Applying The Principles Of Applied Behavior Analysis To Reduce Echolalia In A Child With Autism

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Autism is suggested to be the fastest growing developmental disability with one in every 150 births resulting in a child with an Autism Spectrum Disorder (ASD). This astounding figure represents an approximate annual growth rate of 10% – 17% (Autism Society of America [ASA], 2006). As such, there is a particular urgency with which researchers are looking to effectively address the needs of this population. One of the key symptoms of autism is an impairment in language development. Children with autism often have difficulty learning spoken language, initiating and maintaining appropriate conversation, and using language in a socially appropriate manner (DSM-IV-TR). Specifically, one common element in the verbal repertoires of this population includes echolalia (ASA, 2006; Charlop & Trasowech, 1991; Dipipi et al., 2001).

Echolalia is defined as the immediate or delayed repetition of words or phrases spoken by another (Charlop & Trasowech, 1991; Dipipi, Jitendra, & Miller, 2001; McEvoy, Loveland, & Landry, 1988; Roberts, 1989; Schreibman & Carr, 1978; Violetter & Swisher, 1992). These echolalic responses can be categorized as either pure, the exact repetition of the words or phrases spoken (e.g., "Good morning, Jack" in response to "Good Morning, Jack"), or mitigated, which is when the response includes segments of the echoic statement but may also include grammatical, syntactical, or affirmation/negation changes made to the original statement without comprehension (Roberts, 1989). For instance, a child who demonstrates mitigated echolalia may respond by saying "The airplane is flying" when asked "Do you see the airplane flying?"

While the cause of echolalia has not been determined, its function has been at the center of many studies. In fact, several functions have been identified (see Prizant and Duchan, 1981), however gaining social attention or escaping an unknown, unfamiliar stimulus (e.g., the child is asked a question or given a direction they don't understand) are two functions that appear to be particularly common (McEvoy, Loveland, & Landry, 1988). For example, McEvoy et al. found

that 96% of the children in their study who demonstrated immediate echolalia did so for the purposes of engaging in social interaction or to indicate a lack of comprehension. Echolalia that serves the function of obtaining social attention is often inadvertently reinforced by adults through the continuation of the conversation and thus the maintenance of attention. Similarly, echolalia that serves the function of escaping a negative stimulus (i.e., one that may be unfamiliar, confusing, anxiety-provoking or aversive) is often negatively reinforced by the discontinuation of the conversation and thus removal of the unpleasant stimulus (Prizant & Duchan). Given the frequency with which echolalia is reinforced, it is vital that adults determine the function of the echolalic behavior and monitor their own responses to ensure that they are not reinforcing the echolalia but rather teaching the child to exhibit a more socially appropriate behavior as a means of achieving the desired outcome (Prizant & Duchan).

Addressing the presence of echolalia in children with autism is especially important given the negative implications that have been identified. Echolalia often interferes with social development, communication and spontaneous language development, and learning in general. For example, echolalia has been shown to cause significant interruption in the academic and social performance of children with autism in the school setting (Schreibman & Carr, 1978). When children echo teacher commands rather than complying, they are less likely to learn from what is being presented by the teacher. Furthermore, if children simply echo conversation rather than providing appropriate responses, they are likely to diminish or altogether extinguish the social advances made by others (Schreibman & Carr, 1978). Finally, the stigma that can result from the presence of echolalia can make integration into society at large very challenging (Dipipi, Jitendra, & Miller, 2001). As such, it is critical that interventions be implemented to successfully target the reduction of echolalia and increase more appropriate language skills.

One intervention approach that has been effectively applied to a wide variety of autism symptoms is Applied Behavior Analysis (ABA). Though the research is somewhat limited, a few researchers have attempted to use the systematic approaches of ABA to reduce immediate echolalia and replace it with a more functional, socially acceptable response (McMorrow & Foxx, 1986; Risley & Wolf, 1967; Schreibman & Carr, 1978). A study completed by Risley and Wolf (1967) was among the first to link the success of teaching replacement responses to eliminate echolalia. A verbal stimulus (i.e., "what is a dog?") and a verbal prompt (i.e., "animal") were employed followed by a reinforcer contingent on the participant echoing the prompt. Gradually the prompt was faded as correct responding increased. While this study was successful in decreasing echolalia and increasing a correct response, it was later criticized for the impracticality of training a verbal response for every verbal stimulus. To address this limitation, Schreibman and Carr (1978) conducted a study in which two children with severe disabilities (ages 7 and 15 years) were taught to say the phrase "I don't know" to unfamiliar questions that had previously elicited echolalic responses. First, the researchers added the statement "I don't know" to the end of a moderately small number of "what," "how," and "who" training questions. When the children echoed the ending "I don't know," they were immediately reinforced. As the children became more successful, both the prompt ("I don't know") and the reinforcers were faded. The researchers concluded that through systematic instruction in a replacement response ("I don't know"), they were able to reduce the frequency of echolalic responses. Furthermore, the researchers also determined that the children learned to discriminate between previously known questions and those that were unknown and required the replacement response ("I don't know"). Thus, the children did not replace all statements with the learned phrase. Overall, this study successfully demonstrated that a more efficient ABA-based treatment could be

implemented to reduce echolalia by teaching a response that applied to a broader selection of questions.

The purpose of the current study is to replicate and extend the work of Schreibman and Carr (1978) by conducting a functional assessment and applying the independent variable to address the echolalia of a young child with autism. Further, generalization will be assessed across questions and settings as well as across people. Finally, the current study will be conducted by a credentialed early childhood special educator within a classroom setting.

Participants

The participant in this study was a four-year-old boy who had been diagnosed with autism and was enrolled in the researcher's Preschool Special Day Class for 13 months at the beginning of the study. The participant, Ryan (pseudonym), was chosen because he demonstrated a mixture of limited functional language and echolalia. Although Ryan manifested both forms of echolalia (immediate and delayed), he used immediate echolalia more frequently.

Setting

All training and probe sessions occurred in the participant's Preschool Special Day Class classroom. During training and probe sessions, approximately six other students were in the classroom working with a paraprofessional. The researcher and participant positioned themselves in a secluded area of the room that limited the participant's visibility of the other students. During all sessions the participant and the researcher sat across from each other at a small table.

Instruments and Reliability

Data were collected using lists of training questions, probe one questions, probe two questions, and known questions. These lists were compiled by the researcher based on the criteria presented in a similar study by Schreibman & Carr (1978). The list of training questions

consisted of 30 questions: (a) 10 “what” questions (i.e., “What are you doing?”), (b) 10 “how” questions (i.e., “How are you?”), and (c) 10 “who” questions (i.e., “Who is he?”; see Appendix A). Probe One consisted of 15 questions, five “what” questions, five “how” questions, and five “who” questions (see Appendix B). The Probe Two list consisted of five “where” questions, five “why” questions, and five “when” questions (i.e., “Where do fish swim?” “Why do you smile?” and “When is lunch?”). (see Appendix C). The last list of questions consisted of those familiar to the participant and ones that the participant responded to with consistency and without exhibiting echolalia (see Appendix D).

Reliability was collected on 33% of the data. Interrater reliability was 100%. Validity was established by the inclusion of a variety of questioning formats that would elicit an echolalic response from the participant. A list of known questions were included in training sessions to determine the participant’s ability to discriminate between previously known and unknown questions.

Data Collection Procedures

Data were collected using direct observation. The researcher would present the participant with a question, then record his exact response on the data collection sheet. Both training and probe sessions were held once per day, five times per week, for about 15 minutes per session. The duration of the study was approximately four months. Maintenance data was collected by both the original researcher in the original setting and a new researcher in a new setting. Maintenance data was collected after six months from the completion of the original data collection. New data was collected during eight sessions spanning one month.

Variables

The independent variables were the probe one and two questions and the list of known questions. In different stages of the experiment, the researcher manipulated the independent variables to determine their impact on the participant's responses. The dependent variables in this study were the participant's responses in reply to a given question. These responses were coded as echolalic, appropriate, or other (i.e., silence or unrelated answer).

Procedures

This study replicated elements of research completed by Risley & Wolf (1967) and Schreibman & Carr (1978).

Baseline sessions. During baseline sessions, the participant was presented with 30 "how," "what," and "who" training questions. Each question was presented three times and participant's responses were recorded. No consequences (positive or negative) were delivered for responding to questions, however, intermittent reinforcement (praise and stickers) was used to reinforce attending and sitting still.

Training session Phase One. During the phase one training session, the participant was taught the intraverbal/phrase "I don't know" when presented with a question that the participant previously echoed. Prompts and continuous reinforcement were used to increase responding. To prompt the response "I don't know," during this phase the researcher would present the question and then immediately say "I don't know." Since the prompt was placed at the end of the question, the participant was likely to repeat it. If the participant echoed the prompt, he would receive immediate reinforcement. The prompt was gradually eliminated as the participant increased his rate of responding "I don't know." Once the participant reached the performance criterion (correct response to three unprompted questions in a row) the phase two session began.

Training Session Phase Two. During phase two, the participant was presented with the newly acquired question from phase one mixed in with three known questions. During phase two, the participant was taught to discriminate between known questions and unknown questions. To successfully complete this phase, the participant had to respond correctly to 10 consecutive, unprompted questions (both known and unknown).

Training Session Phase Three. During phase three, the use of reinforcement was faded from continuous to a fixed-ratio schedule 3). The participant needed to respond correctly to 10 consecutive questions to move to the probe sessions.

Intervention Session Probe One. During the intervention sessions, the participant was presented with 15 untrained, previously echoed "what," "how," and "who" questions to determine if generalization of the "I don't know" response had occurred. If generalization had not occurred, the participant was presented with another training session using a different question followed by another probe session to determine generalization. This process of alternating training and probe sessions continued until the participant had successfully responded to 14/15 untrained questions over two consecutive probe sessions. During probe one intervention sessions the participant was continually reinforced for a correct response. If he answered incorrectly to a question, that question was repeated and if necessary the correct response was prompted.

Probe two generalization sessions. When the participant had successfully provided the response "I don't know" to the untrained "what," "how," and "who" questions in probe one sessions, the participant began probe two generalization sessions. During the generalization sessions the participant was given a list of 15 untrained "where," "why," and "when" questions. The generalization session format was identical to the probe one session format.

Maintenance Baseline Probe. During the maintenance baseline probe, the participant was presented with the 30 "how," "what," and "who" training questions from the original baseline session with no prompts or reinforcement.

Refresher Probe Phase One. During the refresher probe session, the participant was retaught to respond "I don't know" to one of the previously echoed questions from the maintenance probe using direct prompts and consistent reinforcement.

Refresher Probe Phase Two. During phase two, the participant was asked previously echoed "who", "what", and "how" questions mixed with known questions. During this phase prompts were used as needed and reinforcement continued to be consistently applied.

Refresher Probe Phase Three. Once the participant responded with the learned "I don't know" phrase to the "who", "what" and "how" questions, these questions were presented again to the participant with limited prompts and a reinforcement fixed ratio schedule 3.

Maintenance probe. During the maintenance probes, the participant was asked probe one and probe two questions with intermittent reinforcement and no prompts.

Generalization probe. During the generalization probes, probe one and probe two questions were presented to the participant with intermittent reinforcement and no prompts in a new classroom environment, by his new classroom teacher who had not participated in the original research.

Experimental Design and Data Preparation and Analysis

A single-subject, changing criterion design (Alberto & Troutman, 2003) was implemented to examine the effectiveness of using ABA-based procedures to replace echolalia with the trained phrase " I don't know" or an appropriate response to a variety of questioning formats. A single-subject design was used because it enabled the researcher to observe an

individual subject and clearly assesses the impact of an independent variable (Abbott & Bordens, 1999). A changing criterion design was used because it incorporates the use of reinforcement to meet specific criteria to move from phase to phase (Alberto & Troutman, 2003).

Responses were coded into three categories, echolalia, appropriate verbal response, or other verbal (i.e. silence or random response). For the categories appropriate verbal response and other verbal, the participant's actual response or lack of response was recorded. If the child echoed part of or the entire question, this was indicated by a check in the column titled Echolalia.

Results - Baseline

Figure 1 indicates that Ryan was in baseline for three sessions. During these baseline session, Ryan echoed portions of or the entire baseline question presented to him for 100% of the baseline questions. When echoing the questions, Ryan frequently used mitigated echolalia (i.e., when asked, "What is a dog?" Ryan would reply "Yeah, a dog."). On other pretest questions, Ryan would echo the last words of the question (i.e. when asked "What is yellow?" Ryan would reply "yellow"). During baseline conditions, Ryan did not respond "I don't know" to any of the baseline questions. When presented with the three questions to which he knew the answer, Ryan responded appropriately to all three.

Post-Training Probe One

Ryan required seven training sessions using the baseline questions before he met the criteria to move into the probe one generalization sessions (e.g. "What time is lunch?", "How hot is the sun?", "Who do you know?"). During the first three training sessions, Ryan required prompts to produce the response "I don't know." By session seven, Ryan's dependence on prompts faded to only needing the reminder, "Remember to say I don't know if you don't know the answer," at the onset of the session. By the beginning of the eighth Probe One session, Ryan

responded, “I don’t know,” to 100% of the 15 Probe One questions without prompting over two consecutive probe sessions.

Post-Training Probe Two

During the probe two generalization sessions Ryan answered “I don’t know” to all of the probe two questions without prompts.

During both probe one and two sessions, Ryan was also asked known questions to assess his ability to discriminate between known questions (for which he had an appropriate response) and unknown questions (for which he must reply “I don’t know”). Ryan demonstrated discrimination by responding with the right answer to all known questions while continuing to reply to unknown questions with the phrase “I don’t know.”

Maintenance and Refresher

Seven months after the original data collection, the experimenter presented Ryan with the baseline questions to determine his retention of the learned response “I don’t know”. When asked the 30 original baseline questions with no prompts or reinforcement, Ryan responded appropriately (either with the trained response or an acceptable response) to 13 of the questions. He demonstrated echolalia in response to the remaining 17 questions.

After one refresher session of the trained response, in which Ryan received prompts and reinforcement for responding “I don’t know”, Ryan successfully replaced the learned response “I don’t know” for previously echoed responses. To assess Ryan’s ability to generalize the learned response across question formats, the experimenter asked Ryan both probe one and probe two questions mixed with known questions. During these phases, Ryan required no prompts to produce the learned response for all 15 questions asked during each session. Furthermore, he

was able to discriminate between known and unknown questions and was able to respond appropriately with a known response when possible.

Generalization

During the next generalization phase, Ryan's ability to maintain the learned response when presented with probe one and probe two questions in a new setting by a new person was assessed. During this phase, Ryan was able to respond to all the questions with the learned response when given intermittent reinforcement and no prompts with 100% accuracy.

Summary of Results

This study proposes that a child's echolalic responses to a variety of question formats can be eliminated through specific applied behavior analytic techniques namely, teaching of an appropriate replacement behavior (the phrase "I don't know") using prompting and reinforcement. By strategically teaching the child to replace echolalia with the phrase "I don't know" through a mixture of prompting and reinforcements, the researcher was able to eliminate most occurrences of echolalia. After training on a small sample of "what," "how," and "who" questions, the child was able to generalize the "I don't know" response to larger set of untrained questions that included "what," "how," "who," "why," "where," and "when" questions. Furthermore, the child was able to produce the learned "I don't know" response across different experimenters, environments, and across time.

Not only was the child successful at generalizing the newly learned response, but the fact that he continued to respond appropriately to the three known questions demonstrates his ability to discriminate between questions which were previously echoed and questions for which he already knew the appropriate response. This ability to discriminate confirms that the instruction in the response "I don't know" did not over-ride all other appropriate responses.

The findings from this study validate evidence provided by Schreibman and Carr (1978). Both studies indicated that it is possible to eliminate echolalic responses by training children to respond "I don't know" to a small set of questions. This study as well as the study completed by Schreibman and Carr (1978) also suggest that it is not necessary to train a child in an appropriate response for every given question, but that by training the response "I don't know" to a small sample of questions, the child will generalize the statement to other questions. These findings demonstrate a very economical form of intervention for children who demonstrate immediate echolalia. As Ryan expanded his vocabulary and communicative repertoire, he began to replace the learned phase with an appropriate response to many of the questions (eg. When asked, "What is yellow?", Ryan would respond, "A color"). Thus fulfilling his need for attention through conversation maintenance appropriately by utilizing either the learned response or an appropriate response unique to the given question.

Reliability

The data collected during reliability sessions matched data collected by the primary experimenter indicating reliability and validity of data. Furthermore, the consistency of responses across experimenters indicated that Ryan had generalized the response not only across untrained questions, but across experimenters as well. This study concluded that specific ABA based training of the response "I don't know" to a small set of questions was also generalized across experimenters, as indicated by the reliability and novel experimenter data, as well as environments (school and home). This further demonstrated the conclusions drawn by Schreibman and Carr (1978) that the elimination of echolalia was not a result of one experimenter's manner when presenting a question or a particular environment in which the

question was presented, but rather it was a result of the child's ability to generalize the newly learned response across people, questions, environments, and time.

Limitations

Through the course of this study two main issues arose. First, the child's responses to only "what," "how," "who," "where," "why," and "when" questions were assessed. The study did not include data collected on the child's responses to other verbal stimuli such as mands (i.e., "Raise your hand."), inversion questions (i.e., "Is it raining outside?"), and tag questions (i.e., "You can color, can't you?"). To continue this study further, the researcher should present verbal stimuli in these formats to determine the child's success at generalizing the phrase "I don't know" across these different contexts.

The second limitation relates to the ability to generalize the results. Even though the subject has a diagnosis of autism, he is very high functioning and his language development, including spontaneous language, has increased significantly prior to this study as a result of his involvement in an early intervention special education program for the past year. Therefore, one should be cautioned before generalizing these results to a child who exhibits a more severe form of autism and has not already undergone prior intervention. However, prior studies in this area, utilizing subjects who were lower functioning, indicated success in generalizing the phrase "I don't know" after more probe sessions (Schreibman & Carr, 1978). In fact, when the experimenter probed untrained questions at home Ryan's success of responding with the phrase "I don't know" was slightly less (11/15 untrained questions), yet continued to demonstrate his ability to generalize the response across environments.

Future Research

Valid research linking Applied Behavior Analysis based teaching to the elimination of echolalia in children with autism is still very limited. Not only is further research necessary to replicate this study using children with varying degrees of autism and different levels of prior intervention, but further research applying other AB- based techniques to reduce echolalia would also be significant. For instance, research surrounding the direct teaching of the use of environmental cues when responding to questions might also lead to a reduction in echolalia and an increase in an appropriate response. Furthermore, a longitudinal study completed on a child with autism following the teaching of the appropriate replacement response (i.e., "I don't know") through the time in which the child learns to replace the learned response with the specific correct answer learned through the course of his education would also be beneficial. Findings from a study such as this would indicate if the teaching of the phrase "I don't know" has served its purpose as a transitional, functional response until the child has learned the specific, correct response to a given question.

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Appendix A

Baseline Questions

	Echolalia	Appropriate Verbal (write exact response)	Other Verbal (i.e. silence or random response)
1. What are you doing?	X		
2. What time is it?	X		
3. What is your friend's name?	X		
4. What is a dog?	X		
5. What is up there?	X		
6. What do you do?	X		
7. What is yellow?	X		
8. What does a fruit taste like?	X		
9. What says "ow"?	X		
10. What do you want?	X		
11. How are you?	X		
12. How is your friend?	X		

13. How did he get home?	X		
14. How does a chicken walk?	X		
	Echolalia	Appropriate Verbal (write exact response)	Other Verbal (i.e. silence or random response)
16. How is your tummy?	X		
17. How tall is a giraffe?	X		
18. How many people do you see?	X		
19. How far is Disneyland?	X		
20. How do monkeys talk?	X		
21. Who are my friends?	X		
22. Who is first in line?	X		
23. Who wears yellow?	X		
24. Who jumps high?	X		
25. Who is he?	X		
26. Who does she need?	X		
27. Who runs fast?	X		
28. Who swims in the water?	X		
29. Who needs you?	X		
30. Who ate the sandwich?	X		

Appendix B

Probe One Questions
(Subject used echolalia unless "I don't know" response is indicated)

	Echolalia	Appropriate Verbal (write exact response)	Other Verbal (i.e. silence or random response)
1. What is your elbow?		"I don't know" (with prompt) – Day 3 "I don't know" (without prompt) – Day 4	
2. What is an elephant?		"I don't know" (with prompt) – Day 2 "I don't know" (without prompt) – Day 3 "I don't know" (without prompt) – Day 4	
3. What do you do?		"I don't know" (without prompt) – Day 4	
4. What time is lunch?		"I don't know" (with prompt) – Day 1 "I don't know" (with prompt) – Day 2 "I don't know" (without prompt) – Day 3 "I don't know" (without prompt) – Day 4	
5. What does the teacher say?		"I don't know" (with prompt) – Day 2 "I don't know" (without prompt) – Day 4	
6. How big is the school?		"I don't know" (with prompt) – Day 2 "I don't know" (with prompt) – Day 3 "I don't know" (without prompt) – Day 4	
7. How many friends do you have?		"I don't know" (with prompt) – Day 1 "I don't know" (without prompt) – Day 4	

8. How old is the president?		"I don't know" (w/out prompt) Day 3 "I don't know" (w/out prompt) Day 4	
	Echolalia	Appropriate Verbal (write exact response)	Other Verbal (i.e. silence or random response)
9. How dark is the night?		"I don't know" (with prompt) – Day 1 "I don't know" (without prompt) – Day 2 "I don't know" (without prompt) – Day 3 "I don't know" (without prompt) – Day 4	
10. How hot is the sun?		"I don't know" (with prompt) – Day 1 "I don't know" (without prompt) – Day 2 "I don't know" (without prompt) – Day 3 "I don't know" (without prompt) – Day 4	
11. Who is the oldest person?		"I don't know" (with prompt) – Day 1 "I don't know" (without prompt) – Day 3 "I don't know" (without prompt) – Day 4	
12. Who ate the last cookie?		"I don't know" (with prompt) – Day 1 "I don't know" (without prompt) – Day 4	
13. Who finished first?		"I don't know" (with prompt) – Day 3 "I don't know" (without prompt) – Day 4	
14. Who do you know?		"I don't know" (with prompt) – Day 1 "I don't know" (without prompt) – Day 4	

15. Who did she visit?		"I don't know" (with prompt) – Day 3 "I don't know" (without prompt) – Day 4	

Appendix C

Probe 2 Questions

	Echolalia	Appropriate Verbal (write exact response)	Other Verbal (i.e. silence or random response)
1. Where do fish swim?		"I don't know" (without prompt) – Day 1	
2. Where is the door?		"I don't know" (without prompt) – Day 1	
3. Where do cows sleep?		"I don't know" (without prompt) – Day 1	
4. Where is the principal?		"I don't know" (without prompt) – Day 1	
5. Where does the rain fall?		"I don't know" (without prompt) – Day 1	
6. Why do rabbits run?		"I don't know" (without prompt) – Day 1	
7. Why do you smile?		"I don't know" (without prompt) – Day 1	
8. Why does the sun shine?		"I don't know" (without prompt) – Day 1	
9. Why does she cry?		"I don't know" (without prompt) – Day 1	
10. Why is the dirt brown?		"I don't know" (without prompt) – Day 1	
11. When is lunch?		"I don't know" (without prompt) – Day 1	
12. When do we play?		"I don't know" (without prompt) – Day 1	
13. When does he leave?		"I don't know" (without prompt) – Day 1	
14. When do you sing?		"I don't know" (without prompt) – Day 1	
15. When does the horse sleep?		"I don't know" (without prompt) – Day 1	

Appendix D

Known Questions
(answered these questions appropriately throughout all training and probe sessions)

1. What's your name?
2. How old are you?
3. Who am I?