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# Increasing Vocalizations in Children with Autism

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## **Abstract**

This study focuses on increasing vocalizations for students with Autism spectrum disorder. A three-part intervention was used to attempt to establish an echoic repertoire in students who had little to no vocalizations. Both students attended an early intervention classroom with a special education school. Students were selected from their classroom if they showed little to no vocalization or echoic skills. The goal during the first phase was to collect all sounds being made by the student to increase the overall number of vocalizations being made. This was done by continuous reinforcement using edible reinforcers. In phase two, the student's dominant sounds from phase one were put on extinction to increase variety of vocalizations. The final phase was echoic training which chosen from target sounds made by the students in previous phases. An echoic repertoire was established successfully for the first student, and an echoic procedure is currently in place for the second student. This study can help future research to examine further methods for increasing vocalizations in children with autism.

*Keywords:* Autism, vocalizations, echoic training, shaping

## Increasing Vocalizations in Children with Autism

When we begin early intervention for a child with autism, one of the initial procedures that we implement is an echoic procedure. These types of procedures are necessary when a child is producing little to no independent vocalizations when communicating. “One of the most challenging tasks is establishing functional verbal repertoires to children who have no speech and no ability to imitate” (Drash, High, & Tudor, 1999). “The conventional approach to teaching verbal behavior to nonverbal autistic children was to target vocal imitation as the first step” (Drash et al., 1999). If the child cannot echo, they need to be taught in a different method to begin to produce more vocalizations. “Because the primary function of the behavior of speakers is to produce reinforcement through others, it stands to reason that the mand should be established first before proceeding to echoic behavior” (Drash et al., 1999).

Esch, Lepper, & Petursdottir, 2013 suggested another method known as stimulus-stimulus pairing for increasing vocalizations of nonverbal children with disabilities. Stimulus-stimulus pairing involves pairing the speech of the researcher while presenting a reinforcer to the child. “The goal of this procedure is to produce a temporary increase in vocalizations, thus creating a larger variety of sounds that can subsequently be brought under appropriate stimulus control” (Carbone, Demolino, Miliotis, Rader, Reeve, Sidener & Sidener, 2012). This may not produce direct echoics, but it can establish a basis of sounds of the child. This could then lead to echoic procedures with more correct responding. Further research on stimulus-stimulus pairing has been done and suggests, “early human vocal activity may develop, at least in part, from automatic reinforcement

related to stimuli generated through speech behavior itself” (Carr, Esch, & Grow, 2009). If sounds have the strength to be reinforcing, echoing sounds can be trained to produce these sounds that will be reinforced.

Research has also been conducted to show results of pairing multiple training procedures. When combining echoic training with mand or tact training, it increased unprompted manding and tacting (Clements & Kodak, 2009). Clements and Kodak found that fewer trials were required to acquire tacts when training procedures were combined. With fewer trials being run, the student acquired a larger speech repertoire at a faster rate. Along with pairing procedures, other studies have shown success in “not only directly increasing appropriate behavior, but also decreasing inappropriate behavior” (Ahearn, Clark, Colon, & Masalsky, 2013). Response interruption and redirection effects were found to increase appropriate vocalizations by prompting child to emit appropriate language following any stereotypy, which eventually decreased (Ahearn et al., 2013).

There is limited research on alternative ways to teach echoic behavior in children with autism. To date, 12 studies have evaluated Stimulus-stimulus pairing as a procedure to increase vocalizations. Nine studies demonstrated a temporary increase in at least one target vocalization with 19 of the 25, three studies failed to demonstrate an increase in any target vocalizations for any of the participants (Miliotis et al., 2012). Based on limited research in this area, it is important that we investigate alternative approaches to increasing vocalizations.

The overall goal of this project is to increase overall vocalizations and eventually establish an echoic repertoire. Our hope is that this echoic repertoire will generalize to novel and functional sounds. A classroom procedure was created based off of this

intervention so that it could be used within the classroom setting. In the first phase we reinforced any and all sounds. Any time the student made an appropriate vocalization, a fruit snack was delivered. The goal of the first phase was to increase the overall number of vocalizations that the child was engaging in. Dominant sounds were collected during the first phase to then implement a second phase. In the second phase, dominant sounds were put on extinction and all other sounds continued to be reinforced. This would hopefully increase the variety of the sounds the student made during sessions. Once we increased the variety of sounds that the child engaged in, a third phase was put in place. In this phase, target sounds were chosen for echoic training. Once echoics had been mastered, an echoic procedure could be put in place.

We conducted the study with one student to begin, who was having difficulty echoing sounds. Once the third phase was implemented, the student mastered the echoic target sounds within the first few sessions. Sessions with another student have just begun, in the first phase. We are hopeful that we will see the same positive result that we saw with our first student.

## **Method**

### **Participants**

The students in the study were two children with a diagnosis of Autism Spectrum Disorder. Both students attended a discrete trial classroom in a special education public school. Students were chosen based on limited echoic repertoire. Alice was four-year old female who did not have an echoic procedure already in place. When tested for echoics, she did not demonstrate any immediate echoic responses, however she did demonstrate minimal delayed echoic responses. Jeremy was a three-year old male who was demonstrating no responding with his current echoic procedure.

Students were selected for the intervention based on their limited number of vocalizations and lack of echoic repertoire. If students were successfully producing echoics during echoic procedures, they were not selected for participation in the study. Both of the students would benefit from the study because of lack of either mastery of an echoic procedure or lack of reliable echoic repertoire.

### **Design**

An ABC design was used for the study. Sessions took place in a quiet room in a discrete trial classroom. Quiet rooms were used to ensure that those implementing the intervention could hear any vocalizations made by the student and eliminate additional prompts from external sounds in the environment. The participant sat in a chair facing the experimenter and a reinforcer assessment was conducted. During the first phase, the experimenter recorded any sounds produced by the participant. The ultimate goal during phase one was to see an increase in appropriate vocalizations and attending to the experimenter. Reinforcement was delivered for any and every appropriate sound made. The dependent variable for phase one was the number of vocalizations made by the participants. To eliminate any inappropriate sounds, reinforcement was not provided for any vocal stereotypy or crying. Once baseline vocalizations increased, phase two was implemented. During this phase, vocalizations with the highest frequency from phase one were put on extinction. All sounds were reinforced except for the dominant sounds that were currently on extinction. The dependent variable consisted of a measure of the number of vocalizations made by the student that were not on extinction. Once we saw the emergence of new dominant sounds, phase three was implemented. During this phase, five to six target sounds were chosen from vocalizations produced by the participant

during phase one and two. In this phase, the experimenter provided the SD, one of the six sounds (ex. “bah”), and waited three seconds for a response. The experimenter provided the verbal prompt up to three times and waited for a response to occur. If the student echoed the verbal prompt, it was reinforced with an edible reinforcer and praise. If the student did not echo the response, the experimenter simply terminated the trial and moved on. The dependent variable in phase three was the number of correct echoic responses. Each session in phase three consisted of four trials for each of the target sounds. Mastery criteria was defined as two sessions at ninety percent or above, or three sessions at eighty percent or above.

### **Procedure**

Sessions were run an average of six times per week, and each session lasted between five and ten minutes. Any sessions that were conducted in the same day were done at least 20 minutes apart from each other. The procedure for phase one included setting up a video camera to record the session, and preparing the fruit snacks or M&M’s for the student. At the beginning of a session, the experimenter would set a timer for five minutes. Once the timer was started, the experimenter would wait for the student to make any sort of vocalization. For the duration of the session, vocalizations were reinforced and tallied on a data sheet with the date and session number. For Alice, reinforcement was delivered for all sounds that she made. In the case of Jeremy, the experimenter began by holding out the fruit snack and waiting for a vocalization. Originally, he was not always orienting to the experimenter. A clear container was then placed over of the fruit snack, in hopes to increase attending. Vocalizations resulted in removal of the container and access to the reinforcer. Jeremy is currently running sessions in the first phase, and

he will be moving onto phase two very soon. Dominant sounds were recorded in order to determine which sounds would be put on extinction for phase two. The criteria in order to move on to phase two, was for the student to orient to the experimenter and for overall vocalizations to increase during the five-minute sessions. Certain sounds seemed to function as mands, which included pointing or grabbing to the experimenter's hand while making a sound in order to receive the reinforcer.

Sessions during phase two were also recorded, and the reinforcer used was a fruit snack, a video camera was again set up and fruit snacks prepared. This phase involved an extinction component to increase the variety of sounds the student was making. For the first two minutes, the experimenter waited and reinforcement was delivered for all sounds. In the last three minutes, the dominant sound for Alice "hee" was put on extinction. All other sounds were reinforced and tallied on data sheets. Once the extinction of dominant sounds was successful and we saw emergence of new dominant sounds, phase three was implemented.

Prior to phase three, a list of six echoic sounds from the student's repertoire was made for the sessions. A camera was the set up and fruit snacks were prepared for reinforcement. During sessions, an initial SD of one of the sounds was provided and experimenter waited 3 seconds for a response. A verbal prompt was provided up to three times if no responding occurred. Incorrect responses were any sounds other than verbal SD or verbal prompt and were ignored. Correct responses were any echoed verbal responses the student made, and were reinforced with fruit snacks and tallied on data sheets. Mastery criteria was three consecutive sessions at eighty percent or above, or two consecutive sessions at ninety percent or above.



## **Settings & Materials**

The setting in this study is the WoodsEdge Learning Center in the student's discrete trial classrooms. The classrooms have rooms adjacent to children's assigned booths. Sessions were conducted inside these rooms to assure limited external sounds. In the room was a table with two chairs for the student and the experimenter. Materials used for the study were pencils, paper, a timer, a video recorder and edible reinforcers for the student such as fruit snacks and M&M's.

## **Results**

In phase one, we hoped to see an increase in vocalizations when reinforced for any sounds made during sessions. During the extinction phase, we expected the dominant sounds of each student to decrease, while other sounds increased. For both students, there was an increase in vocalizations. In phase one, both students establish dominant sounds that began to serve a "mand-like" function. Phase three was implemented when there was a decrease in dominant sounds on extinction and an increase of other appropriate vocalizations. In phase three, an echoic test was done using the words tested prior to phase one and both students were functionally echoing all words.

For Alice, vocalizations increased after nine sessions in phase one. In phase two, the word "hee" was her dominant sound and showed the "mand-like" function for edible reinforcers. "Hee" was put on extinction during phase two, and after three sessions we saw a rapid increase in other sounds. After the completion of phase two, an echoic probe was done before phase three. The echoic probe results showed that she was echoing, so continued running sessions. She mastered the list of target sounds after seven sessions averaging 90%. Jeremy's vocalizations were at a steady rate for 13 sessions before phase two was implemented. The word "wee-sha" was his dominant sound and was put on

extinction for phase two, with a steady rate of vocalizations during the second phase. An echoic probe was done for Jeremy after phase two and results showed echoing, so sessions continued running. He mastered the list of target sounds after four sessions.

### **Discussion**

The results of the intervention were consistent with previously established goals for the intervention. In phase one, we expected that there would be higher rates of responding for continuous reinforcement of vocalizations. It was expected in phase two that the production of dominant sounds that were put on extinction would decrease. The original plan was to implement an echoic phase for phase three, however during the echoic test following phase two, both students were echoing target sounds.

Echoics could have been the result of receiving high rates of reinforcement for making those particular sounds. In addition, most sessions were run before the student's lunch break, so there could have been a higher motivation for the edible reinforcers. The set up for running sessions was very different from the student's normal work environment. There was no access to other reinforcers or edibles, as well as almost no external noise coming from other parts of the classroom. This led to high attending from the students during sessions with little opportunity of external factors diverting attending.

During the first sessions of the echoic probe with Jeremy, responding rates were low, between only 0-30 percent correct. The students had just returned from a two-week holiday break, which likely attributed to not receiving direct reinforcement for the target behaviors for an extended period of time. Once school began again, there was a change in rooms and sessions were being run in a larger, louder room with many more distractions. This too could have led to the low correct responding during the first sessions with Jeremy.

Based on the results of the intervention a classroom procedure was created for implementation by tutors. The procedure could also be used for other students who are not able to echo sounds and have a very limited repertoire as well. The phases are modeled after each phase in our intervention, to hopefully produce similar results. Sub-phases are written in to cater to students' specific capabilities. At this time, three students in the classroom are using this procedure to target echoics.

Future research could look at the impact of variables such as the quiet environment on responding where sessions took place. This would be able to determine if accurate responding was due to the quiet environment or if similar rates of responding would occur in various other settings. Running procedures to establish mands first by the students, before testing for echoics, could also be researched more in-depth. This way it could determine if it is necessary to establish mands prior to echoics, for more accurate results.

## Appendices

Appendix A:

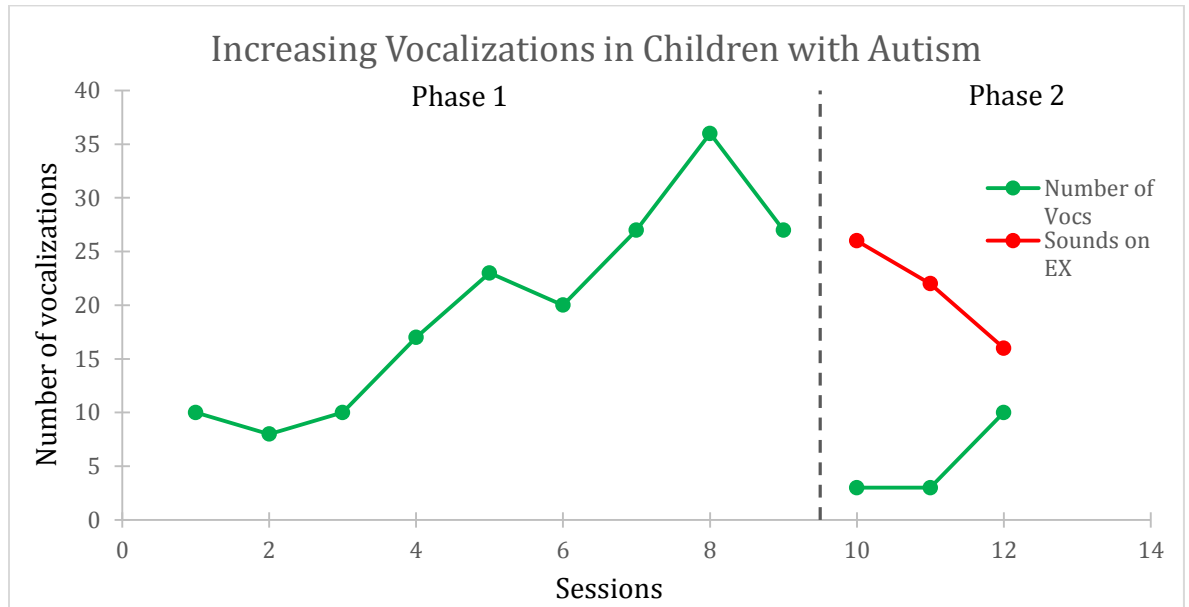


Figure 1

Figure 1 shows the increase in number of vocalizations made by Alice in phase one during the collection sessions. Phase two shows the decrease in responding of the dominant sound that was on extinction and increase in other sounds made by Alice.

Appendix B:

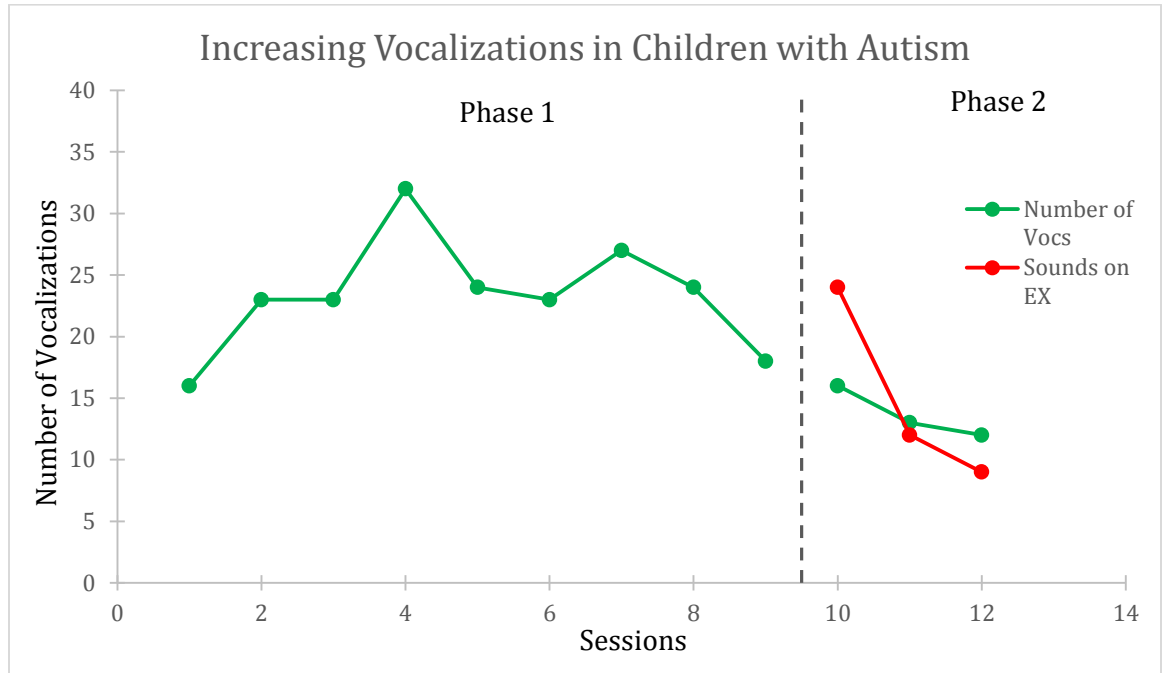


Figure 2

Figure 2 shows the number of vocalizations made by Jeremy in phase one during collection sessions. It also shows the decrease in responding of the sound “wee-sha” that was on extinction and an increase in other sounds.

Appendix C:

	<b>Phase 3</b>			
	<b>Session 1</b>	<b>Session 2</b>	<b>Session 3</b>	<b>Session 4</b>
Ah	+	-	+	+
Mama	-	-	-	+
Dada	-	-	+	+
Baba	-	-	+	+
Puppy	-	-	+	+
Shark	-	-	+	+
Wee	-	-	+	+
Sha	+	-	+	+
Go	+	-	+	+
Yuh	-	-	+	+
<b>Percentage</b>	<b>30%</b>	<b>0%</b>	<b>90%</b>	<b>100%</b>

Figure 3

Figure 3 shows the sounds used and correct and incorrect responses made by Jeremy during the echoic probe of phase three.

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