

TEACHING OF ECHOIC IN PEOPLE WITH AUTISM SPECTRUM DISORDERS: SYSTEMATIC REVIEW OF LITERATURE¹

ENSINO DE ECOICO EM PESSOAS COM TRANSTORNO DO ESPECTRO AUTISTA: REVISÃO SISTEMÁTICA DE LITERATURA²

Bárbara Trevizan GUERRA³

Lady Anny Araújo do Espírito SANTO⁴

Romariz da Silva BARROS⁵

Ana Cláudia Moreira ALMEIDA-VERDU⁶

ABSTRACT: Literature has shown a large gap in studies aiming to establish an echoic in people with Autism Spectrum Disorder (ASD). Thus, the objective of this study was to identify the collection of research aimed at teaching echoic in individuals with ASD. The review was based on the *Preferred Reporting Items for Systematic Review and Meta-Analysis* (PRISMA) model. The search, of all occurrences, without time limit, until the year 2018, was performed in the Web of Science, Pubmed, Scopus, ERIC and PsichINFO database. The keywords and boolean operators autism [or] autistic [and] echoic [and] verbal behavior were adopted. The inclusion criteria were articles in Portuguese, English and Spanish that established echoic as a dependent variable in interventions with people with ASD, present a single subject experimental design and demonstrate the data of the echoic acquisition during the teaching sessions. As a result, 338 articles were found and, with the application of the inclusion criteria, three were selected. The results corroborate the data in the literature that point out the deficit of studies to establish echoic as the main target of teaching in people with ASD. Most studies adopt echoic as a prompt for establishing other verbal behavior. Even if scarce, the articles indicate the effects of different procedures under the acquisition of the echoic behavior in people with ASD and with diversified initial repertoires.

KEYWORDS: Autism. Teaching. Language. Echoic. Literature Review.

RESUMO: A literatura tem demonstrado uma grande lacuna em estudos com o objetivo de estabelecer ecoico em pessoas com Transtorno do Espectro Autista (TEA). Assim sendo, este trabalho teve por objetivo identificar o acervo de pesquisas direcionadas para o ensino de ecoico em indivíduos com TEA. A revisão foi pautada no modelo *Preferred Reporting Items for Systematic Review and Meta-Analysis* (PRISMA). A busca, de todas as ocorrências, sem limite de tempo, até o ano de 2018, foi realizada nas bases de dados *Web of Science*, *Pubmed*, *Scopus*, *ERIC* e *PsicINFO*. Adotaram-se as palavras-chave e marcadores booleanos *autism [or] autistic [or] autistic [and] echoic [and] verbal behavior*. Os critérios de inclusão foram artigos em português, inglês e espanhol que estabeleceram ecoico como variável dependente em intervenções com pessoas com TEA, apresentar delineamento experimental de sujeito único e demonstrar os dados da aquisição do ecoico no decorrer das sessões de ensino. Como resultados, foram encontrados

¹ <http://dx.doi.org/10.1590/s1413-65382519000400010>

² Financial support: Coordination for the Improvement of Higher Education Personnel (CAPES) Program/Public Notice No. 59/2014 - Scientific and Technological Research in Assistive Technology (PGPTA) for granting a PhD scholarship to the first author. This work is part of the scientific project of the National Institute of Science and Technology on Behavior, Cognition and Teaching (INCT-ECCE): INCT2014 Processes numbers: São Paulo State Research Support Foundation (FAPESP): 2014/50909-8; National Council for Scientific and Technological Development (CNPq): 465686/2014-1; CAPES: 88887.136407/2017-00.

³ Master's in Developmental Psychology and Learning, *Universidade Estadual Paulista* (UNESP), Campus Bauru. Department of Psychology. barbaratrevizan@hotmail.com. Bauru/São Paulo/Brazil. ORCID: <https://orcid.org/0000-0003-1590-3483>.

⁴ Master's in Behavior Theory and Research from the Graduate Program in Behavior Theory and Research of the Federal University of Pará. lady_fono@yahoo.com.br. Belém/Pará/Brazil. ORCID: <https://orcid.org/0000-0002-7808-342X>

⁵ PhD in Experimental Psychology from the University of São Paulo. Professor at the Behavior Theory and Research Nucleus and at the National Institute of Science and Technology on Behavior Cognition and Teaching. Federal University of Pará. romarizsb@gmail.com. Belém/Pará/Brazil. ORCID: <https://orcid.org/0000-0002-1306-384X>

⁶ PhD in Special Education from the Federal University of São Carlos (UFSCar). Professor at the Department of Psychology at Paulista State University (UNESP) and at the National Institute of Science and Technology on Behavior, Cognition and Teaching. CNPq Researcher. ana.verdu@unesp.br. Bauru/São Paulo/Brazil. ORCID: <http://orcid.org/0000-0001-5202-0263>

338 artigos e, com a aplicação dos critérios de inclusão, foram selecionados três. Os resultados corroboraram os dados da literatura que apontam o déficit de estudos com objetivo de estabelecer ecoico como alvo principal de ensino em pessoas com TEA. A maior parte dos estudos adota o ecoico como *prompt* para o estabelecimento de outro comportamento verbal. Ainda que escassos, os artigos apontam os efeitos de procedimentos distintos sobre a aquisição do comportamento ecoico em pessoas com TEA e com repertórios iniciais diversificados.

PALAVRAS-CHAVE: Autismo. Ensino. Linguagem. Ecoico. Revisão de Literatura.

1 INTRODUCTION

People diagnosed with Autistic Spectrum Disorder (ASD) (American Psychiatric Association [APA], 2014) often have impaired verbal behavior. Verbal behavior is characterized as social behavior that acts on context through a listener (Skinner, 1957). Thus, an important distinction between verbal behavior and other behaviors lies in the fact that its consequences are mediated by the audience (verbal community that has learned to provide consequences for the verbal behavior of its members).

From this definition (Skinner, 1957), verbal behavior was categorized based on the relationship between the stimuli that precede and control the emission of the verbal response and its consequences. The elementary verbal categories presented by Skinner were: mand, tact, echoic, intraverbal, textual and transcription (dictation and copy). Among the verbal operants that may be flawed in the repertoires of individuals with ASD it is the echoic.

The echoic is the duplication, with point to point correspondence, of the vocal verbal antecedent presented. It is behavior maintained by the social consequences provided by the audience (Skinner, 1957). An example of the occurrence of echoic behavior would be the mediator presenting the “Cake” hearing model, the apprentice issues the answer “Cake” and has the consequence answer given by the educator with a “Very good!” compliment. Regarding the echoic, although there are many studies in which echoics are used as support in teaching conditions of other verbal operants (Colón, Ahearn, Clark, & Masalsk, 2012; Finkel & Williams, 2001; Fiorile & Greer, 2007; Shillingsburg, Frampton, Wymer, & Bartlett, 2018) there are few studies investigating conditions to establish and/or strengthen their own echoic-behavior.

Literature review studies that aimed to investigate verbal behavior teaching in people with ASD confirm the gap in studies that aim to teach echoic in this population (Kubina, Wolf, & Kostewicz, 2009; Martone & Santos-Carvalho, 2012; Sautter & LeBlanc, 2006; Souza, Akers, & Fisher, 2017).

Sautter and LeBlanc (2006) conducted a review of empirical studies with humans on the PsycInfo database and a manual search of the following journals: *The Analysis of Verbal Behavior* (TAVB), *Journal of Applied Behavior Analysis* (JABA), *Journal of Experimental Analysis of Behavior* (JEAB) and *Research in Developmental Disabilities* (RIDD) from 1989 to 2004, with the keywords “mand”, “tact”, “echoic”, “intraverbal”, “autoclitic” and “verbal behavior” with the Boolean operators “and/or”.

The inclusion criteria adopted were to present empirical studies with description of dependent variables (DV) and independent variables (IV), and the results should be evaluated

through research design. The researchers found only seven studies on echoic operant teaching (10% of the sample), and in five of them the echoic was taught together with other operants.

Kubina, Wolf and Kostewicz (2009) aimed to measure overall results for the mand, echoic, tact and intraverbal operants. The authors searched for papers in PsycINFO, without period identification, using the search for “mand operant”, “mand training” and “verbal behavior”, following this same model to search for papers about the other target operants of the study. Four study components were analyzed as response form, prompt type, material types, and response timing per session. Inclusion criteria were published in peer-reviewed papers written in English, verbal operants (mand, tact, intraverbal and echoic) defined by the researchers based on Skinner’s analysis, presenting as dependent variables mand, tact, intraverbal and echoic, and participants should be 18 or younger. The researchers found that only five studies listed echoic as a teaching objective (9% of the sample). Of the participants in these studies, three were non-vocal and two were vocal.

In the search for studies especially aimed at people with ASD, Martone and Santos-Carvalho (2012) conducted a search in JABA, between 2008 and 2012, using the words “autism” and “verbal behavior”. The inclusion criteria adopted were to present in the body of the text the words autism and verbal behavior. As a result, only three studies addressed the teaching of echoic-behavior (11% of the sample).

In another literature review study, Souza, Akers, and Fisher (2017) conducted searches of studies published between 2001 and 2017 in the Academic Search Premiere, ERIC, PsycINFO (including manual searches in Behavioral Interventions, JABA, RIDD, and TAVB) databases with the words “autism” with other terms such as “mand”, “tact”, “intraverbal”, “echoic”, “emergence”, “generative”, “derivative” and “verbal behavior”. The inclusion criteria adopted were the participants being children up to 12 years old, presenting a single subject design, including as a DV at least one verbal operant defined by Skinner, and teaching one or more new verbal responses. The authors found that four studies had as their object the teaching of echoic (2.3% of the sample).

Among the few occurrences of echoic teaching as the main target, it is the study conducted by Kodak and Clements (2009). They conducted a research that aimed to teach echoic as a precursor operant for the acquisition of other verbal behaviors. Initially, the authors taught tact and mand operants to a child with ASD who had low frequency of functional vocal behavior and high frequency of vocal stereotypy. As a result, the child failed to acquire independent mand and tact. However, when teaching combined echoic training preceding mand or tact teaching, there was a significant increase in independent responses to mand and tact.

Another example of a study that aimed at teaching echoic in people with ASD is the study conducted by Cividini-Motta, Scharrer and Ahearn (2017). The researchers evaluated the effectiveness of three echoic teaching procedures for six participants with ASD and other developmental delays. The procedures tested were Vocal Imitation Training, Stimulus-Stimulus Pairing and Mand Model which were compared via adapted alternate treatment design; the target responses were isolated phonemes (e.g. “a”, “i”) and not words or phrases. The results showed that the procedures were effective for five participants and the procedure considered most effective varied among the apprentices.

Despite being little investigated in the literature, the importance of the echoic repertoire is recognized, especially in the teaching of other behaviors such as tact and mand (Charlop, 1983; Leung & Wu, 1997; Kodak & Clements, 2009). Several verbal behavior teaching curricula rely on well-established echoic repertoire to install other vocal verbal behaviors (Koehler-Platten, Grow, Schulze, & Bertone, 2013). Thus, training of this operant can be considered as essential for intervention for young children with ASD (Sundberg & Michael, 2001). Still, children with language delay that echo the stimulus they hear, even if inaccurately, have an instructional advantage, as such a repertoire can be used as a prompt for teaching varied verbal behaviors. In contrast, people who rarely vocalize or who do not imitate vocal models have less opportunity to benefit from teaching verbal behavior, as a restricted repertoire will be available for modification by reinforcement contingencies (Esch, Carr, & Grow, 2009).

On the one hand, if studies with the teaching of echoic as the main objective seem to be scarce; on the other hand, there are many studies that use the echoic as a prompt for the acquisition of other operators such as tact, mand and intraverbal (Carroll & Kodak, 2015; Smith et al., 2016; Vedora & Conant, 2015; Williams, Carnerero, & Pérez-Gonzalez, 2006). In such cases, the procedures may involve vocal presentation of the desired verbal response, with differential reinforcement (modeling) and fading of the echoic prompt (by remission of phonemes or delay). Thus, the aim is for a transfer of stimulus control from the instructor's vocal model to the specific vocal antecedent (Watkins, Pack-Teixeira, & Howard, 1989). Although the predominance of studies with echoic as support is understandable (due to the nature of this repertoire as an important behavior for acquiring other repertoires), it ends up determining the lack of knowledge needed to deal with cases where the teaching of the echoic repertoire itself (e.g. in cases of children diagnosed with ASD and severe impairment) where control is exerted by the product of the speaker's vocal response, and not by the learner's need (e.g. mand) or the object (e.g. tact).

Among the studies that exemplify the transfer of stimulus control is Vedora and Conant (2015) whose objective was to compare the effect of echoic and visual prompts (textual and tactile) on the intraverbal behavior of three young adults with ASD. The authors investigated which type of prompt was most effective in promoting the transfer of stimulus control to the mediator's vocal antecedent (predominantly questions beginning with "What?" Or "Who?"). In this case, the results were not conclusive, as there were no significant differences between the types of prompts employed on intraverbal acquisition.

Considering the experimental logic in research in general, the objectives seek to verify if there is a functional relationship between the dependent and independent variables. Dependent variables (DV) are the behavioral properties measured from the effect of independent variables (IV) that are those that the researcher manipulates to verify their effects (Sampaio et al., 2008). In the present study, the DV of interest are the echoic behaviors, while the IV are the manipulations performed to refine or install the echoic operant.

A lot of technology may be involved in teaching programming. The relationship that the variables establish with each other can be more or less accurately assessed. The most precise ways adopt experimental and well-controlled designs in which, according to Matos (1990),

participants are exposed to teaching conditions, and various repertoire measures are performed to verify whether there is a relationship between independent variables (procedure) and the dependent variables (resulting behavior). Experiments should describe designs to verify the effects of IV on DV with the greatest possible control.

In addition, the research also adopt different teaching structures in its procedures. There are situations where a single operant is taught in the sessions (Single Exemplary Instruction [SEI]) and occasions where distinct verbal responses are requested from participants in the same session, allowing multiple Operative Rotations (Multiple Exemplar Instruction [MEI]) (Greer & Ross, 2008).

Another relevant variable in procedure programming is the type of teaching adopted. Among the most commonly used examples are discrete attempts, natural teaching and learn unit. Discrete attempt teaching consists of presenting the discriminative stimulus, occasion for the learner's response, followed by the programmed consequence, and an interval between attempts is made; prompts are faded to ensure independent answers (Dib & Sturmey, 2007). Learn Unit is similar to discrete trial teaching, but it involves greater control of mediator behavior (Greer, 1994). Finally, natural or incidental teaching is one in which stimuli and events are organized in the child's routine, so that the chances of responding increase (Hsieh, Wilder, & Abellon, 2011), and the response is initiated by the child.

Considering the scarcity of the literature on the teaching of echoic repertoire in people with ASD, with rigorous experimental control, in order to support evidence-based practices, this study aimed to identify the body of research to investigate whether verbal echoic behavioral teaching procedures have been effective in ensuring the acquisition of this operant in people with ASD. Unlike other previous literature reviews, this study applied as a criterion for inclusion the description of experimental designs. The variables year and means of publication, independent and dependent variables, characterization of the participants, types and structures of education, adopted designs and main results were analyzed.

2 METHOD

The systematic review was organized in three phases based on PRISMA (Moher, Liberati, Tetzlaff, Altman, & The Prisma Group, 2009), namely: 1. bibliographic survey, 2. article selection, 3. analysis and categorization. In this review, the steps presented by Sampaio and Mancini (2007) that established rigorous criteria for a systematic literature review were effective, namely: (a) Define the research question (it should contain the diagnostic condition, the target population, the intervention, the comparison context and the outcome, also represented by the acronym PICO where P - participant, I - intervention, C - context, O - outcome); (b) Search for evidence (define keywords, search strategies, and appropriate database for the objective); (c) Review and select studies (the search must be performed by two researchers independently and respect the inclusion and exclusion criteria adopted); (d) Analyze methodological quality of studies; and (e) Present the results (detail study methods). The following is a detailed description of the study phases.

- Phase 1- Bibliographic survey.

The search for the papers was performed, with all occurrences, without time limit until December 2018, in the ERIC, PsycINFO, PubMed, Scopus and Web of Science databases in the common search system. The following search words and Boolean operators were adopted: autistic, autistic, autism [and] verbal behavior [and] echoic. Still in this phase, repeated articles in the selected databases were excluded.

- Phase 2 - Selection of papers that described echoic teaching intervention in people with ASD.

After Phase 1, the procedures for reading the title, abstract, participants, and procedures to verify whether the studies fit the scope of the analysis were adopted.

Inclusion criteria were: papers in Portuguese, English and Spanish that established echoic as DV (with the objective of expanding/establishing echoic repertoire or measuring the effects of procedures on this operant) for people with ASD. For studies published prior to the new classification presented by the DSM-V (2013), the diagnoses of Pervasive Developmental Disorder (PDD) and Global Developmental Delay (GDD) were considered; present a single-subject experimental design whose analysis of experimental control consists of visually comparing two or more conditions (typically being a baseline and subsequent interventions) (Byiers, Reichle, & Symons, 2012). The following experimental designs were considered: Multiple Baseline or Multiple Probes, Change of Criteria, Multiple Treatments, Alternate Treatment or Adapted Alternate Treatment (Byiers, Reichle, & Symons, 2012); present echoic acquisition data and the function of the described teaching procedures.

The exclusion criteria adopted were: papers in foreign languages (except English and Spanish); journal editorials, theoretical papers, review papers, papers describing evaluation processes, research that included participants without ASD or did not describe participants' diagnostic characteristics; studies that did not establish echoic as DV or that aimed to reduce this repertoire; papers that did not adopt a single subject experimental design.

- Phase 3 - Analysis and Categorization of papers.

The full reading and book report of the selected papers were performed for later categorization and analysis. The following categories were adopted: year of publication; means of publication; independent variables - the main teaching procedures adopted in teaching; dependent variables – extension of echoic response and contingency in which it was established (teaching or testing), in addition to other behaviors targeted by the studies; characterization of participants - age, sample number, input repertoire and assessment tools; teaching types and structure - one target operant or more per teaching session, discrete trial teaching, natural teaching, stimulus-stimulus pairing or learn unit; adopted designs; main results - in terms of the acquisition of target behavior; cost and variability of responses - referring to the number of sessions and performance in relation to the acquisition of target behavior during teaching.

- *Concordance analysis.*

In order to survey the papers to compose the scope of analysis, two independent observers searched the databases based on the inclusion and exclusion criteria established. Initially, seven studies were found by both observers, three in common. This initial result demonstrated the need for refinement of the inclusion and exclusion criteria adopted and, after refinements and a new search, the observers found three papers, with full correspondence between the two samples (100% agreement).

After defining the sample studies, the observers started recording the variables of interest for the papers found. The results of the systematic review report were submitted to a new agreement analysis between judges. The concordance analysis was obtained by the formula: $\{[\text{number of concordances} / (\text{number of concordances} + \text{number of disagreements})] \times 100\}$ (Kazdin, 1982). The concordance percentage obtained was 89.3%. The difference found in the concordance between the authors was due to the need for interpretation in the graphs of variables that were not described in the text of the papers.

3 RESULTS

The results will be presented according to the steps described in the Method. Figure 1 shows the flowchart of the phases of the review study according to PRISMA recommendations. According to Figure 1, in Phase 1, 338 papers were found, 48 of which were excluded by repetition. From the application of the exclusion and inclusion criteria of Phase 2, three papers were selected and analyzed in Phase 3. It is noteworthy that several studies were eliminated from the scope of analysis as they adopted in the procedures the echoic operant only as a prompt for establishing other verbal repertoires, which is not the main DV.

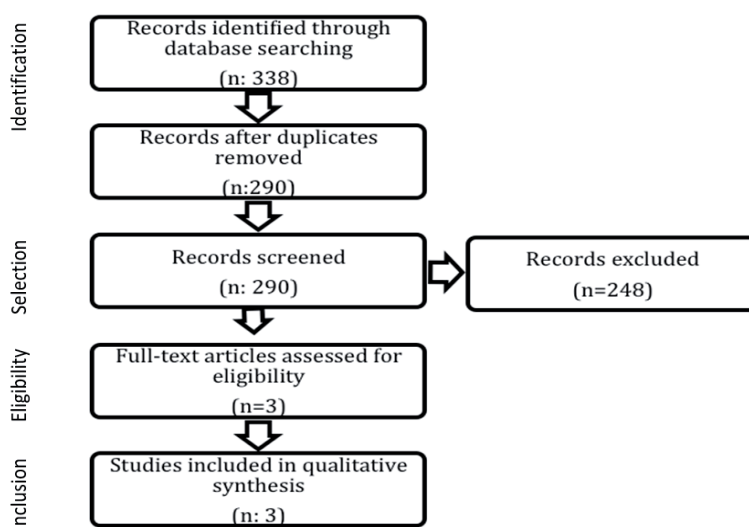


Figure 1. Flowchart of the phases of the review study based on the PRISMA model.

Source: The authors.

Table 1 presents the references of the studies (authors, year of publication, title and means of publication) adopted in the research in chronological order. Studies are numbered 1 to 3, from oldest to most recent study. This numbering will be adopted in the following tables to signal to the reader the reference of the study.

Study	Authors	Year	Title	Means of publication
1	Drash, P. W., High, R. L., & Tudor, R., M.	1999	<i>Using manding training to establish an echoic repertoire in young children with autism</i>	The Analysis of Verbal Behavior
2	Esch, B. E., Carr, J. E., & Michael, J.	2005	<i>Evaluating stimulus-stimulus pairing and direct reinforcement in the establishment of an echoic repertoire of children diagnosed with autism</i>	The Analysis of Verbal Behavior
3	Carroll, R. A., & Klatt, K. P.	2008	<i>Using Stimulus-stimulus pairing and direct reinforcement to teach vocal verbal behavior to young children with autism</i>	The Analysis of Verbal Behavior

Table 1. References of the studies adopted in the research in chronological order.

Source: The authors.

Table 1 presents the results of the papers in relation to the authors, year of publication, title and means of publication. According to Table 1, the three studies were conducted by different groups of researchers. According to the data referring to the researchers, they were different in the three studies found.

Regarding the year, there is a significant gap (eleven years) from the last paper found (2008) to the present. Regarding the means of publication, all studies were found in The Analysis of Verbal Behavior (TAVB), a specific journal of verbal behavior.

Table 2 presents the characterization of participants by age, sample number, participant input repertoire and assessment instruments adopted.

Study	Age of participants	Number of the sample	Input Repertoire	Evaluation Instrument
1	P1: 2 years and 8 months P2: 2 years and 6 months P3: 3 years and 6 months	3	P1: Initial echoic, impure mand (echoic prompt) P2: Initial echoic, impure mand (echoic prompt) P3: Initial echoic, impure mand (echoic prompt)	None.

2	P1: 6 years and 10 months P2: 6 years and 11 months P3: 8 years and 2 months	3	The three participants presented absence of established verbal behaviors.	<i>Behavioral Language Assessment (BLA)</i> (Sundberg & Partington, 1998); <i>Kaufman Speech Praxis Test (KSPT)</i> (Kaufman, 1995); <i>The Peabody Picture Vocabulary Test III (PPVT)</i> (Dunn, Dunn, & Dunn, 1997); <i>Receptive-Expressive Emergent Language Test (REEL)</i> (Bzoch, League, & Brown, 2003)
3	P1: 1 year and 10 months P2: 1 year and 11 months	2	P1: absence of established verbal behaviors P2: Established echoic, initial repertoires of mand, tact and intraverbal.	<i>Behavioral Language Assessment (BLA)</i> (Sundberg & Partington, 1998)

Table 2. Data referring to the study participants.

Source: The authors.

According to Table 2, five participants (62.5% of the sample) were aged up to three years and six months. Three participants were aged between six years and ten months to eight years and two months. Regarding the sample number, all studies were conducted with two or three children. The participants' input repertoire was diverse. Half of the sample had no verbal operants established at the beginning of the intervention. As for the other participants, three presented an initial echoic repertoire and an impure mand (occurred in the presence of an echoic prompt) and one child presented an established echoic repertoire and mand, tact and intra-verbal under acquisition.

The characterization of the participants was given by different instruments. In one study, the application of standardized tests was not adopted. The BLA test was used in two sample studies.

Table 3 presents the extent of the echoic response (e.g., phonemic, syllable, word) and contingency established, other dependent variables of the studies, the independent variables adopted in teaching the main dependent variable, experimental design type, target response variability, number of sessions (cost of response), main outcomes, and maintenance/generalization related to echoic teaching. According to Table 3, echoic was established as DV in the three studies of the sample. However, in Experiment 2 of Study 2, it was also measured in test contingencies. In addition to the echoic, Study 1 established as DV the mand, tact, errors and absence of responses, and Study 3 inserted as another DV vocalizations according to the mediator model (Stimulus-Stimulus Pairing procedure). The data referring to IV show that echoic teaching procedures are diverse; two experiments (Studies 2 and 3) adopted the direct reinforcement of the echoic response and stimulus-stimulus pairing (Study 3, Experiment 2), whereas one study (Study 1) adopted other contingencies that could lead to echoic such as tact and mand as a starting point.

Number	Length of echoic response and contingency	Other DV of the studies	IV in the teaching of the main dependent variable	Design	Target Response Variability	Number of sessions	Main results	Maintenance Generalization
1	Extension: sounds or words Contingency: Teaching	Mand, tact, errors and lack of answers	Mand and Tact	Not specified. However, the figure suggests a design of Alternate Treatment between teaching conditions.	P1: 70% (30 to 100%) P2: 55% (25% to 83%) P3: 39% (48% to 87%)	P1: 14 P2: 10 P3: 11	P1: 100% accuracy for 25 words and 23 sounds. P2: 83% accuracy for 25 words and five sounds. P3: 87% accuracy for 12 words and six sounds.	It does not provide data maintenance or generalization.
2	Extension: Vowels and Syllables Exper. 1 Contingency: Teaching and Testing	None.	Direct reinforcement of the echoic response and Stimulus-Stimulus Pairing	AB multiple baseline between topographies with constant series control	P1: 10% (0 to 10%) P2: 10% (0 to 10%) P3: 0% (remained at zero the percentage of correct answers)	P1: 114 P2: 65 P3: 77	The procedure was not effective for all three participants.	It does not provide data maintenance or generalization.
Exper. 2				Echoic was not established as a DV				
Exper. 3				Echoic was not established as a DV				
3	Extension: phonemes Exper. 1 Contingency: Teaching	Vocalizations similar or equal to the model presented (Stimulus-Stimulus Pairing)	Direct reinforcement of the echoic response.	Not specified for echoic teaching.	P1: 25% (75 to 100%)	P1: 4	The teaching procedure was effective for the participant.	It does not provide data maintenance or generalization.
Exper. 2	Extension: phonemes Contingency: Teaching		Stimulus-stimulus pairing and direct reinforcement (Procedure 1); direct reinforcement without pairing (Procedure 2); direct reinforcement of any vocalization (Procedure 4) and direct reinforcement of the target sound (Procedure 5).	Comparison Design	P2: Proc. 1: 10% (0 to 10%) Proc. 2: 0% (remained at zero the percentage of correct answers) Proc. 4: 43% (47 to 90%) Proc. 5: 55% (45 to 100%) for one sound and 80% for another sound (0 to 80%)	P2: 34	Procedures 4 and 5 were effective for the participant.	Maintenance was conducted for ten weeks and results were maintained at 100% hits.

Table 3. Study data: extension of echoic response and contingency, other dependent variables, independent variables, design, target response variability, number of sessions, main outcomes, and maintenance/generalization related to echoic teaching.

Study data: extension of echoic response and contingency, other dependent variables, independent variables, design, target response variability, number of sessions, main outcomes, and maintenance/generalization related to echoic teaching.

Source: The authors.

Of the teaching procedures adopted, those adopted in Study 2 (direct reinforcement of the echoic response and stimulus-stimulus pairing) are associated with the higher cost of response by participants (from 65 to 114 teaching sessions); and, although response variability is lower, it occurred at a very low level (from 0 to 10% correct answers).

No records were found in the studies of echoic prompt fading to established echoic repertoire in the participants. It is also observed that all studies were performed by discrete trial and SEI, i.e., only one operant taught per teaching session. The adopted design was different for the three studies. Although Study 1 communicates speech accuracy data, there is no description of how this measurement was performed.

4 4 DISCUSSION

The results presented confirm the lack in the literature about studies on eco-repertoire teaching. In this study, the search was conducted without date limit, adopted variations of descriptors according to database recommendations, and was performed in five different databases and, although few articles were identified whose DV was the echoic behavior, the results allow us to identify the diversity of procedures and their different effects on the acquisition of echoic behavior in people with ASD and should be the target of more systematic investigations. If, on the one hand, the gap indicates the need for studies on the conditions

under which echoic behavior can be established; on the other hand, when such investigations occur, they can make relevant contributions to the clinical and educational context, since professionals who work with language teaching can identify appropriate procedures according to the initial repertoire of their students/clients.

The literature review in the introduction identified some previous studies interested in the teaching conditions of echoic behavior that were not part of this review either because it was adopted as pre-current (Kodak & Clements, 2009), or because participants had other diagnoses besides by ASD (Cividini-Motta, Scharrer, & Ahearn, 2017). Although echoic is an important repertoire to be established, as it may be a condition for the acquisition of other more complex behaviors (Rosales-Ruiz & Baer, 1997), the literature reveals its use mainly as a prompt and in studies with little experimental rigor, which does not support evidence-based practices.

It would be coherent to be part of this review of the papers selected by previous literature reviews. However, among papers found by Kubina, Wolf and Kostewicz (2009), not all studies were included because participants had no diagnosis of ASD (Lowe, Horne, Harris, & Randle, 2002; Stewart, Barnes-Holmes, Roche, & Smeets, 2001; Yoon & Bennett, 2000). Regarding the study conducted by Martone and Santos-Carvalho (2012), the authors do not present the references of studies that aimed to teach echoic, and it is not possible to identify similarities or differences in the search results. Regarding the study conducted by Souza, Akers and Fisher (2017), two studies were removed from the sample because not all participants had a diagnosis of ASD (Tarbox, Madrid, Aguilar, Jacobo, & Schiff 2009) and because it did not appear in the survey conducted with the specific descriptors and selected databases (Speckman-Collins, Lee Park, & Greer, 2007). Finally, Cividini-Motta, Scharrer and Ahearn's study (2017) did not compose the sample of this review because one participant was not diagnosed with ASD.

One of the contributions of this review study is related to the method, more specifically to the insertion of inclusion criteria additional to those of previous studies, which allowed to be selected for analysis only papers that had greater experimental control, such as using a single subject design. Another study identified in the literature that adopted stricter inclusion criteria was Souza, Akers and Fisher (2017), that is, studies with single-subject design in experiments that systematically manipulated two or more independent variables; that included one or more of Skinner's (1957) verbal operants as the dependent variable and involved teaching one or more new verbal responses; but unlike this study, it set a date limit (2001 to 2017) and included other verbal operants besides the echoic. Compared to other review studies, it is observed that when the inclusion criteria of the papers are more refined, the number of papers identified in echoic teaching drastically reduces. While Kubina, Wolf and Kostewicz (2009), Martone and Santos-Carvalho (2012) and Sautter and Le Blanc (2006), found a sample of studies that aimed to teach echoic from 9 to 11% of the sample, this study and Souza, Akers and Fisher (2017) found respectively 1.25% of the sample and 2.3%.

Although the review studies point to the echoic study in people with ASD as a gap, the importance of this operant should not be reduced. Echoic is an important behavior since placing vocalizations on echoic control assist in the use of prompts to teach other verbal operants (Souza, Akers, & Fisher, 2017). Thus, echoic play an important role in the acquisition of other behaviors, such as tact and mand (Charlop, 1983; Kodak & Clements, 2009). Research further

hypothesizes that echoic behavior can facilitate the acquisition of listener behavior (Cividini-Motta, Scharrer, & Ahearn, 2017).

Regarding the means of publication of the papers, while other studies identified a larger number of JABA publications (Sautter & Leblanc, 2006; Souza, Akers, & Fisher, 2017), this research found the total sample in the TAVB Journal. Although these means of communication are reference and widely used, they can limit access to information for people who do not work in the field of Behavior Analysis. Thus, there is a limitation on the dissemination of information that could benefit mediators from other areas about verbal behavior studies in people with ASD.

As for the participants, the results showed that all were aged between one and eight years old. Few surveys were conducted with adolescents and adults, as it was also found by Guerra and Almeida-Verdu (2016). Thus, it can be stated that the need for research with this population continues.

Survey participants were predominantly grouped into samples of three. This organization is possible through the single-subject design, which understands that the controlling variables must be identified in the environment in which the answer is presented (Martone & Santos-Carvalho, 2012). This analysis allows individual differences to be analyzed without compromising the data. In a review conducted by Martone and Santos-Carvalho (2012), the authors identified that 55% of the studies used samples with three participants.

Regarding the participants' input repertoire, Martone and Santos-Carvalho (2012) highlight the need for further research to refine the description of the input repertoires. Specific data regarding the participants' age and initial behavior were not described in other review identified. Considering the structures and types of education, the data corroborate the findings of Guerra and Almeida-Verdu (2016), in which the authors found that most studies used SEI (82.7%) and discrete attempts (77%) in teaching verbal behavior. These results point to the need for more research with MEI and other types of teaching, such as learn unit.

5 FINAL CONSIDERATIONS

The teaching procedures adopted in the studies found in this review were varied and the effect on the participants' repertoire was also very variable. The procedures were mand and tact (Drash, High, & Tudor, 1999), direct reinforcement, and stimulus-stimulus pairing (Carroll & Klatt, 2008; Esch, Carr, & Michael, 2005). Such IV used in the studies resulted in different results regarding the variability and the cost of the response during the acquisition/reinforcement of the echoic repertoire. While the study that used as mand and tact as IV resulted in a speech accuracy rate greater than 83% for the three participants and a response cost of 11 to 14 sessions, studies using different direct reinforcement and stimulus-stimulus pairing procedures had varying results, with the three participants in Study 2 having 0 to 10% variability with a high response rate (65 to 114 sessions), and in Study 3 only two direct reinforcement procedures adopted were effective for one of the participants, ranging from 0 to 80% and totaling 34 sessions.

From the results obtained in the studies, it was found, in general, that the variability of target behavior was less than 50% for most participants. One variable that may have interfered with these results is the participants' input repertoire, since most of them did not show functional and independent verbal behavior. Although studies are scarce, their results are relevant and may impact echoic teaching practices applied to individuals diagnosed with ASD in clinical and educational contexts. However, these results indicate that it is still necessary to investigate echoic teaching procedure variables, namely: a) to verify the effectiveness of a teaching via multiple baseline design; b) to compare different procedures via alternate treatment design; or c) to adopt separate teaching structures (i.e. echoic teaching alone as a single copy or rotating teaching with other operatives in multiple copies) to people with ASD that reduce intra and inter-subject variability observed.

Another gap observed was the absence of analysis of the accuracy or accuracy of the response (Yoder, Camarata, & Gardner, 2005). Although the point-to-point correspondence of a verbal response with the preceding auditory stimulus is the basis for defining the echoic response, when considering larger units of speech (e.g. syllables, words, phrases), accuracy may fail. Future studies may demonstrate whether echoic-vocalizations are accurate or partially accurate after teaching as in recent studies, but with different diagnoses of ASD (Grecco, Almeida-Verdu, & Buffa, 2018; Rique, Almeida-Verdu, Silva, Buffa, & Moret, 2017).

Although not tracked by the present study, there are other research groups that study the conditions under which verbal repertoires are acquired in people with ASD, but not necessarily echoic. Among the national groups, we can cite the researchers from the Service and Research on Learning and Development (*Atendimento e Pesquisa sobre Aprendizagem e Desenvolvimento* - APRENDE) of the Federal University of Pará (UFPA) and the Center for Autism and Social Inclusion (Centro de Autismo e Inclusão Social - CAIS) of the University of São Paulo (USP), both associated with the National Institute of Science and Technology on Behavior, Cognition and Teaching and the Human Learning, Interactive Multimedia and Computerized Teaching Laboratory (*Laboratório de Aprendizagem Humana, Multimídia Interativa e Ensino Informatizado* - LAHMIEI) of the Federal University of São Carlos (UFSCar). Among the international groups, we mention *Verbal Behavior Research Lab* (VBLAB) - *California State University* or *Autism Support Services: Education, Research and Training* (ASSERT) - *Utah State University*, both in the United States. We also point out the *Comprehensive Application of Behaviour Analysis to Schooling* (CABAS) - *Columbia University*, also in the United States. Future research may take the agenda of systematizing research produced by groups already consolidated in the study of verbal behavior and, especially, echoic in participants with ASD.

REFERENCES

- Associação Americana de Psiquiatria (2014). *DSM-V-TR: Manual diagnóstico e estatístico de transtornos mentais*. Porto Alegre: Artmed.
- Byiers, B. J., Reichle, J., & Symons, J. (2012). Single-subject experimental design for evidence based-practice. *American Journal of Speech-Language Pathology*, 21(4), 397-414.
- Bzoch, K. R., League, R., & Brown, V. L. (2003). *Receptive-Expressive Emergent Language Teste*. Austin, TX: Pro-Ed.

- Carroll, R. A., & Klatt, K. P. (2008). Using stimulus-stimulus pairing and direct reinforcement to teach vocal verbal behavior to young children with autism. *The Analysis of Verbal Behavior*, 24(1), 135-146.
- Carroll, R. A., & Kodak, T. (2015). Using instructive feedback to increase response variability during intraverbal training for children with autism spectrum disorder. *The Analysis of Verbal Behavior*, 31, 183-199.
- Charlop, M. H. (1983). The effects of echolalia on acquisition and generalization of receptive labeling in autistic children. *Journal of Applied Behavior Analysis*, 16, 111-126.
- Cividini-Motta, C., Scharrer, N., & Ahearn, W. H. (2017). An assessment of three procedures to teach echoic responding. *The Analysis of Verbal Behavior*, 33(1), 41-63.
- Colón, C. L., Ahearn, W. H., Clark, K. M., & Masalsky, J. (2012). The effects of verbal operant training and response interruption and redirection on appropriate and inappropriate vocalizations. *Journal of Applied Behavior Analysis*, 45(1), 107-120.
- Dib, N., & Sturmey, P. (2007). Reducing student stereotypy by improving teacher's implementation of discrete-trial teaching. *Journal of Applied Behavior Analysis*, 40(2), 339-343.
- Drash, P. W., High, R. L., & Tudor, R. (1999). M. Using mand training to establish an echoic repertoire in young children with autism. *The Analysis of Verbal Behavior*, 16, 29-44.
- Dunn, L. M., Dunn, L. M., Dunn, D. M. (1997). *Peabody Picture Vocabulary test*. Circle Pines, MN: American Guidance Service, Inc.
- Esch, B. E., Carr, J. E., & Michael, J. (2005). Evaluating stimulus-stimulus pairing and direct reinforcement in the establishment of an echoic repertoire of children diagnosed with autism. *The Analysis of Verbal Behavior*, 21(1), 43-58.
- Esch, B. E., Carr, J. E., Grow, L. L. (2009). Evaluation of an enhanced stimulus-stimulus pairing procedure to increase early vocalizations of children with autism. *Journal of Applied Behavior Analysis*, 42, 225-241.
- Finkel, A. S., & Williams, R. L. (2001). A comparison of textual and echoic prompts on the acquisition of intraverbal behavior in a six-year-old boy with autism. *The Analysis of Verbal Behavior*, 18, 61-70.
- Fiorile, C. A., & Greer, R. D. (2007). The induction of naming in children with no prior tact responses as a function of multiple exemplar histories of instruction. *The Analysis of Verbal Behavior*, 23, 71-87.
- Grecco, M. K., Almeida-Verdu, A. C. M., & Buffa, M. J. M. B. (2018). Treinamento parental de ensino de comportamento verbal para crianças usuárias de implante coclear: uma intervenção com mães. *Boletim - Academia Paulista de Psicologia*, 38(95), 218-229.
- Greer R. D., & Ross, D. E. (2008). *Verbal Behavior Analysis: Inducing and expanding new verbal capabilities in children with language delays*. Boston: Pearson.
- Greer, R. D. (1994). The measure of a teacher. In R. Gardner, D. M. Sainato, J. O. Cooper, T. E. Heron, & W. L. Heward (Eds.), *Behavior analysis in education: Focus on measurably superior instruction* (1st ed., pp. 225-248). Pacific Grove: Brooks/Cole.
- Guerra, B. T., & Almeida-Verdu, A. C. M. (2016). Ensino de operantes verbais em pessoas com Transtorno do Espectro Autista no *The Analysis of Verbal Behavior*: revisão sistemática. *Revista Brasileira de Terapia Cognitiva e Comportamental*, 18(2), 73-85.

- Hsieh, H. H., Wilder, D. A., & Abellon, O. E. (2011). The effects of training on caregiver implementation of incidental teaching. *Journal of Applied Behavior Analysis, 44*(1), 199-203.
- Kaufman, N. R. (1995). *Kaufman Speech Praxis Test*. Detroit: Wayne State University Press.
- Kazdin, A. E. (1982). *Single-case Research Designs: Methods for Clinical and Applied Settings*. New York: Oxford University Press.
- Kodak, T., & Clements, A. (2009). Acquisition of mands and tacts with concurrent echoic training. *Journal of Applied Behavior Analysis, 42*, 839-843.
- Koehler-Platten, K., Grow, L. L., Schulze, K. A., & Bertone, T. (2013). Using a lag reinforcement schedule to increase phonemic variability in children with autism spectrum disorders. *The Analysis of Verbal Behavior, 29*, 71-83.
- Kubina, R. M., Wolf, P., & Kostewicz, D. E. (2009). General outcome measures of verbal operants. *The Analysis of Verbal Behavior, 25*(1), 33-49.
- Leung, J. P., & Wu, K. I. (1997). Teaching receptive naming of Chinese characters to children with autism by incorporating echolalia. *Journal of Applied Behavior Analysis, 30*, 59-68.
- Lowe, C. F., Horne, P. J., Harris, F. D., & Randle, V. R. (2002). Naming and categorization in young children: vocal tact training. *J Exp Anal Behav., 78*(3), 527-549.
- Martone, M. C. C., & Santos-Carvalho, L. H. Z. (2012). Uma revisão dos artigos publicados no Journal of Applied Behavior Analysis (JABA) sobre comportamento verbal e autismo entre 2008 e 2012. *Revista Perspectivas em Análise do Comportamento, 3*(2), 73-86.
- Matos, M. A. (1990). Controle experimental e controle estatístico: A filosofia do caso único na pesquisa comportamental. *Ciência e Cultura, 42*, 585-592.
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: the prisma statement. *Plos Medicine, 6*(7), 1-6.
- Rique, L. D., Almeida-Verdu, A. C. M., Silva, L. T. N., Buffa, M. J. M. B., & Moret, A. de L. M. (2017). Leitura após formação de classes de equivalência em crianças com implante coclear: Precisão e fluência em palavras e textos. *Acta Comportamental, 25*(3), 307-327.
- Rosales-Ruiz, J., & Baer, D. M. (1997). Behavioral cusps: A developmental and pragmatic concept for behavior analysis. *Journal of Applied Behavior Analysis, 30*, 533-544.
- Sampaio, A. A. S., Azevedo, F. H. B., Cardoso, L. R. D., Lima, C., Pereira, M. B. R., & Andery, M. A. P. A. (2008). Uma introdução aos delineamentos experimentais de sujeito único. *Interação em Psicologia, 12*(1), 151-164.
- Sampaio, R. F., & Mancini, M. C. (2007). Estudos de revisão sistemática: um guia para síntese criteriosa da evidência científica. *Revista Brasileira de Fisioterapia, 11*(1), 83-89.
- Sautter, R. A., & Leblanc, L. A. (2006). Empirical applications of Skinner's analysis of verbal behavior with humans. *The Analysis of Verbal Behavior, 22*, 35-48.
- Shillingsburg, M. A., Frampton, S. E., Wymer, S. C., & Bartlett, B. (2018). A preliminary procedure for teaching children with autism to mand for social information. *Behavior Analysis in Practice, 11*(1), 34-38.
- Skinner, B. F. (1957). *Verbal Behavior*. New York: Appleton – Century – Crofts.

- Smith, D. P., Eikeseth, S., Fletcher, S. E., Montebelli, L., Smith, H. R., & Taylor, J. C. (2016). Emergent intraverbal forms may occur as a result of listener training for children with autism. *The Analysis of Verbal Behavior*, *32*, 27-37.
- Souza, A. A., Akers, J. S., & Fisher, W. W. (2017). Empirical application of Skinner's verbal behavior to interventions for children with autism: a review. *The Analysis of Verbal Behavior*, *33*(2), 229-259.
- Speckman-Collins, J., Lee Park, H., & Greer, R. D. (2007). Generalized Selection-Based Auditory Matching and the Emergence of The Listener Component of Naming. *Journal of Early and Intensive Behavioral Intervention*, *4*, 412-429. DOI: <https://doi.org/10.1037/h0100382>
- Stewart, I., Barnes-Holmes, D., Roche, B., & Smeets, P. M. (2001). Generating derived relational networks via the abstraction of common physical properties: A possible model of analogical reasoning. *The Psychological Record*, *51*, 381-408.
- Sundberg, M. L., & Michael, J. (2001). The value of Skinner's analysis of verbal behavior for teaching children with autism. *Behavior Modification*, *25*, 698-724.
- Sundberg, M. L., & Partington, J. W. (1998). *Teaching language to children with autism or other developmental disabilities*. Pleasant Hill, CA: Behavior Analysts, Inc.
- Tarbox, J., Madrid, W., Aguilar, B., Jacobo, W., & Schiff, A. (2009). Use of chaining to increase complexity of echoes in children with autism. *J Appl Behav Anal.*, *42*(4), 901-906. DOI: 10.1901/jaba.2009.42-901
- Vedora, J., & Conant, E. (2015). A comparison of prompting tactics for teaching intraverbals to young adults with autism. *The Analysis of Verbal Behavior*, *31*, 267-276.
- Watkins, C., Pack-Teixeira, L., & Howard, J. S. (1989). Teaching intraverbal behavior to severely retarded children. *The Analysis of Verbal Behavior*, *7*, 69-81.
- Williams, G., Carnerero, J. J., Pérez-Gonzales, L. A. (2006). Generalization of tacting actions in children with autism. *Journal of Applied Behavior Analysis*, *39*(2), 233-237.
- Yoder, P., Camarata, S., Gardner, E. (2005). Treatment effects on Speech intelligibility and length of utterance in children with specific language and intelligibility impairments. *Journal of Early Intervention*, *28*(1), 34-49.
- Yoon, So-Y., & Bennett, G. M. (2000). Effects of a stimulus—stimulus pairing procedure on conditioning vocal sounds as reinforcers. *Anal Verbal Behavior*, *17*, 75-88. DOI: 10.1007/bf03392957