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Increasing Novel Vocalizations for Individuals with ASD Using a Voice Output Communication Aide

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INCREASING NOVEL VOCALIZATIONS FOR INDIVIDUALS WITH ASD USING

A VOICE OUTPUT COMMUNICATION AIDE

by

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ABSTRACT

INCREASING NOVEL VOCALIZATIONS FOR INDIVIDUALS WITH ASD USING A VOICE OUTPUT COMMUNICATION AIDE

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This study aimed to extend the literature on VOCA as a means of producing increased verbal speech using a prompt delay and shaping methods. Intervention targeted novel vocalization for three children with autism spectrum disorder (ASD) and limited vocal speech. All three participants increased vocalizations, but to varying degrees and only after a second phase where an echoic prompt was introduced. While the results vary across participants, increased vocal speech for all participants and high social validity suggest that VOCA-based interventions may be an appropriate intervention to increase vocal output for children with ASD.

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CHAPTER I – INTRODUCTION AND REVIEW OF THE LITERATURE

Many individuals with autism spectrum disorder (ASD) are slow to develop or fail to develop spoken language skills (Sigafoos, 2005). Grunting, eye gazing, reaching, or manipulating the hands or body of another may serve as alternative forms of communication, but can be difficult for others to interpret. Failure to emit even a limited vocal repertoire presents serious challenges and barriers to the development of vocal verbal behavior later in life (Whitehurst et al., 1991). For example, some individuals with ASD may develop problematic behaviors, such as tantrums and aggression that become functionally equivalent to the more acceptable ways to communicate their wants and needs (Carr & Durand, 1985; Sigafoos, 2005).

Children of typical development often demonstrate a wide variety of vocal responses without the need for explicit teaching or planned intervention. Some have argued that this language acquisition occurs mainly through a combination of automatic reinforcement that may not be sufficient to support varied and frequent vocal output in children with ASD (Carbone, 2016). Therefore, the performance of such vocal responses in children with ASD may require the use of contrived and direct contingencies of reinforcement intended to increase the probability of vocal sound production (Tincani, Crozier, & Alazetta, 2006).

In contrast to other approaches, behavior analysts view communication as verbal behavior. In the landmark book Verbal Behavior, Skinner (1957) posited that language is a learned behavior under the same types of control as non-verbal behavior. Variables such as reinforcement, extinction, and motivating operations shape the way we communicate. Also, Skinner shifted the focus away from the formal properties of language, such as parts of speech, phonetics, and other topographical views of language, to the functional properties of language. In other words, the sources of reinforcement influence the use of various types of language. Skinner proposed that a number of verbal operants, as well as different types of speaker and listener behavior, make up an individual's verbal repertoire. Although the unique names Skinner (1957) provided for the verbal operants may seem confusing at first, establishing a child's mand, tact, intraverbal, or echoic repertoire can provide valuable information on how that child communicates and where they might have a deficit (Sundberg, 2007).

Basic Verbal Operants

Verbal operants are basic units of language as described by Skinner (1957) and are classified by the antecedents and consequences that control them. The mand is the first type of verbal operant acquired by children and it is essentially a request (Sundberg, 2007). In technical terms, a mand is a verbal operant under the direct control of motivating operations (MO) and specific reinforcement. Deprivation, satiation and aversive stimulation are MOs directly tied to the evoking of a mand. For example, a child who has not eaten in several hours may put forth more effort to say "eat" when temporarily deprived of food. In such an arrangement, the MO alters the *value* of reinforcement. In this example, the MO is unconditioned (UMO) in that no learning is required to produce an effect. Conditioned motivating operations (CMOs), on the other hand, acquire this value-altering influence through a specific learning history (Cooper, Heron, & Heward, 2007). The three kinds of CMOs are surrogate (CMO-S), reflexive (CMO-R), and transitive (CMO-T). CMO-S, through many pairings of neutral stimuli with unconditioned stimuli, creates a surrogacy in which the neutral stimuli now has the same effects as the UMO. The effect of CMO-Ss are debatable (Cooper et al., 2007); however, CMO-Rs, have been shown to greatly affect our everyday interactions. The CMO-R is defined as any stimulus that precedes an aversive situation and achieves avoidance of that situation, including how individuals react to mands from others. Cooper and colleagues (2007) give the example of a stranger asking for directions. By responding to the stranger's request, the individual responding avoids the social awkwardness that would result from a non-response. Similarly, CMO-Ts also affect our everyday interactions. A variable functions as a CMO-T when it is related to the presence of another variable and some form of improvement. UMOs also function as CMO-Ts for conditioned stimuli that are paired with unconditioned stimuli. CMO-Ts are important for mand training; an individual wants something, mands for it, and is reinforced by delivery of the item or activity. Unconditioned reinforcers can be used to teach mands, but CMO-Ts allow for unlimited ways to achieve the items. If socks and shoes are required to go outside, the individual would need to mand for "shoes" and "socks" to reap the larger reward of playing outside. The interruption of reinforcement often associated with a CMO-T offers an effective instructional tool in basic mand acquisition, but also the development of more elaborate and sophisticated mands (Carbone, 2013).

Skinner (1957) chose the word mand as a condensed form of words like "command" and "demand." A child's mand repertoire may include words ("cookie, please") or non-verbal communication such as pointing to the item, crying, or hitting as long as a clear relationship exists between the source of reinforcement (e.g., cookies), the behavior (e.g., saying "cookie" or hitting) and the antecedent condition influencing the contingency (e.g., five hours of food deprivation, an establishing operation). Many therapists first focus on mand training because problem behaviors can be reduced or eliminated when one is taught other ways to communicate their needs. Additionally, the child reaps the rewards of using the new skill when the item requested is delivered and gains autonomy as the delivery of reinforcement comes under the control of their manding (Sundberg, 2007). The mand is the only verbal operant that directly benefits the speaker.

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When a prior verbal stimulus controls a verbal response that bears formal similarity and point-to-point correspondence (as in repeating the word your communication partner just said), the response is called an echoic. A strong echoic repertoire facilitates mand and tact training. For example, when providing mand training, it would be advantageous for the client to be able to repeat the therapist's verbal prompts in order to gain immediate access to a preferred item for correct responding.

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Transcription also called taking dictation, is considered a verbal operant even though the verbal behavior is not audible. Transcription consists of writing and spelling words that are spoken by a communication partner. It is a response to a verbal stimulus with point-to-point correspondence but without formal similarity (Tincani, Bondy, & Crozier, 2011). Similar to the transcription operant, textual operants have point-to-point correspondence with the stimulus and response and no formal similarity. Textual behavior includes the ability to identify a word, but not necessarily comprehend the reading (Sundberg, 2007). For example, a child may be able to read a passage with acceptable fluency (textual behavior), but be unable to answer questions about the passage (intraverbal behavior).

Although vocal responses remain the ultimate goal of intervention, the more immediate need of non-vocal children may include the development of non-vocal forms of communication. In the absence of verbal behavior, these children may not have alternative responses sufficient to evoke the behavior of listeners in order to access reinforcement, potentially supporting the acquisition of problem behaviors as a means to gain access. As such, methods have emerged to study the effects of teaching alternative methods of communication on the development of vocalizations in children with autism (Schlosser & Wendt, 2008; Tincani, 2004; Tincani et al., 2006). In order to help individuals with ASD acquire functional communication skills like the ones discussed above, therapists may employ alternative and augmentative communication (AAC) modalities to progress beyond pre-linguistic strategies (Mirenda, 2003). The initial goal of AAC utilization is for mand training. As previously stated, when an individual is able to ask for what they want, he or she may develop increased independence while decreasing the need for problem behavior.

AACs are divided into two categories: unaided and aided. Unaided AACs do not require technology apart from the human body, exemplified by sign language. Aided AACs require additional technology (Mirenda, 2003). Examples of aided technology include picture exchange communication systems (PECS) and vocal output communication aides (VOCA).

The use of sign language as a functional communication aide has shown mixed results (Mirenda, 2003). Its primary benefit boasts technology that is free and accessible wherever the user's body goes. However, many drawbacks prevent this AAC from being utilized as often as its aided counterparts. Sign language requires a great deal of training and has produced unsatisfactory results for spontaneous use and generalization (Bondy & Frost, 1994; Mirenda, 2003). Additionally, sign language requires fine motor skills and pre-requisites from the user, such as eye contact and imitation (Sigafoos et al., 2004). However, arguably the biggest drawback of this form of alternative communication could be that it requires any potential communication partner to also know sign language (Bondy & Frost, 1994; Mirenda, 2003).

Tincani (2004) compared sign language to picture exchange for mand training using the presentation of preferred items with prompting and prompt fading procedures with two elementary school students with ASD and severely limited functional speech. Using an alternating treatments design, both students received sign language and PECS training counterbalanced across days, times, instructor, and order to reduce confounding variables. The final phase for each student was a best treatment phase, utilizing whichever method worked best for that student. Tincani found that sign language produced greater independent mands for one of the two students participating in the study (from 2.1% in baseline to 34.1% during training). The other student lacked hand-motor imitation skills and favored PECS. However, most interestingly, the sign language training produced more vocal output compared to baseline for both students (46.3% compared to 22.3% for PECS for student one and 93.4% compared to 77.9% for PECS for student two).

PECS was first developed by Bondy and Frost (2002) in response to the drawbacks of sign language. This system initially involves exchanging a picture representation for a preferred item. The user performs a basic request and receives a positive consequence, increasing the frequency of its use. More complex responding happens in phases where the user is required to discriminate between pictures, travel to the PECS book and communication partner, and eventually, make complex sentences. PECS does not require any pre-requisites for use and can be immediately utilized to request preferred items and activities. Most conversation partners would be able to identify the meaning of the card. However, the picture exchange system is bulky, containing either a large PECS book or numerous cards which would have to be transported wherever the user wishes to communicate. Responses would be limited to the pictures available.

Tincani and Devis (2011) conducted a quantitative synthesis and component analysis of PECS in single-participant studies. They confirmed that data supports PECS as an effective intervention for mand training for individuals with autism as well as other disabilities. However, the 16 studies included in their meta-analysis failed to demonstrate more advanced communication, such as tacts or intraverbals. Most participants from these studies met criterion for Phases I-III, whereas the more advanced communication training is exclusive to Phases IV and V. This analysis demonstrates a great variability among how successfully and readily participants employ picture exchange; for example, one participant mastered all six phases in a total of 246 trials (Charlop-Christy, Carpenter, Le, Leblanc, & Kellet, 2002), while another participant met criterion for the first two phases with 358 trials (Tincani et al., 2006). Despite this variability, typical for studies conducted using children with ASD, Tincani and Devis (2011) found that 10 out of the 16 participants in the analysis increased vocal output with a range from mild to substantial, supporting findings by Schlosser and Wendt (2008).

Voice output communication aides (VOCA) are electronic devices that convert non-vocal communication behavior (pressing a button) into synthesized verbal messages. They are also referred to as speech generating devices (SGD). The voice output can be understood by a wide range of communication partners, including strangers. Large and heavy stand-alone systems made original VOCA difficult to generalize to different locations; however, applications for tablets and smartphones transform widely used technology into VOCA that can hold unlimited amounts of words in a lightweight, easily portable device. VOCA applications can be instantly customized to include novel responses and pictures and the number of icons (stimuli) seen on the screen. According to Common Sense Media and Rideout (2013), 75% of families in 2013 had access to the internet in their home with 10% of children owning their own tablet. In 2013, there were over 265 SGD apps available in the Apple Store. Tablets and smartphones are highly desired items that may lessen the stigma of carrying and using an SGD. Gervarter and colleagues (2013) suggest that VOCA (and other aided AAC) produces quicker acquisitions perhaps because of the addition of the graphic symbol which may act as a prompt; it's user need only learn one response class (pointing to a picture) for a variety of requests.

While all AACs are used for functional communication training, research supports the hypothesis that AACs may have the potential to increase vocal speech (e.g., Schlosser & Wendt, 2008; Tincani, 2004; Tincani & Devis, 2011; Tincani et al., 2006; Carbone, Sweeney-Kerwin, Attanasio, & Kasper, 2010). This is in direct contradiction to fears cited by clinicians and parents that a child may become dependent on an alternative modality to communicate, inhibiting the acquisition of verbal speech (Schlosser & Wendt, 2008). The promising data using AAC to increase vocal output leads to new paths for research: Which modality most successfully generates vocal speech? Why do some individuals increase vocal output when trained in AAC and others do not? Can the likelihood of generating speech be increased when training clients with AAC?

Although studies have demonstrated that all three major forms of AAC (manual signs, picture exchange, and voice output communication aids) may be used to train individuals with autism and developmental delays to communicate a functional request, the question emerges of which form is superior. Several studies have found that mand acquisition in children with ASD was roughly equal, though the children showed a preference for PECS (Bock, Stoner, Beck, Hanley, & Prochnow, 2005; Son, Sigafoos, O'Reilly, & Lancioni, 2006). However, these studies compared PECS to the cumbersome stand-alone speech generating devices. With the popularity and availability of smartphones and tablets that can be easily converted to an SGD through the purchase of an AAC application directly from the smart device, the differential response effort may have tipped in favor of VOCA. A study conducted by Lorah et al. (2013) compared picture exchange (PE) and the iPad as an SGD (or VOCA) in mand training for children with ASD.

Lorah and colleagues (2013) collected data from five boys diagnosed with autism, aged between 3-5. All participants scored limited or absent for manding and echoic skills on the *VB-MAPP Barriers Assessment* (Sundberg, 2007). It was reported that the boys had no history with PE or SGD. The study employed an alternating treatment design in which the dependent measure was observed. The dependent variable included independent and prompted mands. For the PE, this would involve placing a picture representation into the hand of the therapist. For SGD, the icon representing the item must be pressed with enough force to elicit vocal output. The application Proloquo2Go was utilize to transform the iPad into an SGD. Pictures taken from Proloquo2Go were then used to create the pictures for PE. Following baseline, the two training conditions were presented in random order with an equal number of trials each. During training, a preferred item was placed in view but just out of reach with the appropriate AAC arranged directly in front of the participant. A 5-s time delay followed by a physical prompt ensured skill acquisition. Upon criterion of both modalities, the therapist conducted a preference assessment.

The results of the study show SGD produced an 85 % overall higher rate of prompted or unprompted manding during training and maintenance, compared to a rate of 64% produced using PE. Additionally, four out of five of the participants showed a preference for the iPad as an SGD. While one could surmise that the ease and customizability make the iPad (or other smart device) the obvious choice for an SGD, this study does have limitations that should be further explored. First, no discrimination training was conducted for either AAC, an important factor in communicating functionally. Second, the absence of data for generalization across trainers or environments limits any conclusions drawn from the study. Finally, future research should investigate the effects of using AAC for mand training on increasing vocal speech.

A study by Tincani et al. (2006) explored the effects of PECS on manding and speech development for non-vocal children with autism. Tincani et al. (2006) particularly wondered about the effects on manding in older children using PECS and wanted to confirm reports of spontaneous speech development during Phase IV of PECS. Speech development would be a highly desirable outcome of functional communication interventions.

Tincani and colleagues (2006) broke the study down into two smaller studies. Participants in the first study comprised two boys with autism, ages 10 and 12, neither of whom used speech to communicate nor had prior training with AAC.   The dependent variables included independent and prompted manding (either physical or gestural) and speech (words or approximations). Baseline data confirmed that neither participant used PECS to request a preferred item nor manded vocally. During PECS training within a delayed multiple baseline design, the therapists followed the protocol established by Bondy and Frost (2002). The participants moved from one level to the next after mastering 80% criterion during at least one session of that phase (see introduction for further explanation of PECS phases). Speech was neither reinforced nor prompted for the first three phases. However, in Phase IV, participants were trained to create sentences using the PECS cards. Additionally, a 3-5-s delay for the delivery of the reinforcer was employed for word vocalization or approximates. When the participant would successfully place the sentence in the hand of his communication partner, the partner would delay the delivery of the reinforcer. If the participant vocalized during the delay, reinforcement was immediately delivered. If not, the reinforcer would be delivered at the conclusion of the delay. A generalization condition included the child's teacher as therapist. During Study 1, both participants increased manding significantly compared to baseline. One participant progressed through Phase IV and produced vocal output. Because of the presence of vocal output during the addition of the prompt delay procedure, a second study was conducted to explore the relationship between the additional procedure and speech development.

A nine-year-old boy with autism participated in Study 2. He had a history with PECS but did not use it functionally. The therapists retrained him in Phases I-III, using identical procedures to Study 1 until he met criterion for each. Study 2 began at Phase IV using an ABAB design. The "A" condition included Phase IV training with no prompt delay, while the "B" condition included training plus prompt delay. Although the number of independent mands was not affected by the condition changes, the participant's approximations increased greatly from A to B. The first change increased from 3% to 83% and the second change saw increases from 2% to 80%. No full words were observed during Study 2.

Tincani et al. (2006) expanded the literature on AAC in a very important way. It affirms that AAC can effectively be used to teach functional communication (like manding) to non-vocal children with ASD. However, it also confirms the possibility of speech generation in some previously non-vocal children with ASD using AAC techniques. Further, it introduces the prompt delay as a possible means of increasing speech production when used in conjunction with AAC training.

Carbone et al. (2010) performed a study to evaluate the effectiveness of the addition of prompt delay and vocal prompting to manual sign mand training when used to increase vocalizations in children with autism and developmental delays. Previous research had suggested that sign language may increase vocal responding in children with strong imitative repertoires. Carbone and colleagues hypothesized that the addition of prompt delays and vocal prompting may increase vocal responding in children with poor imitative skills, based on previous research by Tincani et al. (2006) that combined a prompt delay procedure with PECS as the alternative communication system. Two boys with autism (ages 4 and 6) and one boy with Down syndrome (age 4) participated in the study. All three had no functional verbal speech, though two used signs to request between 10-15 strongly preferred items.

Carbone et al. (2010) used a multiple baseline design across participants to measure the occurrence of unprompted and prompted vocal responses including sounds, approximations of words, or full words. Unprompted vocal responses were counted if they occurred while signing, after a non-vocal prompt to sign, or within 5-s of the manual sign. Prompted responses were counted if they occurred after a vocal prompt. Sessions were conducted twice a day for 50 trials. Six items selected from a preference assessment conducted prior to intervention were presented one at a time to the participant at eye level. If the participant did not look at or reach for the item, the next item was presented. If the participate did indicate interest but did not mand for the item within 5-s, the therapist would begin a prompt sequence until the participant successfully requested the item. The therapist first gestured, then provided a physical prompt if 2-s passed without response. The participant was then provided 30-s of access to the item. During the prompt delay and vocal prompt condition, the therapist performed a 5-s prompt delay of the reinforcer when the participant correctly signed for the item. If the child produced vocal output without the sign, the therapist used the prompt sequence and then performed the 5-s delay. During the delay in either scenario, if the child produced a vocal response, the reinforcer was delivered immediately. If the child failed to produce vocal output, the instructor provided vocal modeling of the item's name. If vocal output was then produced within 2-s, the item was delivered. If not, the therapist repeated the sequence two more times.

All participants in the Carbone study (2010) showed increases in unprompted vocal responding during intervention as compared to baseline (as much as three times the amount). The study supports other findings that AAC may not hinder vocal output, but actually, facilitate it. After increasing vocal output, the participant could access a form of communication that brought immediate results from his communication partner while strengthening the more desired skill. Increased vocal output in previously non-vocal participants also provides the therapist with a foundation in which to shape sound into speech. While Carbone and colleagues acknowledge that similar results may be produced without the addition of alternative communication, the use of sign language allowed for immediate reinforcement for the participant while the new skill was being mastered.

A study by Gervarter et al. (2016) examined the use of an SGD to increase independent target vocalizations for children with ASD who exhibit very limited vocal output. Gervarter and colleagues proposed to determine whether a combination of differential reinforcement and delayed reinforcement (a 5-s delay before reinforcement to provide opportunities for the preferred response and therefore access to the highly preferred item) while using an SGD could increase vocalizations, and if not, could vocalizations be increased through the addition of echoic prompts and prompt delays. This study also aimed to produce independent vocalizations that would remain even upon the removal of the device.

Gervarter et al. (2016) collected data on four boys, aged 4-7 years old, diagnosed with ASD. Requirements for participants included limited vocalizations (assessed by the Vineland Adaptive Behavior Scale), limited echoic skills (assessed using the VB-MAPP), and experience using an SGD for manding. Sessions were conducted in-home using an iPad as an SGD with the AAC application GoTalkNow. MSWO preference assessments conducted prior to intervention determined items used as reinforcement and did not include any items with a request history. Items were labeled in the AAC application with efforts to include sounds reported emitted by the individual (for example, “Sun,” instead of “Capri Sun” for the participant with an “S” sound in their vocalization history).

Gervarter and colleagues (20160 used a multiple baseline across participants design to evaluate their interventions. Although the number of baseline sessions was determined randomly, Greenberg, Tomaino, and Charlop (2014) set the precedent for allowing up to 15 intervention sessions for each individual to reach criterion for the dependent variable, independent vocalizations (full words or approximations). During baseline, the SGD was placed within reach of the child and in view of a highly preferred item. A correct response occurring within 5-s, one that produced speech output on the SGD for that particular item, allowed access to 20-s of reinforcement. Vocal responses, incorrect responses, or no response was followed by physically prompting the correct response on the SGD and then providing access to the preferred item. After baseline, the intervention unfolded into three phases: Phase I, reinforcer delay and differential reinforcement; Phase II, addition of echoic prompt after delay; and generalization probes.

Phase I continued the protocol of the baseline condition, however, full vocal responses for the preferred item received immediate reinforcement whether utilization of the SGD occurred or not. Responses using only the SGD were not immediately reinforced, but instead initiated a 5-s delay. If during that delay, a vocal mand was performed, reinforcement would follow immediately. If no vocalization occurred, a simple request (like “clap your hands”) was given followed by access to a less preferred item. Following vocal word approximations, the SGD response would be physically prompted and then reinforcement would be delivered. So, only full vocal responses or approximations in conjunction with an SDG response provided access to the highly preferred item. Children who did not meet criterion during this phase moved on to Phase II.

Phase II procedures continued to follow the protocol for Phase I but added a vocal echoic prompt if vocalization did not occur in tandem with the SGD response. Vocal responses yielded access to the highly preferred item, but failure to respond initiated the "distractor trial" ("clap your hands") followed by access to the less preferred item. Once the child demonstrated mastery of this phase, Phase I would be repeated. Generalization probes occurred throughout the conditions and provided opportunities to request for items vocally without the presence of the SGD.

Two of three participants reached criterion at Phase I, one required the supplemental procedures in Phase II to then reach criterion for Phase I, and the other participant never met criterion despite mastering the Phase II skills. During intervention, only one participant emitted target vocalizations (approximates) during the generalization probe; however, three participants showed an increase in post-intervention probes (all approximations). Additionally, initiations were observed in three out of the four participants. However, only one child ever emitted full words during any of the phases.

Gervarter et al. (2016) provided a valuable extension to previous research on SGDs and PECS. All participants successfully emitted target vocalizations, and, of particular interest, two of the participants did not require vocal modeling from the therapist to be successful. This could arguably be a great advantage over using the PECS system in interventions. Gervarter and colleagues also solidified the research suggesting that children with ASD will employ an alternative form of manding when their initial form is ignored; more specifically, vocal speech (a higher effort mand) increases when the possibility of the SGD response (a lower effort mand) is placed on extinction. Results of this study also indicate that vocalizations may increase for children with ASD when adding a vocal instruction component (with reinforcement) to the SGD training, consistent with previous research. This could be an effective procedure for children who display poor imitation skills initially. Implications for this study include reducing fear that assisted communication procedures hinder talking, giving the child an immediate outlet to communicate while developing further skills. Further, vocal output can be maintained and improved upon even while fading the use of the device.

This study made great strides in expanding the literature, however, it was not without limitations. First, the study did not account for SGD proficiency in language acquisition. This study also failed to provide a comparison for language acquisition with only vocal instruction. Gervarter et al. (2016) suggest that further research addresses these issues while also exploring how targeting novel sounds might affect the procedures and how well the skill acquisition might generalize to requesting for other items. Finally, the variance in the study's data proved to be a limitation in that stable responding was not achieved. One explanation could be that the study utilized ineffective motivating operations in the form of weak potential reinforcers. While Gervarter (2016) performed an initial MSWO to identify preferred items, research suggests that daily preference assessments produce more effective stimuli (Call et al., 2012; Deleon et al., 2001).

Summary and Purpose

The literature indicates that sign language, PECS, and VOCA function effectively as functional communication aides. Research also suggests that AAC produce increased verbal output for some previously non-verbal children with ASD, particularly when used with a prompt delay. Modalities selected by the clinician for AAC training may reflect the preference or ability of the client; for example, a child with limited imitative skills may not respond well to sign language and a child with poor fine motor skills may be unable to manipulate a Velcro board of picture exchange cards. It would seem that VOCA, in its most modern form as a smartphone app, most appropriately addresses the variability in skill sets among children with autism, including the added benefit of instant customization through the device camera function; ability to store endless graphics and words while remaining lightweight and portable; and providing a means to communicate functionally without the stigma of other modalities. The purpose of this study is to extend the literature on VOCA as a means of producing increased verbal speech using a prompt delay and shaping methods. Specifically, this study aims to extend Gervarter et al. (2016) study by targeting novel sounds.

Research Questions

1. Will differential reinforcement and prompt delays increase novel vocalizations in children with ASD using VOCA as an alternative communication device?
2. Will training using the VOCA with prompt delay method generalize to novel settings and novel communication partners?
3. Would daily preference assessments improve the efficacy of the Gervarter (2016) study?
4. Do parents of children with ASD rate the VOCA with prompt delay method as an acceptable intervention?

CHAPTER II – METHODS

Participants and Setting

Two participants were recruited from an ABA clinic at a southern university; one was recruited from an elementary school in a nearby town. Upon approval from the institutional review board, we obtained parental consent for each child. Only children with a diagnosis of ASD and a non-functional vocal repertoire participated in the study. A portion of the Early Echoic Skills Assessment (EESA) of the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP; Sundberg, 2007) was used as a pre-screener for participants prior to baseline based on the similar criteria as Gervarter et al. (2016) with the exception that this study included participants who scored a 0 on the EESA. In addition, the participants all demonstrated familiarity with the use of an iPad by performing basic functions (unlocking iPad, opening an app and interacting using the touch screen, returning to the home screen, etc.).

Participants included a set of five-year-old twins diagnosed with ASD who currently receive ABA services through the University and at a local clinic. James and John also receive weekly speech and occupational therapy services. Parents reported that neither brother communicated verbally, but that they do engage in vocal stereotypy in the form of an “iiii” or “eeee” sound. James scored a .5 on the EESA and John scored a 0.

Stephen, the third participant, is a ten-year-old boy who receives minimal supportive services outside of his self-contained classroom at a local elementary school. A paraprofessional assists him with a stand-alone speech generating device that has approximately 20 icons which he uses to request for things like “break” or “tablet.” Both his father and teacher reported that Stephen does not say any words, but will make noises when excited akin to grunting or humming. Stephen also scored a 0 on the EESA.

Materials

All participants used an SGD consisting of an iPad with the application Proloquo2Go®. Additional materials included participants' preferred items from the results of a preference assessment. Participants had no history of requesting for these items using a vocal mand.

Measures

The Behavior Intervention Rating Scale (BIRS; Elliot & Treuting, 1991)

This study utilized the BIRS (Appendix D) to measure the social validity of this intervention. The BIRS is a 24-item questionnaire used to capture teacher or parent satisfaction with treatment (Elliot & Treuting, 1991); the scale ranges from a score of 1 (strongly disagree) to 6 (strongly agree). Parents and teachers completed the measure at the conclusion of the intervention with greater scores indicating greater acceptability. The BIRS was chosen based on reported high levels of internal consistency (alpha coefficient of .97).

Early Echoic Skills Assessment (EESA) of the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP; Sundberg, 2007)

Potential participants had to achieve a score greater than 0, but no higher than 20 on Group 1 of the EESA. Group 1 consists of 25 simple and reduplicated syllables like "wow" and "wa wa." Criteria aligns with Gervarter (2016) and was selected because 20 is the minimum score needed to demonstrate criterion for Level 1 of the EESA.

Experimental Design

In order to evaluate potential functional relationships, a concurrent multiple baseline design across participants was employed to evaluate the effectiveness of the independent variable (Watson & Workman, 1981).

Dependent Measures

The primary dependent variable measured in this study was the occurrence of novel independent vocalizations defined as either full target words or approximations that occur unprompted by a vocal model from the therapist. Vocal responses were also counted as independent even when occurring in tandem with the VOCA response or following the VOCA response during the 5-s time delay. A secondary variable included prompted responses that occurred after a vocal model from the therapist. Additionally, data were collected on whether the response was a full target word or an approximation. An approximation would contain some sound from the target word. Finally, social validity (parental satisfaction with the intervention) was assessed using the Behavior Intervention Rating Scale (BIRS) questionnaire.

Interventionists and Data Collectors

The primary interventionist was a second-year master's student in a university applied behavior analysis program. Additional data collection and interobserver agreement was provided by other applied behavior analysis graduate students.

Interobserver Agreement and Procedural Integrity

Trained observers collected data for 30% of sessions for each participant to ensure interobserver agreement. For each trial, the data collector recorded the level of prompt (verbal or physical) needed to evoke the use of VOCA to mand and the occurrence of any vocalizations and whether they were prompted or unprompted (see Appendix B). All vocalizations were recorded phonetically using pen and paper to distinguish between full words and approximations (e.g., “outside” or “ows”). We compared data from the primary collector and the independent observer for each trial and then calculated the agreement by dividing the number of agreements by agreements plus disagreements and then converting that number into a percentage.

Procedural integrity was assessed using the steps of the protocol to create a checklist for each phase (see Appendix C). Independent observers collected data for 30% of sessions for each participant with at least one session for each condition. We calculated procedural integrity by dividing the number of steps performed correctly by the total number of steps and converted that number to a percentage.

General Procedures

Stimulus Preference Assessment

We conducted a preliminary multiple-stimulus without replacement preference assessment (MSWO; DeLeon & Iwata, 1996) for each participant prior to baseline and intervention conditions to determine what items would be used as potential reinforcers during the study. A brief open-ended interview with the child’s caregiver provided the basis for items presented in the MSWO. Daily one-step preference assessments were conducted during baseline and intervention (Call, Trosclair-Lasserre, Findley, Reavis, & Shillingsburg, 2012; Deleon et al., 2001). Examples of James and John’s items/activities included bubbles, a ball, a phone, going outside, and being picked up. Stephen’s preferred items included candy, crackers, a phone, lotion, bubbles, and a ball.

Baseline

During baseline, we positioned the participant's selected preferred item so that it would be in view but out of reach for the child. The session would begin once the child demonstrated interest in the item (e.g., reaching, pointing, grunting). If the child did not show interest, the interventionist might interact with the item to evoke a response or select another highly ranked item. Once motivation had been indicated, the interventionist would place the SGD in front of the child with the picture of the item on the screen. If the participant provided a correct response (pushing the button with enough force to activate voice output) within 5-s of presentation of the iPad, the response would be immediately reinforced with 30-s of access to the highly preferred item. If no response or an incorrect response occurred, the interventionist would provide a physical prompt that would then be reinforced. Sessions consisted of 10 trials and each trial ended upon delivery of the preferred item. Phase changes occurred after visual analysis indicated stable responding.

Intervention: Prompt Delay and Differential Reinforcement

Intervention followed the same protocol as baseline with the exception of a prompt delay and differential reinforcement. Once motivation was established and the iPad was presented, the interventionist would wait 5-s for a response. A complete vocal mand (saying the name of the item) during this waiting period would access delivery of the highly preferred item for 30-s regardless of whether the SGD was activated or not. A partial vocal mand in tandem with an SGD response would also result in the immediate delivery of the preferred item. A partial vocal mand in the absence of an SGD response would result in physical prompting of the SGD and access to the reinforcer. If an SGD response was made independent of any vocalizations, the interventionist would wait 5-s. Vocal mands that occurred during this time were immediately followed by access to the reinforcer, otherwise delivery of reinforcement would occur after the 5-s had passed. No response at all after the initial 5-s at the beginning of a trial would initiate a physical prompt to activate the SGD followed by a 5-s delay to allow another opportunity for vocalization. If no vocalizations were emitted, a physical prompt would then guide the participant to activate the SGD and a final opportunity for vocalization. If no full or partial vocalizations were produced, the interventionist would deliver a less preferred item for 30-s access and the trial would end.

Phase II: Addition of an Echoic Prompt

. If Phase I failed to produce responses for less than 80% of trials, a second phase was introduced. The procedures remained the same as Phase I with the exception of an echoic prompt provided by the therapist. If no vocalization occurred during the prompt delay, the therapist would provide a vocal model and the participant would then be afforded an additional 5-s to make a vocalization. If vocalization (full or partial) occurred, the participant would gain immediate access to the preferred item. If no vocalization occurred, the student would receive 30-s access to a less preferred item.

Generalization

We conducted generalization probes during all phases to test for vocalizations in the absence of the VOCA. The interventionist performed three consecutive trials in which the preferred item was in view but out of reach. If the child emitted a vocal mand or approximation, access to the item was given immediately. If not, the reinforcer was delivered after five seconds without a response.

Data Analysis

To analyze the treatment integrity and student outcome data, visual analysis was utilized. More specifically, data was analyzed by examining level, trend, variability, immediacy, non-overlap, and consistency across similar conditions (Horner et al., 2005). A nonparametric effect size was also calculated to supplement visual analysis, specifically Tau-U. Effects sizes between 0 and 0.20 are considered small effects, 0.20 and 0.60 are moderate effects, 0.60 and 0.80 are large effects, and above 0.80 are very large effects (Vannest & Ninci, 2015). Effect sizes were calculated for student outcomes.

CHAPTER III - RESULTS

Pre-Screening

Scores from the EESA are reported in Table 1. None of the participants demonstrated mastery of echoic skills or showed it to be an emerging skill. John and Stephen both scored 0, and James scored a .5.

Table 1

EESA Scores

EESA Scores		
James	John	Stephen
.5	0	0

Single-Case Effect Sizes

Tau-U (Parker & Vannest, 2009) was calculated to determine the effect of intervention. Table 2 shows the Tau-U value for the intervention for independent vocalizations. James is the only participant to show a very large effect size of intervention. John has a moderate effect size from baseline to Phase I, but no effect from Phase I to Phase II. Stephen had no effect size for either.

Table 2

Intervention Effect

Participant	**Baseline to Phase 1 Independent Vocalizations**	**Baseline 1 to Phase 2 Independent Vocalizations**
James	.36	.95
John	.43	-.04
Stephen	0	0

Vocalizations

Table 4 captures prompted and independent vocalizations for all three participants. James had two instances of independent manding during baseline (4%). He produced independent vocalizations in 14% of trials for Phase I. In Phase II he produced independent vocalizations in 83% of trials and prompted responses for 9% of trials. John had one instance of independent vocalization in baseline (1%), 11% in Phase I, and 11% in Phase II with 12% prompted responses. Stephen had no vocalizations during baseline and Phase I but had two instances of independent vocalizations (20%) during Phase II.

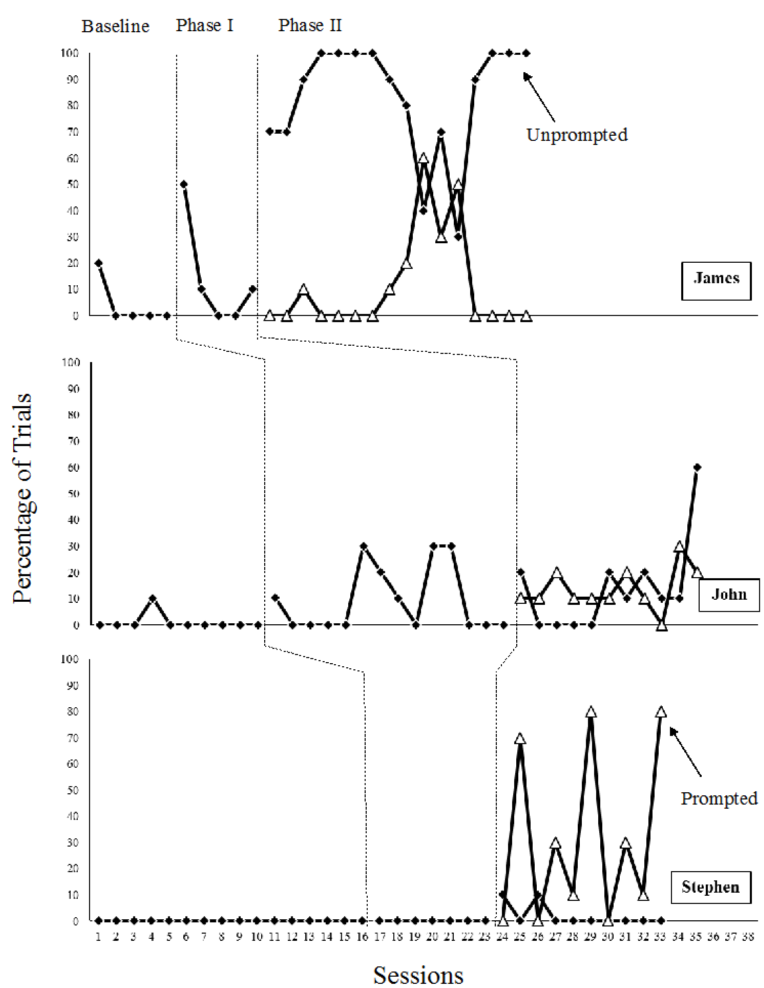

Figure 1. Percentage of trials with unprompted or prompted vocalizations for James (top panel), John (middle panel), and Stephen (bottom panel).

Approximations and Full Words

All target vocalizations were handwritten and approximations were spelled out phonetically. Table 5 shows the variety of novel sounds for each participant. James produced six full words, John produced three, and Stephen produced one full word; however, all three participants produced a variety of novel sounds. These findings differ from that of Gevarter and colleagues (2016) in that their participants failed to acquire a variety of sounds and only one participant spoke a full word.

Table 3

Approximations and Full Words

James		**John**		**Stephen**	
Full	Approximate	Full	Approximate	Full	Approximate
outside bubbles car bye up open	buba (bubbles) pho (phone) own (phone) tr (truck) ho (horse) ors (horse) ar (car) osau (dinosaur) oen (open)	horse bubbles bye	tata (tickle) hor (horse) buh (ball) uh (up) oh (phone) own (phone) fff (phone) buh (bubbles)	Phone	Fff (phone) ho (phone) pho (phone) own (phone) oh (phone)

Generalization

Generalization probes were conducted during each phase of intervention. None of the participants emitted target vocalizations during baseline or Phase I. James is the only participant to provide target vocalizations during Phase II generalization probes. He produced unprompted vocalizations in 100% of trials, using both full words (i.e., “bye-bye”) and approximations for “open” and “bubbles.”

Social Validity

While the results show varying success of the intervention, it scored high in social validity. James and John's father and Stephen's teacher completed the Behavior Intervention Rating Scale (BIRS). All scores reflected agreement or strong agreement in favor of the VOCA-based intervention. Both father and teacher strongly agree that the intervention is beneficial and produces a lasting improvement. Additionally, both teacher and parents expressed excitement to the researchers in regards to improvement in vocalizations.

Interobserver Agreement & Procedural Integrity

IOA data was collected across all three conditions and participants. Data was recorded during 53% of James trials with 95% agreement, 88% of John's with 91% agreement, and 45% of Stephen's with 97% agreement. Treatment integrity data was taken for 30% of sessions (nine for James, and ten for both John and Stephen) with 100% procedural integrity.

CHAPTER IV – DISCUSSION

The current study sought to evaluate the efficacy of a VOCA-based intervention in conjunction with differential reinforcement and prompt delays along with the use of daily preference assessments in increasing independent and prompted vocalizations in children with autism who were mainly non-verbal at the time of the study. Specifically, the research questions included:

1. Will differential reinforcement and prompt delays increase novel vocalizations in children with ASD using VOCA as an alternative communication device?
2. Will training using the VOCA with prompt delay method generalize to novel settings and novel communication partners?
3. Would daily preference assessments improve the efficacy of the Gervarter (2016) study?
4. Do parents of children with ASD rate the VOCA with prompt delay method as an acceptable intervention?

In regard to Question 1, the results of this study demonstrate that the use of a VOCA-based intervention in conjunction with differential reinforcement and prompt delays increased independent novel vocalizations for all three participants. However, consistent with the Gevarter (2016) study, the majority of novel sounds and independent manding occurred in Phase II of the study with the addition of an echoic prompt. James showed some independent vocalizations in Phase I, but occurrences were low (approximately 10% of trials) and inconsistent. His vocalizations increased with the addition of the vocal prompt in Phase II; by the end of the phase, James used vocal mands to request for items in 100% of trials independently of VOCA. Additionally, he produced a variety of previously unheard vocalizations (e.g., "open," "bubbles," "bye-bye"). In regards to Question 2, James was the only participant who continued to use vocal mands in the absence of the SGD during generalization probes. He continued to use verbal mands across different communication partners and settings. While there is no data to support it, his parents reported the independent vocalizations generalized to their home setting.

John also showed a low rate of new and independent vocalizations in Phase I which increased with the introduction of the echoic prompt in Phase II; however, his rate of independent responding remained much lower than James' (60%) by the end of the study, though he also produced multiple novel sounds (e.g., "own," "uh," "bye-bye"). John did not demonstrate independent vocalizations during generalization probes, but parents report that they are hearing more verbal manding at home.

Stephen showed no independent verbalizations during Phase I and very little in Phase II. However, during Phase II, he increased the prompt-dependent vocalizations of one novel sound, an approximation of "phone". He also did not demonstrate independent vocalizations during generalization probes.

This study attempted to improve the efficacy of the Gevarter (2016) study through the use of a daily preference assessment; however, the results show the same variability. It should be noted, though, that the variety of items/activities in the daily preference assessment resulted in a variety of novel sounds for two of three participants. Despite the variability across participant responses, this intervention resulted in successfully increasing vocalizations in three children who previously demonstrated little or no verbalizations. Further, all three participants quickly mastered the use of VOCA for manding across several icons (between 6-8).

The major limitation of this study is that it is unknown whether or not vocal mand training alone could produce novel vocalizations in the same capacity as a VOCA-based intervention. However, the use of VOCA allows for immediate access to a reinforcer which could expedite the training process. Future studies should compare the rate and effect of speech generating devices to vocal-only mand training.

This study is also limited by the unclear effect of the prompt delay. This study failed to demonstrate whether any intervention effects were the result of the prompt delay or the effects of learning. Future studies should explore prompt delays and how different latencies affect language production.

Finally, the brevity of this study failed to produce any effect for Stephen. This could be explained by procedural issues such as moving from Phase I to Phase II too quickly. It could also be the result of a longer history of learning as compared to the other participants in that Stephen has communicated non-verbally for a longer amount of time. Finally, Stephen has no outside supportive services other than speech therapy once a week at school, while the other participants receive outside ABA, speech therapy, and occupational therapy multiple times a week. Future studies should examine the individual differences that determine successful language interventions.

APPENDIX A – Parent Consent Form

The University of Southern Mississippi

Consent Document for Research Participants

Dear Parent,

Hello, my name is Katie Bishop, and I am a graduate student at the University of Southern Mississippi in the Applied Behavior Analysis Psychology Master's Program. I am currently conducting my thesis, which will assess the effectiveness of a voice output communication aide (VOCA) in producing novel vocalizations. This study is being conducted under the supervision of Dr. James Moore.

Please consider the following when deciding if you will participate in this study:

Purpose of the Study

The purpose of this study is to assess the effectiveness of a voice output communication aide in producing novel vocalization in children with limited communication. VOCA software will be used to conjunction with an iPad utilized as a speech generating device.

Procedure

If you agree to participate in this study, your child will receive training to request for items using VOCA software on the iPad. We will provide the iPad and software for use during training at the clinic at no cost to you. We will also provide items to be used as potential reinforcers for correct responding based on your input and a preference assessment. We require a commitment from you to be available for training appointments at our scheduled time. This should not require more than a 2-3 hour weekly commitment.

We will conduct a pre-assessment on echoic verbal skills prior to participation in the study using the early echoic skills assessment of the VB-MAPP. If your child qualifies, we will schedule times and dates to begin the intervention.

After training your child to request items using the VOCA software, we will begin using differential reinforcement and prompt delays in an attempt to produce verbal requests for the same items. Differential reinforcement means we will deliver the preferred item for certain responses but not others. A prompt delay will delay the delivery of the reinforcement to allow time for alternative responding (vocal requests).

Training and data collection will be conducted by trained graduate students from the USM Applied Behavior Analysis Program under close supervision of the program director. You will have opportunities to observe all sessions through tv monitors or behind one-way mirrors.

Benefits

By agreeing to this study, there may be several benefits for you and your child. Your child will be trained to functionally communicate to request for items. The ability to successfully request (and receive) preferred items of activities often results in a decrease in undesired forms of communication like tantrums or aggression.

Risks

There are no foreseeable risks for your child. I and/or other trained graduate students will provide rationale for each step, feedback, materials necessary, and will be available to answer any questions you may have along the way.

Confidentiality

All interviews, observations and other information obtained during this study will be kept strictly confidential. Your name, your child's name, and other identifying information will not be disclosed to any person not connected with this study. Results from this research project may be shared at professional conferences or published in scholarly journals; however, all identifying information will be removed from publications and/or presentations.

Consent

Your participation in this study is entirely voluntarily. In addition, you may withdraw from this study at any time without penalty, prejudice, or loss of benefits. Whereas no assurance can be made concerning results that may be obtained (as results from investigational studies cannot be predicted) the researcher will take every precaution consistent with the best scientific practice.

If you agree to participate, please read, sign, and return the following page. Please keep this letter for your records. If you have any questions about this study, please contact Katie Bishop (601-xxx-xxxx or xxxx.xxxx@usm.edu) or Dr. James Moore (xxxx.xxxx@usm.edu). This project and this consent form have been reviewed by the Human Subjects Protection Review Committee at USM, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research subject should be directed to the Institutional Review Board Office, The University of Southern Mississippi, Box 5147, Hattiesburg, MS 39406-5147, (601) xxx-xxxx.

Sincerely,

___________________________ ___________________________

Katie Bishop, B.A., B.S., R.B.T.
Behavior Analyst-in-Training
The University of Southern Mississippi

Dr. James Moore, Ph.D., BCBA-D
Director of Training
The University of Southern Mississippi

Please Read, Sign, and Return the Following:

I have read the above documentation and consent to participate in this project. I have had the purpose and procedures of this study explained to me and have had the opportunity to ask questions. I am voluntarily signing this form to participate under the conditions stated. I have also received a copy of this consent. I understand that my child will be trained to use VOCA software on an iPad to request for items or activities. Additionally, differential reinforcement and prompt delay procedures will be used in an attempt to evoke verbal requests. I further understand that all data collected in this study will be confidential and that my name and the students' names will not be associated with any data collected. I understand that I may withdraw my consent for participation at any time without penalty, prejudice, or loss of privilege.

_________________________ __________________________

Signature of Caregiver *Date*

_________________________ __________________________

Signature of Witness *Date*

APPENDIX B – IOA Data Sheet

Date:					Data Collector:				IOA? Y or N
Trial No.	Vocalization (written)	Full (F) or Approximate (A)	Prompted			Unprompted	Occurrence		
			Verbal	Gesture	Physical		w/VOCA	w/prompt	delay

APPENDIX C – Procedural Integrity Data Sheet

Procedural Integrity

Implementer(s): ___________ Observer: _______ Phase: _______ Date: _________

Participant: __________ IOA?:___________

Mark "I" for each step each time the implementer(s) completed the step correctly. Mark "0" for each time an implementer missed or incorrectly completed a step. Integrity = I/(I+0) * 100

Integrity Step:	Instances correct & incorrect:
1. MSWO conducted prior to baseline.	
2. Daily one –step preference assessment conducted.	
3. Preferred item place out of child's reach, but in view.	
4. SGD placed in front of child once child demonstrates interest in item.	
5. **Therapist** provides 30-s access to item if correct response is demonstrated within 5 seconds of presentation of iPad (full vocal, partial vocal + SGD.	
6**. Therapist** provides physical prompt in presence of partial vocalization but no SGD response followed by 30-s access to item.	

7. **Therapist** waits 5-s in presence of SGD with no vocalization.										
8b. Therapist provides 30-s access to item if vocal mand occurs during delay.										
8c. **Therapist** provides physical prompt to activate SGD in presence of incorrect or no response and then initiates another 5-s delay.										
8d. **Therapist** provides 30-s access to item if vocal mand occurs during delay.										
8e. **Therapist** provides 30-s access after 5-s delay if no response or incorrect response. Trial ends.										
9. Data collector records responses.										
Total Percent Correct Implementation										%

APPENDIX D –Behavior Intervention Rating Scale (BIRS)

1=Strongly Disagree, 2=Disagree, 3=Slightly Disagree, 4=Slightly Agree, 5=Agree, 6=Strongly Agree

1.	This would be an acceptable intervention for the child's behavior.	1	2	3	4	5	6
2.	Most parents would find this intervention appropriate for behavior problems in addition to the one described.	1	2	3	4	5	6
3.	The intervention should prove effective in changing the child's problem behavior.	1	2	3	4	5	6
4.	I would suggest the use of this intervention to other parents.	1	2	3	4	5	6
5.	The child's behavior is severe enough to warrant use of this intervention.	1	2	3	4	5	6
6.	Most parents would find this intervention suitable for the behavior described.	1	2	3	4	5	6
7.	I would be willing to use this in the home setting.	1	2	3	4	5	6
8.	The intervention would *not* result in negative side effects for the child.	1	2	3	4	5	6
9.	The intervention would be appropriate for a variety of children.	1	2	3	4	5	6
10	The intervention is consistent with those that have been used in other settings.	1	2	3	4	5	6
11.	The intervention was a fair way to handle the child's behavior.	1	2	3	4	5	6
12.	The intervention is reasonable for the behavior described.	1	2	3	4	5	6
13.	I like the procedures used in the intervention.	1	2	3	4	5	6
14.	The intervention was a good way to handle this child's behavior.	1	2	3	4	5	6
15.	Overall, the intervention would be beneficial for the child.	1	2	3	4	5	6
16.	The intervention would quickly improve a child's behavior.	1	2	3	4	5	6
17.	The intervention would produce a lasting improvement in the child's behavior.	1	2	3	4	5	6

18.	The intervention would improve a child's behavior to the point that it would not noticeably deviate from other peers' behavior.	1	2	3	4	5	6
19.	Soon after using the intervention, the teacher/parent would notice a positive change in the problem behavior.	1	2	3	4	5	6
20	The child's behavior will remain at an improved level even after the intervention is discontinued.	1	2	3	4	5	6
21.	Using the intervention should not only improve the child's behavior in the home, but also in other settings (e.g., classrooms, etc).	1	2	3	4	5	6
22.	When comparing this child with a well-behavior peer before and after the use of the intervention, the child's and the peer's behavior would be more alike after using the intervention.	1	2	3	4	5	6
23.	The intervention should produce enough improvement in the child's behavior so the behavior no longer is a problem at home.	1	2	3	4	5	6
24.	Other behaviors related to the problem behavior also are likely to be improved by the intervention.	1	2	3	4	5	6

APPENDIX E – IRB Approval Letter

THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 17012701
PROJECT TITLE: Increasing Novel Vocalizations for Individuals with ASD Using a Voice Output Communication Aide
PROJECT TYPE: New Proejct
RESEARCHER(S): Shawn "Katie" Bishop
COLLEGE/DIVISION: College of Education and Psychology
DEPARTMENT: Psychology
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 01/30/2017 to 01/29/2018
Lawrence A. Hosman, Ph.D.
Institutional Review Board

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