

5-1-2020

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NORTHERN ILLINOIS UNIVERSITY

Intervention Techniques Targeting Echolalia: A Systematic Review

A Capstone Submitted to the

University Honors Program

In Partial Fulfillment of the

Requirements of the Baccalaureate Degree

With Honors

Department Of

Allied Health and Communicative Disorders

By

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DeKalb, Illinois

May 2020

University Honors Program

Capstone Faculty Approval Page

Capstone Title (print or type)

Intervention Techniques Targeting Echolalia: A Systematic Review

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Date of Approval (print or type) 5/1/20

**Date and Venue of Presentation February 7th, 2020 Donald E. Stephens Convention Center
- Rosemont, IL.**

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Abstract

Purpose: Echolalic speech impacts individuals with autism spectrum disorder (ASD)'s social acceptance, vocational opportunities, and independent living opportunities. However, speech-language pathologists (SLPs) face multiple challenges when consulting the empirical literature on how to effectively target echolalia, such as inconsistent definitions and philosophically different approaches across disciplines. The purpose of this systematic review was to explore the current evidence for interventions targeting echolalia to help guide clinicians using evidence-based practice.

Method: Search terms were entered into five databases. After eliminating irrelevant and duplicate articles, 81 articles underwent full text review to determine whether they met the inclusionary/exclusionary criteria. The five included articles were then appraised for the quality of their research design, treatment fidelity, and interobserver agreement and analyzed for final data extraction.

Results: All studies reported reduced echolalic speech outcomes. Of the five studies, three used a response interruption and redirection intervention technique, one utilized a whole-body vibration, and the final used a computer-based intervention program. None of the included interventions were implemented by an SLP.

Conclusion: SLPs need to be aware of how other disciplines, such as behavioral specialists, define echolalia and how these fields shape the philosophical underpinnings of intervention approaches. Future research from SLPs is needed.

Introduction

As many practicing speech-language pathologists (SLPs) are aware, children with autism spectrum disorder (ASD) present with serious social communication deficits (American Psychiatric Association, 2013). But, in addition to these social communication weaknesses, the second key diagnostic feature of ASD stipulates that an individual must present with “restricted, repetitive patterns of behavior, interests, or activities” (American Psychiatric Association, 2013). In the speech realm, these repetitive behaviors are described in a variety of ways, such as verbal stereotypies or echolalia (Stiegler, 2015; van Santen et al., 2013). Echolalia, or the repetition of utterances produced by oneself or others, is one of the most recognizable characteristics of autism spectrum disorder (ASD; Stiegler 2015). It has been estimated that 75% to 85% of children with ASD produce repetitive speech (Mayes et al., 2011; Rutter et al., 1967; Wing, 1971). Although this characteristic feature is pervasive within the ASD population, many aspects of echolalia remain relatively unknown.

It is unclear as to why children produce echolalia. SLPs within the field often speculate that it is a compensatory mechanism for when language is insufficient for current language situations (Prizant & Rydell, 1984). According Grossi et al. (2013), echolalia can be defined as an imitative behavior whose expression is dependent on the environment. This phenomenon occurs in situations such as the induced condition when (automatic) processes that require the inhibition of the repetition of received communication are missing. In other words, echolalia is speculated to be a compensatory mechanism for situations where there is a conversational response required; echolalia may not be the correct response, but it can be a form of functional communication (Grossi et al., 2013).

Even though echolalia may be utilized as a compensatory mechanism, echolalic speech has been shown to impact one's quality of life, such as lower social acceptance, vocational opportunities, and independent living opportunities (Paul et al., 2005). In a small-scale comparative study, Fay (1969) commented on the vocal delivery of the echoing behavior of those with echolalia. Fay referred to it as having an "unemotional parasitic fidelity" and as being "monotone without evidence of interest in the semantic features of dialogue". Fay also noted how repetitions seemed so literal and automatic that tone of voice, accent, and intonation patterns are mimicked as are coughs, hisses, or other environmental sounds (Fay, 1969, p. 38; Fay & Coleman, 1977)

Because vocal stress and resonance irregularities associated with echolalia and language impairments influence how listeners perceive a speaker's social and communicative competence (Paul et al., 2005), SLPs need to know how to respond to help children with ASD who produce echolalia. The American Speech-Language-Hearing Association (ASHA) explains that SLPs should ensure that individuals with ASD develop a functional communication system that allows for optimal social and educational experiences and promotes independence and self-advocacy (ASHA, 2016). Although interventions targeting social communication weaknesses are widely implemented by SLPs who work with children with ASD, clear intervention practices addressing echolalia also need to be outlined in order for clinicians to support functional communication.

Obstacles Limiting Echolalia Research

Research guiding clinicians on best-practices for echolalia is limited. Due to wide ranging definitions within research, inconsistent and limited measuring techniques, and other behavioral approaches with different philosophies (Stiegler, 2015), SLPs are faced with a challenge to provide sound evidence-based interventions.

Differing definitions. The repetitive speech patterns characteristic of ASD have been discussed and labeled in a variety of ways, primarily using the terms echolalia and stereotypy. There are two types of echolalia most often discussed in the literature, immediate and delayed, and two types of stereotypy, vocal stereotypy and verbal stereotypy. Because the echolalia intervention literature is full of disagreements as to how to define echolalia (van Santen et al., 2013), making well-informed clinical decisions is difficult. In an earlier review on interventions targeting echolalia and vocal stereotypy, Stiegler identified at least 12 different operational definitions of just the term “vocal stereotypy” within the empirical literature over a time period of only nine years (2015). Prizant and Rydell (1984) mention that there are vast variations of echolalia definitions due to considering the dimensions of exactness of repetition, the degree of comprehension of the utterance repeated, and the presence or absence of communicative intent underlying the production of echoic utterances. Perhaps it’s not surprising that practicing clinicians are unclear on how best to approach echolalia in intervention given that a consistent definition has yet to be established within the empirical literature.

Challenges objectively measuring echolalia. Quantifying echolalic speech is time consuming and labor intensive, so research that measures echolalia is severely limited (van Santen et al., 2013). Most previous studies have broadly considered repetitions of “words or phrases” to be echolalia speech, but this vague use of terms can lead to inconsistent approaches to measuring echolalia across studies. Operationalized definitions of echolalia have been explicitly measured in some studies (e.g., Paccia & Curcio, 1982; Roberts, 1989), whereas others provided little detail regarding how instances of echolalia were defined or measured (e.g., Paul et al., 1987). As van Santen and colleagues explain, “research has relied solely on human

perceptual judgment to identify repetitive speech behaviors, which is likely to be time-intensive and unreliable across long-duration recordings” (van Santen et al., 2013, p. 2).

Changes in the diagnostic criteria of ASD have also impacted measurements of echolalia. Much of the research on echolalia has reflected more severe forms of ASD (Fombonne et al., 2011). If measurements were based on differing ASD diagnostic criteria, then the challenge of applying these measurements today becomes even more problematic.

Philosophical differences in approaching echolalia. In the field of speech-language pathology, echolalia has long been thought of as serving a variety of communicative functions, such as a means of commenting, protesting, requesting, labeling, turn-taking, and many others (Prizant & Rydell, 1984; Stiegler, 2015). Although SLPs might see echolalia as a compensatory mechanism to communicate that could be cultivated or shaped into more generative or flexible speech, other disciplines philosophically approach echolalia differently. For example, Applied Behavioral Analysis (ABA) approaches often view echolalia as a maladaptive form of speech and is therefore a behavior to be extinguished (Stiegler, 2015). A comprehensive review article by Stiegler (2015) exposed SLPs to the wide range of differing intervention approaches targeting echolalia. Matched stimulation, differential reinforcement of other behaviors, and response interruption and redirection are among a handful of the discussed ABA approaches.

Matched stimulus is when researchers provided stimuli that would be equally comparable to the vocal stereotypy (VS) such as music, recordings or books, or recordings of their individual’s own vocalizations. Because VS is viewed as noncommunicative, some researchers have used forms of matched stimulation, as it appears to provide stimuli that would be equally acceptable to the individual with ASD and perhaps replace the behaviors defined as VS. VS was

shown to reduce when the stimuli were in use but would return when the stimuli was removed (Anderson & Le, 2011)

In a study conducted by Taylor et al. (2005), differential reinforcement of other behaviors was explored. In this study it was hypothesized that if the individual chose to attend more time with an alternative stimuli, such as a preferred toy, then they would be less likely to engage in VS. The researchers presented preferred musical or sound toys after participants quietly played with non-musical toys. If the child engaged in VS during the time interval, the researcher would say, “No, that’s not quiet. I have to reset your timer”. If the child did not engage in VS during the allotted time, the researcher would say, “That’s great playing quietly!” and the child would be allowed to play with the preferred auditory toys. Although this study showed reduced VS, researchers could not determine if the child learned to use less VS in appropriate situations or if they simply learned to just be quieter. This is alarming for SLPs who want to encourage children with ASD to increase their communicative attempts, not to become more silent.

Response interruption and redirection therapy, another behavioral approach, applies a method of distracting the child with another command when a VS is produced (Cassella et al., 2011). In one study measuring the effectiveness of this approach, if the child participant engaged in VS, the researcher would say the subject’s name, gain eye contact as a confirmation of attention, and give one of a pool of 10 verbal commands that required non-vocal responses such as “touch head”. This behavioral approach was shown to reduce VS in a formal setting, but it did not generalize to other settings (Cassella et al., 2011).

Purpose of this Study

In summary, targeting echolalia may have significant quality of life implications for children with ASD. But, varying definitions, inconsistent measurements, and philosophical

differences in approaches have left SLPs with difficulty knowing what the best strategy is to target echolalic speech in children with ASD. The purpose of this study was to help SLPs identify any available research on current evidence-based approaches to target echolalia. As such, a systematic review was conducted to explore the current evidence-based interventions for targeting echolalia or repetitive speech in children with ASD.

Method

Inclusion Criteria

Developing a research protocol began with determining a set of inclusion criteria. For a study to be included in this systematic review, the publication must have dated between the date of database inception to October 16th, 2019 (including those that are published on-line first), and the studies were written as an article in a refereed journal, a book chapter, or a document made available through the consulted databases or it appears in published conference proceedings. Participants within each study needed to present with a form of repetitive speech or echolalia, to have a diagnosed Autism Spectrum Disorder according to the Diagnostic and Statistical Manual of Mental Disorders, Third, Fourth, or Fifth edition (DSM-III, IV, or V; American Psychological Association, 1980, 1994, & 2013), the International Statistical Classification of Diseases, Tenth Revision (ICD-10; World Health Organization, 2005), Autism Diagnostic Interview-Revised (ADI-R; Rutter et al. 2003), Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2012), or a reported medical diagnosis, and be between the ages of 0 and 21 before the start of the study. The article needed to have a treatment or intervention study (the study may evaluate one treatment or compare two or more treatments) and report an intervention targeting at least one repetitive speech outcome. Additionally, each study was written in English and employed a (quasi-)experimental design for evaluating the effectiveness or efficiency of a treatment. Articles

were excluded if they did not fall within these guidelines. Excluded articles included topics on motor stereotypy, participants without ASD, and intervention studies that did not directly target echolalia.

Search Strategy

The primary investigator searched a total of five databases within the Northern Illinois University library system. The following electronic databases were included: Cumulative Index to Nursing and Allied Health Literature (CINHAL), PubMed, PsychINFO, Education Research Information Center (ERIC), and Linguistic and Language Behavior Abstracts. Guided by the research question, the following terms were searched: children, Autism Spectrum Disorder (ASD), intervention, and echolalia. Within these databases, synonyms were collected for each individual term and combined with the Boolean operator OR. For example, if the term was Autism and synonyms within the database came up as Autism, Autistic, and Autism Spectrum Disorder then all terms were combined as Autism OR Autistic OR Autism Spectrum Disorder as a concept group. Then, each concept group was combined using the Boolean operator AND. Using the same terms as an example, the concept group Autism and Intervention would be combined as Autism OR Autistic OR Autism Spectrum Disorder AND Intervention OR Therapy OR Treatment. Table 1 summarizes the synonyms searched within each database based on the respective Medical Subject Headings (MESH) terms.

With the combined search terms, the primary investigator found a total of 372 articles. The titles and abstracts were analyzed by the primary investigator. If any article title or abstract opposed the inclusion criteria, then the article was noted and excluded from further review. For example, if the title stated “Stereotypy” and the abstract mentioned intervention targeting “motor stereotypy” then the study was excluded. A total of 81 articles from included titles and abstracts

reviews underwent a full text review. These articles were analyzed by the primary investigator and compared to the inclusion criteria. Out of 81 articles, a total of 5 met all the inclusion criteria. Figure 1 represents the search results from the database search, the title and abstract review, and the full text review.

Inter-rater Reliability

Inter-rater reliability was completed by the primary investigator and one trained research assistants who scored independently of each other. A two-step process was initiated. First, the research assistant was randomly assigned 20 articles (i.e., 25% of total articles) from the articles that passed the title and abstract review. A random number generator (random.org) was used to randomize articles chosen for the blinded, independent research assistant. A copy of the inclusion and exclusion criteria checklist was supplied to the research assistant as well. Second, the research assistant went through each of the 20 randomly assigned articles and marked them as included or excluded according to the inclusionary checklist. The primary investigator completed the same scoring process but with all 81 articles. Once scoring was completed by the primary investigator and the research assistant, results were given to the capstone mentor for scoring to calculate inter-rater reliability. The inclusion reliability resulted in 100% agreement between scorers. The Phi Coefficient was .947 and Cohen's Kappa was .945, indicating almost perfect agreement (Hallgren, 2012).

Study Appraisal

The five articles selected underwent a quality appraisal procedure that rated the quality and appropriateness of study designs, the interobserver agreement, and the treatment integrity of studies using the Certainty of Evidence Framework (Bailey et al., 1991). Interobserver agreement was classified as the degree to which two independent observers agree on what is

being recorded. Acceptable levels of observer consistency are 80% or greater. Treatment integrity was classified as the degree to which an independent variable is implemented as intended (Schlosser, 2002). Treatment integrity should be taken across 20% - 40% of intervention sessions, with 80% considered adequate (independent observers preferred). Depending on the reporting of such standards, the studies were classified as conclusive, preponderant, suggestive, or inconclusive. Conclusive studies would indicate a clearly stated and sound research design. These studies needed to specify if there were independent or blind observers and an 80% or greater interobserver agreement. Also, the study must have clearly reported treatment integrity higher than 80% and taken across 20% - 40% of the sessions. For a study rated as conclusive, the outcomes were almost certainly a result of the intervention. Preponderant studies showed a strong design but included minor flaws within the treatment integrity or interobserver agreement. A preponderant rating could also be given if the interobserver agreement and treatment integrity were strong but there were minor flaws within the design. The outcome of a preponderant study likely occurred as a result of the intervention. Suggestive studies may contain either minor flaws in the design and either missing or flawed interobserver agreement or treatment integrity. In suggestive studies, it is plausible that outcomes are a result of the intervention. Inconclusive studies would show fatal flaws in the design or were missing both treatment integrity and interobserver agreement. No conclusions about the intervention outcomes may be drawn from inconclusive studies.

After going through each article's design, interobserver agreement, and treatment integrity, two studies were rated as preponderant (Gibbs et al., 2018; Love et al., 2012) and three were rated as suggestive (Bressel et al., 2011; Hetzroni & Tannous, 2004; Pastrana et al., 2013). The articles rated as preponderant met the guidelines of high-quality research but did not overtly

state if the reliability raters were independent or blind (i.e., a minor flaw). In the articles rated as suggestive, no measures of treatment integrity were reported, but otherwise the research designs and interobserver agreement were sufficient.

Results

This systematic review was interested in the state of the current evidence on interventions targeting echolalia in children with ASD. To provide clinicians with the information needed to make informed clinical decisions, the findings pertaining to the participant characteristics, echolalia definitions, interventions, and outcomes from all five included studies are presented here. A detailed summary of these results is available in Table 2.

Participants Characteristics

Of the five studies collected, all were single-subject designs. As such, a total of fourteen children between the ages of four and twelve were included across all studies. All participants had a diagnosis of ASD according to the DSM-III, IV, or V, ICD-10, ADI-R, ADOS, or through a reported medical diagnosis, and all presented with varying forms of echolalia. Participants' echolalia was defined within each study.

Echolalia Definitions

In the five included studies, echolalia was defined six different ways. Definitions varied for each study and, in one study, on the participants involved. Gibbs, Tullis, Thomas and Elkins (2018) defined echolalia as “any instance of contextually inappropriate vocalization lasting at least 3 seconds” (p.4). Bressel and Gibbons (2011) stated their definition as “disruptive stereotypy that interfered with learning; and, possessed no other medical conditions” (p. 8). Hetzroni and Tannous (2004) defined it as “a distortion in the interaction between language components produced a form of speech that was defined as functional immediate or delayed

echolalia” (p. 2). Echolalia was split into two definitions dependent on the participant in the Love et al. (2012) study. For the one participant, echolalia was “any instance of non-contextual phrases or repetitions of non-contextual words, phrases, or sounds was considered echolalic responses. It included non-contextual repetitions, defined as at least two occurrences of phonemes (two or more emissions of the same phoneme within a 5-s interval” (p. 3). For the other participant, “non-contextual or nonfunctional speech, including rhythmic or patterned and single phonemes, repetitions of words, phonemes or non-contextual high-pitched squeals or squeaks, and reciting of movie or videogame scripts” (p. 3) were included as echolalic responses. Pastrana et al. (2013) defined echolalia as “any vocalization using the vocal chords or any vocalization activating the vocal chords, whispered sounds, rapid audible breathing (two or more breathing cycles in 1 s), and exhaling through the lips causing audible vibration” (p. 5).

Interventions Targeting Echolalia

The interventions used to target echolalia were whole body vibration (Bressel et al., 2011), response interruption and redirection (RIRD; Pastrana et al., 2013), noncontingent music and RIRD (Gibbs et al., 2018), a computer-based intervention program (Hetzroni & Tannous, 2004), and matched stimulation (MS) and RIRD (Love et al., 2012).

One study assessed the effectiveness of whole-body vibration (Bressel et al., 2011). The theoretical support behind the use of whole-body vibration put forth by the author was related to other effective uses of vibration. For example, whole body vibration has been shown to reduce repetitive hand tremors in patients with Parkinson’s disease (Bressel et al., 2011). The whole-body vibration intervention was completed by standing on a vibration platform with the machine turned off and on for three to four, 30-s periods. Using this approach, the frequency of

stereotypic behaviors was measured for 5 minutes before and after standing on the vibrating platform (Bressel et al., 2011).

In another study, a computer program was developed to target echolalia (Hetzroni & Tennaous, 2004). The computer program intervention implemented computer-based practice on the use of functional communication in a controlled setting (Hetzroni & Tannous, 2004). The justification for using a computer program was that computers have been found to be effective for teaching children with ASD across various instructional skills; there was a need to investigate whether children with ASD could learn specific language skills within a structured and a controlled environment (Hetzroni & Tannous, 2004).

Three included studies implemented RIRD, a behavioral approach (Gibbs, Tullis Thomas, & Elkins, 2018; Love, Miguel, Fernand, & LaBrie, 2012; Pastrana, Rapp, & Frewin, 2013). In these studies, the experimenter instructed the participant to follow a series of gross motor imitation antecedents, such as putting blocks into a bucket. The experimenter presented gross motor imitation antecedents until the participant correctly and independently responded to three consecutive instructions in the absence of the target motor stereotypy (Schumacher & Rapp, 2011). For incorrect or non-responses, the experimenter reissued the antecedent and provided brief physical prompting to assist the participant in demonstrating the response (Pastrana, Rapp, & Frewin, 2013). Noncontingent music and RIRD aimed to provide noncontingent (NC) music via headphones, as a MS. One study evaluated both RIRD and MS + RIRD during task demands to determine which was more effective at reducing the level of vocal stereotypy (Gibbs et al., 2018). Matched stimulus (MS) and RIRD intervention consisted of lowering the motivating operation for the products of stereotypy and adding in MS (Love, Miguel, Fernand, & LaBrie, 2012).

Echolalia Outcomes

All five included studies reported reductions in echolalia following intervention. The whole-body vibration intervention found that two of three children produced lower vocal stereotypy (Bressel et al., 2011). The computer program intervention had three of the five children produce fewer sentences with immediate echolalia and five of five children produce fewer sentences with delayed echolalia (Hetzroni & Tannous, 2004). All three RIRD studies had reduced forms of echolalia. The noncontingent music and RIRD intervention reported that all participants had decreased vocal stereotypy and increased on-task behavior for addition of MS to RIRD (Gibbs, Tullis Thomas, & Elkins, 2018). Love et al. (2012) found that all participants produced lower levels of stereotypy using a MS and RIRD intervention. Pastrana et al. (2015) RIRD intervention showed that one participant had an immediate decrease for vocal stereotypy.

Discussion

The aim of this systematic review was to identify evidence-based interventions targeting echolalia to aid practicing SLPs in clinical decision-making. In this review, five intervention studies were identified that resulted in decreases in echolalic speech in individuals with ASD. Through this review process and based on the results, there are clear explanations for the challenges SLPs face when trying to incorporate evidence-based approaches to targeting echolalia. Each of these findings will be discussed, and future recommendations to overcome these challenges are outlined below.

First, a large number of articles first identified had to be excluded from this review because they did not report specific diagnoses of ASD. Most of these excluded articles had statements such as, “participants with autism,” but did not indicate how they determined the participants were diagnosed or under which diagnostic criteria (i.e., under the DSM-IV or DSM-

5 guidelines). Without knowing the specific diagnostic procedures, SLPs would be unable to make an informed decision about whether the intervention in the article would be appropriate or generalizable to the children on their caseloads. But, this should also be encouraging for future researchers hoping to make progress within this body of research; simply reporting how the children with ASD were diagnosed would significantly improve the current literature base.

Second, of the five articles found studying echolalia intervention techniques, none were published within a speech-language pathology journal. Differing fields, such as ABA, are leading in the echolalia research that SLPs need to make informed clinical decisions. Although SLPs have access to many evidence-based publications, especially through their ASHA membership, they may not have access to ABA specific journals or several of the databases utilized in this systematic review. This severely limits clinicians' access to the current body of evidence focused on echolalia interventions. Moving forward, SLPs conducting more research and publishing their findings within journals accessible to practicing clinicians could make a huge difference on the knowledge of echolalia and effective intervention approaches.

Thirdly, it is evident that pushes to settle on consistent definitions of repetitive speech are not yet resolved; each study included had defined their participants' echolalia differently. The definitions of echolalia within the same studies can range from any form of vocal utterances (squeals, humming, rapid audible breathing) to repetition of words or reciting dialog (Love et al., 2012). This is particularly important when distinguishing functional and non-functional speech. Stiegler (2015) explained that although echolalic utterances may appear non-contextual on the surface, they may have idiosyncratic meanings that can be discovered over time with familiarity and/or careful study. Because of the loose definitions pervasive in the evidence, individuals with

echolalic speech are placed at risk for interventions that could stifle their communication growth rather than shape it.

This brings into question why an abatement intervention would be applied towards echolalia. Stiegler (2015) mentions that in these behavioral treatments, “echolalia is consistently viewed as nonmeaningful, inappropriate, non-contextual, and noncommunicative” (p. 8).

Reasons for abating echolalia are often because parents or teachers feel it interferes with the child’s education or the education of classmates and limits opportunities for the child to interact with peers (Athens et al., 2008; Enloe & Rapp, 2014). Parents and teachers have also worried that echolalia can be stigmatizing and make the individual appear different from their peers (Haley, Heick, & Luiselli, 2010; Rapp et al., 2009). However, if studies are not considering the reasons or functions behind a child’s use of echolalia, it’s not clear that abatement approaches are effective in progressing an individual’s communication abilities.

Past studies have indicated multiple functional uses of both immediate and delayed echolalia in children with ASD. A study by Prizant and Dunchan (1981) found seven functional uses of immediate echolalia after analyzing how children with ASD interact with adults in school and home settings. A later study done by Prizant and Rydell (1984) found fourteen functional uses of delayed echolalia. Their findings indicated that children used echolalia for a variety of communicative uses, such as requesting items, calling for attention, and protesting. These studies enhance SLPs’ understanding of a child’s communication system and how its functional uses can lead to specific intervention plans and approaches to accomplish communication goals (Prizant & Rydell, 1984).

Of the five included studies, three found that RIRD was effective for reducing vocal stereotypy. Although RIRD intervention had reduced echolalia outcomes, it is an extinguishing

behavior technique. It is possible that these differing approaches are combating each other in producing a strong communication system for children with ASD. For example, if an ABA therapist is working to reduce a child's repetitive speech productions while an SLP who is seeing the same child is attempting to elicit more communicative bids from that child, their approaches could be working counter to each other within the same child. If the leading research is in RIRD and other abatement forms of therapy, SLPs need to be aware of how other professionals from outside disciplines working with the same child could be affecting their progress in intervention. In that regard, research done by SLPs is strongly needed to see how shaping echolalia can lead to a more functional communication system.

And finally, of the five included articles, all used single-subject designs, indicating that more group-design research is still needed. Single-subject designs have limited generalization compared to group studies, especially for a heterogenous group like the ASD population. For clinicians to appropriately use evidence and apply it to their clients, more research that spans across larger groups of children with ASD and echolalia is desperately needed.

Limitations

One possible limitation to this systematic review could be that, as indicated within the inclusion criteria, the interventions must have specifically targeted echolalia. There are certainly other intervention studies that set out to include other therapeutic targets that may have also reported secondary echolalia outcomes which would not have been included in this study. In other words, if the study did not set out to target echolalia within their design, then those articles were not included. Future systematic reviews could expand their inclusionary criteria to focus on interventions with echolalia outcomes, even if they did not directly target the echolalic speech in

intervention to give clinicians a broader sense of the clinical options available to help target echolalia in individuals with ASD.

Conclusion

In summary, SLPs are faced with many challenges when targeting echolalia. The varying terms, challenges with objectively measuring, and philosophical differences in approaching echolalia interventions reported by others (e.g., Stiegler, 2015) were still found in the current study. Also, it is apparent that there is a need for more research within the field of speech-language pathology; other fields are dominating the published intervention options. It is important for SLPs need to be aware of how other disciplines, such as behavioral specialists, define echolalia and vocal stereotypy, and how these fields shape the philosophical underpinnings of intervention approaches and may be affecting speech-language interventions attempting to enhance communicative outcomes in children with ASD.

Acknowledgements

Thank you to Beth McGowan and Olivia Portnov for their contributions. This research was supported by the NIU center for the Interdisciplinary Study of Language and Literacy.

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Table 1*Database Search Terms*

Database	Search Terms
CINAHL	Autistic Disorder
	Child Disabled, Child Behavior Disorders, Child Behavior, Child, Preschool, Children
	Echolalia, Repetitive Speech, Stereotypy
	Early Childhood Intervention, Early Intervention, Intervention Trials, Nursing Interventions, intervention, Behavior Therapy, Therapy, Treatment Outcomes, Treatment
ERIC	Autistic Disorder
	Child Disabled, Child Behavior Disorders, Child Behavior, Child, Preschool, Children
	Echolalia, Repetitive Speech, Stereotypy
	Early Childhood Intervention, Early Intervention, Intervention Trials, Nursing Interventions, intervention, Behavior Therapy, Therapy, Treatment Outcomes, Treatment
PsychInfo	Autism Spectrum Disorder
	Children
	Echolalia, Stereotyped behavior, Repetitive speech

	Response to intervention, Group intervention, Family intervention, School based intervention, Early intervention, Intervention, Therapy, Treatment, Treatment outcomes, Treatment process and outcome measures
PubMed	Autistic Disorder, Autism Spectrum Disorder Child, Adult Children, Disabled
	Children, Child, Preschool
	Echolalia, repetitive speech, stereotypy
	Treatment Outcome, Therapeutics, therapy, Early Intervention (Education), Clinical Trial, Intervention
Linguistic and Language Behavior Abstracts	Autism
	Children, preschool children
	Echolalia
	Therapy, Speech Therapy, Language Therapy

Table 2*Results*

Article and Author	Participants	Intervention	Comparison	Design	Echolalia Definitions	Outcomes
Gibbs, Tullis Thomas, & Elkins, 2018	2 (1 male) ages 4 and 7	Noncontingent Music and Response Interruption and Redirection (RIRD)	RIRD-only condition	Single Subject ABAB Reversal Design	Any instance of contextually inappropriate vocalization lasting at least 3 seconds	All participants had decreased vocal stereotypy and increased on-task behavior for addition of MS to RIRD
Gibbons, 2011	3 (3 males) Ages 5, 5, and 4	Whole body vibration	No vibration pre-measurements	Single-case pilot study	Disruptive stereotypy that interfere with learning; and, possess no other medical conditions	2 of 3 children produced lower vocal stereotypy
Hetzroni & Tannous, 2004	5 (3 males) Ages 12.5, 11.5, 8, 8.5, 7.8	Computer-Based Intervention Program	No intervention	Single subject multiple baseline	A distortion in the interaction between language components produces a form of speech that is defined as functional immediate or delayed echolalia	3 of the 5 children produced fewer sentences with immediate echolalia and 5 of 5 children produced fewer sentences with delayed echolalia

Love, Miguel, Fernand, & LaBrie, 2012	2 (2 males) Ages 8 and 9	Matched Stimulus (MS) and Response Interruption and Redirection (RIRD)	No consequences	Single subject multiple baseline design	<p>Any instance of non-contextual phrases or repetitions of non-contextual words, phrases, or sounds. It included non-contextual repetitions, defined as at least two occurrences of phonemes (two or more emissions of the same phoneme within a 5-s interval).</p> <p>Non-contextual or nonfunctional speech, including rhythmic or patterned and single phonemes Repetitions of words, phonemes or non-contextual high-pitched squeals or squeaks, and reciting of movie or videogame scripts were also included.</p>	Both participants produced lower levels of stereotypy
Pastrana, Rapp, & Frewin, 2013	2 (2 males) Ages 9.6 and 6.11	Response Interruption and Redirection	No Treatment levels	Single subject multiple baseline design	<p>Any vocalization using the vocal chords.</p> <p>Any vocalization activating the vocal chords, whispered sounds, rapid audible breathing (two or more breathing cycles in 1 s), and exhaling through the lips causing audible vibration.</p>	1 participant had immediate decrease for vocal stereotypy

Figure 1

Database Search, Title, and Full Text Results

