, “Circle”, and “Triangle”). Since the procedures proved effective for adding these intraverbal responses to a student’s repertoire, more complex responses (e.g., full sentences or completion of lines of a song) could also possibly be taught using these procedures.

Conclusion

This study has a few implications for practice. First, teachers and classroom staff can train peers using the procedures in this study to increase verbal behavior in students with ASD. This verbal behavior can target academic language, such as shape names (as were used in this study), numbers, vocabulary, etc. However, more training of peers may
be needed than occurred in this study, so that the peers could more independently teach verbal behavior to other students. Second, teachers themselves can use the echoic to intraverbal transfer-of-control procedures from this study to teach intraverbal behavior to students. This could eliminate the extra time needed to train peers in procedures. Teachers could also build on the intraverbals learned in this study by further discussing property of shapes and uses of shapes with students. For instance, after students had acquired the intraverbal responses of “Square” “Triangle” and “Circle”, a teacher could ask them what shape would make the best wheel for a car. After a student responded correctly to this question (“Circle”), the teacher could ask the student why this is (“Because it is round”), further utilizing the intraverbal skills now in the student’s repertoire.

In conclusion, all students in this study acquired intraverbal behavior during intervention, and maintained this behavior post-intervention; these results align with previous research done using echoic to intraverbal transfer-of-control procedures. The data also support previous research that has demonstrated peer-mediated interventions to be effective when teaching verbal behavior to students with ASD. The peer-mediated intervention methods used in this study were effective in adding intraverbal behavior to the repertoires of young students with ASD. Future research using these methods or similar methods could further expand on the literature regarding intraverbal behavior. In practice, these methods could eventually help teachers implement interventions that are a more naturalistic and socially acceptable form of teaching intraverbal behavior. This
study can be used as a building block for more complex interventions that aim to improve the social and academic functioning of individual with ASD through peer mediation.
References


APPENDIX A: PEER TRAINING FORMS
Peer Training (3 sessions a week, 4 trials per session, for two weeks)

Make a checkmark next to each step as it is completed.

Note: If only one peer is being trained, the experimenter will play the part of Peer 2

Teach Skill  

Script:  
Instructor: Today we are going to learn how to teach our friends about shapes!

First, who can tell me what this shape is? (Hold up picture of a circle, wait for a response). That’s right, it’s a circle. (If no response: This shape is a circle. What shape is this?) Now, what shape is this? (Hold up a picture of a square, wait for response). That’s right, it’s a square. (If no response, use same error correction procedure that was used for circle). Okay, what shape is this? (Hold up a picture of a triangle, wait for a response). Very good, it’s a triangle! (Use same error corrections if needed). Note: If students make an error in identifying shapes, repeat procedure until they can identify them with 100% accuracy.

Next, who can tell me what shape has four sides? Yes, a square has four sides! (If no response: A square has four sides. What shape has four sides?). Okay, now what shape is round? That’s right, a circle is round. (Use same error correction procedure that was used for square, if needed). Okay, last one. What shape has three sides? Great job, a triangle has three sides! (Use same error procedure that was used for square, if needed).

Okay, now I’m going to show you how to teach our friends that a circle is round, and about how many sides a square and a triangle have.

Model Skill  

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**Example/Script:**

Instructor (sitting at table across from another student/adult): First, we want to get our friend’s attention. To do this, say your friend’s name and say “look at me please, I’m going to ask you a question”. Wait until your friend is looking at you before you ask them the question. If they don’t look at you, repeat the instruction. If they are moving around a lot or talking, tell them “Show me quiet hands, please. Look at me, I’m going to ask you a question”. When your friend is looking, then you can ask the question. Now let’s practice.

Okay (name of helper), repeat me after I say the answer; I am going to say the answer right after I ask. (Name), look at me, please. I’m going to ask you a question. (Name), what shape has three sides? Triangle.

Helper: Triangle

Instructor: That’s right, a triangle does have three sides!

Instructor: If your friend does not repeat what you said, I will tap your shoulder after 3 seconds. When I tap your shoulder, it means you should say “(Friend’s name), say ‘triangle’”. When your friend answers, say “That’s right, a triangle does have three sides!” Now let’s try it with the other two shapes. This time (name), don’t respond right after I say the answer the first time.

Instructor: (Name), what shape has four sides? Square

Helper:…

Instructor: Say, “Square”
Helper: Square

Instructor: That’s right, a square has four sides!

Okay, now let’s practice teaching our friends about shapes.

**Role play with peers**

**Example of role-play activity and script***:

Instructor: Okay, (peer 1), you will play yourself and (peer 2) you will play one of our friends who we are going to teach. (Peer 2), don’t say the answer until after (peer 1) says it. (Peer 1), after (peer 2) responds, say, “That’s right, a square does have four sides!” If you forget what you should say next, ask me.

Instructor: Okay, now (peer 2) I don’t want you to say anything at all until after (peer 1) says “say ‘square’”. (Peer 1), I’ll tap your shoulder when it’s time to say “square” the first time and then again when it’s time to say “say ‘square’”.

Instructor: Great job! Now, let’s have you two switch places. (Peer 2) will be the teacher and (Peer 1) will play our friend.

*Repeat this procedure with each question

**Peer can role play both roles with 100% accuracy in ¾ trials (once peer meets this criterion, intervention with students can begin)**
APPENDIX B: DATA COLLECTION SHEETS
Baseline and Maintenance

Sessions will consist of 6 questions (each question will be repeated 2 times). Tell the peer what question to ask next. Questions will be asked in a random order. Write down what shape is asked about for each trial under the “shape” column.

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<thead>
<tr>
<th>Trial</th>
<th>Shape</th>
<th>Correct</th>
<th>Incorrect</th>
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Intervention

Sessions will consist of 12 questions (each question will be repeated 4 times). Tell the peer what question to ask next. Questions will be asked in a random order. Write down what shape is asked about for each trial under the “shape” column.

<table>
<thead>
<tr>
<th>Trial</th>
<th>Shape</th>
<th>Correct/Unprompted</th>
<th>Correct/Prompt 1</th>
<th>Incorrect/Prompt 2</th>
<th>Correct/Prompt 2</th>
</tr>
</thead>
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</table>
APPENDIX C: PROCEDURAL INTENSITY CHECKLIST
RESEARCHER BEHAVIOR
Circle One

<table>
<thead>
<tr>
<th>Statement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>The researcher correctly prompted the peer.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The researcher correctly modeled the skill for the peer.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The researcher waited until after the peer’s first prompt to tell them to prompt again.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The researcher marked all correct answers by target students.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The researcher marked all incorrect answers by the target student.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The researcher gave reinforcement to both peers and the target student after 6 trials.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The researcher took data for 12 trials per session.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>The researcher waited 5 seconds after the second prompt before marking an answer as “incorrect”</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

PEER BEHAVIOR

<table>
<thead>
<tr>
<th>Statement</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did peer correctly implement echoic prompt?</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Did peer correctly give second prompt (if needed)?</td>
<td>YES</td>
<td>NO</td>
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<tr>
<td>Did peer give appropriate praise?</td>
<td>YES</td>
<td>NO</td>
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</table>
APPENDIX D: SOCIAL VALIDITY
Social Validity Questionnaire

1. Did you like teaching your friends about shapes?
   a. Yes
   b. No

2. Did you like taking data about what your friends knew?
   a. Yes
   b. No

3. Did you like learning how to teach your friends about shapes?
   a. Yes
   b. No

4. Would you want to continue helping your friends learn more about shapes?
   a. Yes
   b. No

5. What was your favorite part of teaching your friends?

6. What do you think would make you like teaching your friends more?