Does Mastery of ABLA Level 6 Make it Easier for Individuals with Developmental Disabilities to Learn to Name Objects?

by

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Abstract

Level 6 of the Assessment of Basic Learning Abilities (ABLA) assesses the ease or difficulty with which persons with developmental disabilities (DD) are able to learn a two-choice auditory-visual discrimination. Individuals with DD who have passed ABLA Level 6 are likely to have at least some language skills, and their language is likely to be more complex than those individuals who have not passed Level 6 (Marion et al., 2003). Thus, an individual's performance on Level 6 of the ABLA may be predictive of the types of language skills he/she will readily learn. Previous research (Verbeke, Martin, Yu & Martin, 2007) demonstrated that an individual's pass/fail performance on ABLA Level 6 predicted his or her ability to point to pictures of common objects when the tester said the names of the objects. The present research examined whether performance on ABLA Level 6 might predict the ability of a person with a severe DD to learn to say the names of common objects (called tacting). Specifically, this study investigated whether participants who passed ABLA Level 6 (the Auditory-Visual Group – Group 1) would more readily learn object naming behavior (vocal tacts) than those clients who failed ABLA Level 6 (the Visual Group – Group 2). The groups were matched on the Communication Subscale of the Vineland Adaptive Behavior Scale (VABS). Results indicated that: (a) Group 1 met mastery criterion for a significantly larger number of naming responses than Group 2; and (b) the mean number of trials to mastery criterion was significantly lower in Group 1 than in Group 2. The implications for language training are discussed.

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The ability to make auditory and auditory-visual combined (AVC) discriminations is likely a pre-requisite to learning certain language skills (Vause, Martin, & Yu, 2000). Assessing an individual's ability to perform AVC discriminations, as well as the ease or difficulty with which they will learn AVC discriminations, requires an effective, empirically proven, assessment tool. The Assessment of Basic Learning Abilities (ABLA), developed by Kerr, Meyerson, and Flora (1977), may be that tool. The ABLA assesses an individual's ability to learn a simple imitation and five two-choice discriminations. Research has shown that performance on the ABLA correlates with language assessments for persons with developmental disabilities (DD; Casey & Kerr, 1977; Marion et al, 2003; Vause, Martin & Yu, 2000). Thus, an individual's performance on the ABLA may be predictive of the types of language skills that he/she will readily learn. The present research examined whether performance on the ABLA might predict the ability of persons with severe DD to learn to state the names of common objects.

Behavioral Assessment: Direct and Indirect Assessment Procedures

Behavioral assessment is a cornerstone of applied behavior analysis (ABA) and a behavioral conceptualization of language. Traditionally, psychological assessment techniques have involved both direct and indirect measures of behavior. However, indirect assessment procedures are not always reliable measures of behavior (Iwata, Kahng, Wallace, & Lindberg, 2000; Sturmey, 1994) and behavior analysts have therefore turned to the more direct methods of behavioral assessment. Behavioral assessment involves the collection and analysis of data in order to describe target behavior, identify possible causes of behavior, develop appropriate treatment strategies, and evaluate treatment outcome (Martin & Pear, 2007). In ABA an

important approach to identifying the function(s) of behavior(s) is functional analysis. The goal of functional analysis is to discover controlling variables in order to assess their effects on behavior (Martin & Pear, 2007). Functional analysis should identify the reinforcers that maintain target behaviors, antecedent stimuli, and problematic situations that should be addressed through intervention (Sturmey, 1995). Thus, an adequate assessment of the functions of behavior is an essential step to selecting the appropriate behavioral intervention(s) (Sturmey, 1994; Iwata et al., 1994; Repp, Felce, & Barton, 1988) and to appropriately tailor the treatment strategy. As will be described later, the ABLA is a direct assessment tool that is useful for identifying the learning needs of individuals with DD by identifying the pre-requisite skills needed for particular learning tasks.

The ABLA

The ABLA assesses the ease or difficulty with which a testee can learn six discrimination tasks: Level 1, a simple imitation; Level 2, a two-choice position discrimination; Level 3, a two-choice visual discrimination; Level 4, a two-choice visual-visual quasi-identity match-to-sample discrimination; Level 5, a two-choice auditory discrimination; and Level 6, a two-choice auditory-visual combined discrimination. The tasks comprising the six levels of the ABLA were chosen based on observations that one or more of the discrimination skills assessed at each ABLA level were typically required for clients with DD to readily learn a large number of self-care, academic, prevocational, and vocational tasks (Martin, Yu, & Vause, 2004). The ABLA does not assess the already existing behavioral repertoire of individuals; rather it determines the client's ability to learn new discriminations rapidly and can be considered a test of a client's learning-to-learn capabilities.

ABLA Level 2 is a visual discrimination. During an assessment of a Level 2 task, a client is presented with a red box and a yellow can in fixed positions. The client is required to consistently place a piece of foam in the container on the left when the tester says “put it in”. Level 2 is a simultaneous visual discrimination with position, color, shape, and size as relevant visual cues. Turning on the cold (vs. the hot) water tap is an everyday example of a Level 2 task.

Level 3 of the ABLA is a simultaneous visual discrimination task with color, shape, and size as visual cues. When a red box and a yellow can are randomly presented in right-left positions, a client is required to consistently place a piece of foam in the yellow can when the tester says “put it in”. An everyday example of a Level 3 task is locating one’s coat from among other coats hung in a closet, when the coats are in no fixed position.

Level 4 of the ABLA is a match-to-sample discrimination. A client demonstrates Level 4 if, when allowed to view a yellow can and red box in alternating left-right positions and when presented randomly with either a red cube or yellow cylinder, he/she consistently places the yellow cylinder in the yellow can and the red cube in the red box. Thus, Level 4 is a conditional visual-visual quasi-identity match-to-sample discrimination with color and shape as relevant cues. An everyday example of a Level 4 discrimination would be sorting socks into pairs.

ABLA Level 5 is an auditory discrimination in which, when presented with a yellow can and a red box (in fixed positions), a client is required to consistently place a piece of foam in the appropriate container when the tester says “red box” (high-pitched tone) or “yellow can” (spoken slowly and with a low pitch). Level 5 of the ABLA is considered to be a conditional auditory-visual non-identity discrimination with pitch, pronunciation, and duration as relevant auditory cues and with position, color, shape, and size as relevant visual cues. Responding to instructions to go left or right, to go to different rooms or open different drawers are examples of ABLA

Level 5 tasks. While Kerr et al., (1977) originally included Level 5 in the ABLA, in four studies involving 188 clients, all but four clients who passed Level 5 also passed Level 6. Thus, ABLA Level 5 is commonly deleted from the ABLA (DeWiele & Martin, 1998).

Level 6 of the ABLA is an auditory-visual discrimination. In an assessment of a Level 6 task, a client is required to consistently place a piece of foam in the appropriate container when the tester says, (in a high-pitched tone) “red box” or “yellow can” (spoken slowly and with a low pitch). The positions of the red box and yellow can randomly alternated as to their right/left positions. Thus, Level 6 is considered a conditional auditory-visual non-identity discrimination with color, shape, and size as relevant visual cues, and pitch, pronunciation, and duration as relevant auditory cues. An everyday example of a Level 6 task would be responding appropriately to a teacher’s directions to “find Sam” or “find Pete,” when Sam and Pete are not always standing in the same locations. ABLA Level 6 requires both auditory and visual discrimination skills, whereas ABLA Level 4 requires visual discrimination skills only. Therefore, because language often requires the ability to make complex auditory and visual discriminations, passing ABLA Level 6 may make it easier for persons with DD to learn language skills.

In a previous study, Verbeke, Martin, Yu and Martin (2007) assessed a group of individuals with DD who passed Level 4 and a group who passed Level 6 for their ability to point to pictures of common objects after hearing their names. Passing of ABLA Level 6 was an accurate predictor of object name recognition performance. Thus far, however, no one has examined whether successful performance on ABLA Level 6 might predict the ability of a person with DD to learn to say the names of common objects in the presence of those objects

(called tacting) when asked "What is it?" The purpose of this study was to examine that possibility.

ABLA Test Procedures

When testing a client for a particular ABLA level the client is first given a demonstration of the correct response, a guided trial, and an opportunity for an independent response at a particular level. Following a correct independent response formal testing begins. Each correct independent response is followed with praise (e.g., "good job") and a reinforcer that was chosen by the client at the beginning of the session from a choice of three edibles. If an error occurs, an error correction procedure is implemented. The error correction procedure consists of a demonstration of the correct response, a guided trial, and the opportunity for an independent response. A particular level is passed if a client makes eight consecutive correct responses independently. A level is failed if eight cumulative independent errors occur. Correct responses or errors on assisted trials (e.g., demonstration, guided trial) do not count towards the pass or fail criteria. Errors on the independent response portion of the error correction procedure count towards the failure criterion, but correct responses do not count towards the pass criterion. The pass criterion of eight consecutive correct responses was chosen based on Kerr et al.'s (1977) suggestion that only once in 256 trials will eight consecutive correct responses occur by chance in a two-choice discrimination in which successive responses are independent. This criterion minimizes the likelihood that participants will pass a level by chance.

Research on the ABLA

Several characteristics of the ABLA have been well researched, leading to a number of widely accepted generalizations. First, the levels of the ABLA are ordered in terms of difficulty such that individuals who pass a certain level also pass at lower levels and those who fail at a

certain level also fail at higher levels (Kerr, et al., 1977; Martin, Yu, Quinn, & Patterson, 1983; Wacker, Steil, & Greenbaum, 1983). Second, failed ABLA levels are difficult to teach using standard prompting and reinforcement and may require hundreds of trials before the discrimination is learned, if it is learned at all (Meyerson, 1977; Stubbings & Martin, 1995, 1998; Witt & Wacker, 1981; Yu & Martin, 1986). Third, many vocational, academic, and self-care tasks require the auditory, visual, or motor discriminations assessed by the ABLA (DeWiele & Martin, 1996; Kerr et al., 1977).

Fourth, as indicated in a review by Martin, Thorsteinsson, Yu, Martin and Vause (2008), the ABLA has very good predictive validity for the types of tasks that an individual will readily learn. Therefore, if a task is above a client's ability level, the client may not be able to learn the task even following a number of trials of reinforced practice. On the other hand, if a task is below a client's ABLA level, he or she should be able to learn the task very quickly. Thus, a client's ABLA level has been found to be predictive of the type of tasks which he or she is likely to readily learn; e.g., simple imitation tasks or match-to-sample tasks. Matching training tasks with a client's current ABLA level is important for both clients and staff in that exposure to training tasks matched to a client's ABLA level results in fewer aberrant behaviors than tasks that are mismatched to that client's ABLA level (DeWiele & Martin, 1996; Vause, Martin, & Yu, 2000). Additionally, the ABLA has been shown to be a better indicator of a client's ability level than experienced staff assessment. Stubbings and Martin (1998) asked staff to judge which tasks particular clients would easily master. These judgments were subsequently compared with predictions based on each client's ABLA level. Results indicated that even though each staff member had been working with their respective clients for at least eight months, the ABLA was significantly more accurate in predicting which tasks clients would learn quickly.

Fifth, the ABLA has been found to have high test-retest reliability. Martin et al., (1983) tested 42 individuals on the ABLA and then retested them three months later. Results indicated that for all participants, there were no changes in the pass/fail performance from the first to the second testing. Additionally, considering that the ABLA was administered to participants by several different experimenters, the study demonstrated very high inter-tester reliability. Finally, research has demonstrated that the ABLA can predict the effectiveness of different presentation methods (e.g., object, pictures, spoken words) during choice opportunities (Conyers, et al, 2002; Reyer & Sturmey, 2005).

Language Acquisition

In typically developing individuals, language is the primary method by which a person is able to express his or her needs and wants. However, for individuals with DD language can be delayed, impaired, or even absent. Many individuals who are diagnosed with DD have some type of language deficit. The most common language problem is a failure to communicate in a manner that is characteristic of typical individuals (Sundberg & Partington, 1998). While some individuals may acquire only a few words, others may be mute or echolalic. Research has demonstrated that the acquisition of spoken language prior to age 5 is considered to be a good predictor of long-term outcomes in areas such as adaptive skills and academic achievement (Gilliberg, 1991; Venter, Lord, & Schopler, 1993). Furthermore, failure to develop an understanding of language has serious implications for an individual's ability to develop social relationships and to function independently (Ward & Yu, 2000).

Historically, language theories have focused primarily on cognitive and biological variables (e.g., Brown, 1973; Chomsky, 1957; Piaget, 1926; Pinker, 1994) that were assumed to be responsible for language acquisition. These traditional theories conceptualized language

according to the meaning of words and their syntactical structure. However, more recently, research has suggested that the traditional frameworks of receptive and expressive language are incomplete as they fail to account for the environmental variables that influence language (Sundberg & Partington, 1998). More specifically, focus has shifted to a behavioral conceptualization of language development and language intervention drawn largely from Skinner's (1957) analysis of verbal behavior. Unlike some traditional models of language development, Skinner's theory does not assume that individuals learn the meaning of words independent of context and then use the words correctly for different purposes. Instead, the same vocal responses have separate functions, depending on the context (Lerman et al., 2005).

In his analysis, Skinner (1957) rejected the term "language" because he felt that it referred to the practices of a linguistic community rather than the behavior of any one member. Instead, he adopted the term "verbal behavior" which he felt emphasized the individual speaker. Skinner defined verbal behavior as behavior that is reinforced through the mediation of another person's behavior, where the person providing the reinforcement was specifically trained to do so. The main difference between verbal and non-verbal behavior, (according to Skinner), is that verbal behavior achieves its effect on the environment through a listener. Thus, the only feature of verbal behavior that sets it significantly apart from non-verbal behavior is the nature of the reinforcement that establishes and maintains it. The listener mediates the reinforcement for the behavior because he/she has been specifically trained to do so (Carroll & Hesse, 1987). Additionally, because verbal behavior is subject to the same principles that shape and maintain nonverbal behavior, it can be treated as any other operant behavior under the control of antecedent and consequential environmental events (Carroll & Hesse, 1987).

Skinner's Verbal Operants

In Skinner's (1957) analysis of verbal behavior he distinguished between several different types of functional control. The resulting analysis led to a classification system that allowed for the identification of functionally different types of verbal behavior (Sundberg & Partington, 1998). The analysis of verbal behavior typically begins with the specification of responses in terms of their controlling variables (Carroll & Hesse, 1987). Then, by specifying the antecedent verbal or nonverbal stimuli and consequences, the response can be classified as a verbal operant. Skinner identified six elementary verbal operants which he called the echoic, tact, mand, textual, intraverbal and autoclitic. Only echoics and tacts will be discussed here.

Echoic. An echoic response is verbal behavior under the functional control of a verbal stimulus with point-to-point correspondence between the stimulus and the response (Skinner, 1957, p.55). Stated differently, with the echoic, the response generated by the speaker sounds similar to the stimulus that evoked it. An example of echoic behavior would be saying the word "tree" as a result of hearing someone say "tree." Echoic behavior is typically acquired early in the development an individual's verbal repertoire and is essential in learning to tact the name of objects. In addition, an echoic repertoire is very important for teaching children with verbal behavior delays in that it can be used to teach more advanced forms of verbal behavior and can also be used to improve articulation skills (Sundberg & Partington, 1998).

Tacts. Skinner (1957) defined the tact as, "a verbal operant in which a response of a given form is evoked (or at least strengthened) by a particular object or the property of an object or event" (pp.81-82), and the response is reinforced "with many different reinforcers or with a generalized reinforcer" (p.83). In everyday terms, the tact can be thought of as naming the physical features of the environment. For example, saying "dog" in the presence of a dog may be

a tact. The response topography is not an important consideration in the classification of the tact. The response may be vocal, written, gestural, or any form of behavior as long as the reinforcement is mediated and the form of the response is controlled by a prior non-verbal stimulus (Peterson, 1978).

The ABLA and Language Research

Research has also shown that performance on the ABLA correlates with language assessments. In 1977, Casey and Kerr conducted a study to determine the types of relationships that exist among auditory and visual discrimination skills and language. Participants were 42 typically-developing children (aged 13-35 months) within matched age groups (5-month blocks). The extent of each child's verbal skills was evaluated using three measures: mean length of utterance (derived from morpheme groupings as specified by Brown, 1973), upper bound or longest utterance obtained (according to Brown's rules) and a vocabulary sample. Results indicated that regardless of age, those children who passed ABLA Level 6 had significantly higher scores on mean length of utterance, upper bound or longest utterance obtained, and a vocabulary sample than the age-matched children who failed ABLA Level 6 (Casey & Kerr, 1977). Additionally, a clear association emerged between auditory-visual discrimination skills, a mean length utterance of 2.3 (derived from morpheme groupings), and a vocabulary of more than 75 words. Furthermore, the language of children who demonstrated auditory visual skills was uniformly better than the language of those children who did not. However, just because a child failed an auditory task this did not mean that no speech was present. Some children who failed an auditory task followed simple instructions, and some spoke a few words. Therefore, these results suggest that mastery of auditory tasks may be associated with expressive language.

More recently, Ward and Yu (2000) found that children with autistic-spectrum disorder also exhibited the same hierarchical relationship in ABLA performance as do children with DD. Additionally, the language abilities of the children with autistic-spectrum disorder were correlated with their ABLA performance in that children who had achieved ABLA visual matching (list levels) used only single words or signs and children who had acquired the auditory tasks of the ABLA produced two or three-word utterances. Meyerson (1977) found that no children with DD who failed ABLA Levels 5 and 6 passed the Distar Reading Readiness Test, when screened independently by a reading specialist. Those individuals who did pass the Distar Reading Readiness Test had also passed ABLA Level 6. These results suggest that simple speech discrimination skills as measured by auditory-visual combined discriminations (Levels 5 and 6) are prerequisites for more complex language discriminations.

In a different study, Barker-Collo, Jamieson, and Boo (1995) assessed individuals with DD on the ABLA, the Vineland Adaptive Behavioral Scales (VABS) (Sparrow, Balla & Cicetti, 1984), and the Communication Status Survey (CSS; Barker-Collo, 1995). They found that ABLA Levels 5 and 6 were significantly correlated with VABS scores of receptive and expressive language as well as, communication measures of the CSS. Moreover, individuals with no formal communication abilities were classified at Level 2 or lower on the ABLA, while individuals with advanced language skills were classified at or above ABLA Level 4.

The ABLA and Three Verbal Operants

In designing verbal behavior intervention programs, it may be beneficial to assess the pre-requisite skills needed to learn certain types of verbal behavior (i.e., echoics, tacts, etc.). A recent study conducted by Marion et al. (2003) examined the pre-requisite skills necessary for successful performance on a test of three verbal operants. Marion et al. (2003) examined the

pass-fail performance on the ABLA, two prototype auditory matching tasks, and a test of echoics, tacts, and mands with a sample of persons with DD. They also assessed the test-retest reliability of a test of three verbal operants (echoics, tacts, and mands). The participants consisted of: (a) 14 adults who passed up to and including either ABLA Level 3 and 4, but failed Level 5 and 6, Auditory-Auditory Identity-Matching (AAIM) and Auditory-Auditory Non-Identity Matching (AANM; referred to as the visual group); (b) 13 adults who passed up to and including ABLA level 6, but failed AAIM and AANM (referred to as the auditory-visual group); and (c) 11 adults who passed all ABLA levels and the auditory matching tasks (referred to as the auditory-auditory group). Results indicated that: (a) discrimination skills (e.g., visual, auditory-visual, and auditory-auditory) were a better predictor of performance on the verbal operant assessments than level of functioning based on diagnosis; (b) individuals who passed the two auditory matching tasks performed better on the verbal operant assessment than those unable to pass the auditory matching tasks and; (c) individuals who passed ABLA Level 6 performed better on the test of three verbal operants than those unable to perform this discrimination. Only 2% of the verbal assessments were passed by participants who failed ABLA Level 6, while 36% of the verbal assessments were passed by individuals who passed ABLA Level 6. These results suggest that future research should examine whether ABLA Level 6 is a possible bridging task for teaching echoics, tacts and mands to persons with intellectual disabilities.

More recently, researchers have investigated whether performance on ABLA Level 6 predicts a client's ability to identify pictures of objects when the tester states the names of the objects (Verbeke, et al., 2007). Five clients with severe DD who passed ABLA Level 6, but failed a test of AAIM, and five clients who passed ABLA Level 4, but failed ABLA Level 5 and 6 and AAIM, were assessed to determine their ability to point to pictures of common objects

after hearing their names. The testing procedures for each pair of photographs followed the ABLA procedures for testing Level 6. The experimenter placed the pairs of photographs on the table in front of the participant. The participant was then given a demonstration, a guided trial, and the opportunity for an independent response with each of the two pictures. When a correct independent response was given to each picture, testing of that pair of pictures began. On a test trial the experimenter stated the name of one of the pictures. For example, if the pair of pictures consisted of a cup and a plate, the experimenter either said "cup" or "plate" and the correct response was to point to the appropriate picture. Following a correct response a participant was given the reinforcer and praise. After an incorrect response the experimenter said "no" and then proceeded with a demonstration, a guided trial and an opportunity for an independent response. The location (e.g., left or right side) of the two pictures and the words spoken (e.g., "cup" or "plate") were randomly alternated across trials. For each pair of pictures, testing continued until eight consecutive correct responses (pass) or eight cumulative errors (fail) had occurred. The five pairs of pictures were assessed in a random order across participants.

Results indicated that four of the five Level 4 participants failed all of the name recognition tasks. However, one of the Level 4 participants passed all of the name recognition tasks without any errors. The performance of the Level 6 participants was consistent across all tasks with all five of the participants passing all of the name recognition tasks. For data analysis purposes, participants earned one point for each object name recognition task passed and zero points for each task failed. A one-tailed independent samples *t*-test was used to evaluate the significance of the difference between the points assigned for passing of the name recognition tasks by the Level 4 participants versus the points assigned for the passing of the name

recognition tasks by the Level 6 participants. Results from the one-tailed *t*-test demonstrated a significant difference (t [8] = 4.43, $p < .05$).

The results of this study suggest that ABLA Level 6 may be a prerequisite skill in the acquisition of receptive language, specifically object name recognition. ABLA Levels 2, 3 and 4 consist of a visual discrimination in which the client is asked to discriminate between two visually-presented alternatives. On the other hand, ABLA Level 6 consists of an auditory-visual discrimination. ABLA Level 6 requires an individual to make a discrimination between two words that are spoken by the instructor as well as a visual discrimination between two objects in front of the participant. Therefore, Level 6 requires more complex discriminations than lower ABLA levels. While clients at Levels 2, 3, and 4 have mastered two-choice visual discrimination skills, they have yet to acquire the necessary auditory discriminations required for Level 6.

The results of Verbeke, et al., (2007) indicate that the ability to pass ABLA Level 6, an auditory-visual discrimination, is a good predictor of receptive name recognition. Object naming behavior (i.e., vocal tacting) might also be conceptualized as requiring an auditory-visual discrimination when tacting is vocally manded by someone. For example, if a tester says "what is that?" as opposed to "show me the," then the participant must discriminate the questions and then look at and name the designated object. Because vocally manded tacting appears to include an auditory-visual discrimination, the ability to pass ABLA Level 6 may make it easier to learn such behavior. This research examined that possibility.

Statement of the Problem

This study investigated whether participants who passed ABLA Level 6 (the Auditory-Visual group – Group 1) would more readily learn object naming behavior (vocal tacts) than persons at lower ABLA levels (Levels 2, 3, and 4; the Visual group –Group 2). An attempt was

made to teach six vocal tacts to a group of participants who passed ABLA Level 6 and to a second group of participants who failed ABLA Level 6. It was predicted that (a) the Auditory group would meet mastery criterion on a significantly larger number of naming responses than the Visual group and (b) the mean number of trials to mastery criterion would be significantly lower for the Auditory group than for the Visual group.

Method

Participants and Setting

Participants were divided into two groups: an Auditory-Visual group (Group 1) and a Visual group (Group 2). The Visual group included four adults diagnosed with mental retardation (MR; ABLA Levels 2, 3, & 4) and two children diagnosed with autism (both ABLA Level 4). The Auditory-Visual group was comprised of four individuals diagnosed with MR and two children diagnosed with autism (all Level 6: see Appendix A for a description of participant characteristics). All participants were matched as closely as possible on the Vineland Adaptive Behavior Scales (VABS) Communication Subscale (as will be described later). Consent for the participants to take part in this study was obtained either from the participants themselves (1 participant), or from the participant's legal guardians. Each participant was asked at the beginning of each session if they assented to their participation.

Sessions were conducted in a research room in the Research Centre at St. Amant or in the participant's home. The research room had a rectangular table in the centre with a chair on each side. A participant sat directly across from the experimenter. For sessions conduced in the participant's home, all sessions were conducted at a table in a quiet area that was relatively free from distractions. When inter-observer agreement and procedural reliability assessments were conducted (as described later), an observer sat next to the experimenter.

Materials

The ABLA. The testing materials for the ABLA consists of a large yellow can (approximately 15 cm in diameter and 17 cm in height), a red box with black stripes (approximately 14 cm x 14 cm x 10 cm), an irregularly shaped piece of beige foam, a yellow wooden cylinder (approximately 9 cm long and 4 cm in diameter), and a red wooden cube with black stripes (5 cm x 5 cm x 5 cm). The six levels of the ABLA can be administered in approximately 30 minutes for an individual student (Martin et al., 2004).

Echoics and Tacts. No materials were needed for assessing echoics. For the tact assessment, 11 objects were used: a bowl, a spoon, a bottle of juice, a small three-piece puzzle of a bear, a piece of beige foam, a red box with black stripes, a yellow can, a pen, a small plastic cup, pudding, and a piece of paper. Additionally, a small blue ball was used during both verbal operant assessments.

Object Name Recognition and Tact Training. Materials for the object name recognition task and for tact training consisted of common 3-D objects (e.g., a book, a cup, a spoon, etc.), selected from a list of the first 240 words recommended to be taught to individuals with DD (Sundberg & Partington, 1998).

Procedure

Assessment on the ABLA

At the beginning of the study, each participant was given the ABLA to determine their ABLA level. The test was administered as described by Kerr et al. (1977), and as summarized previously.

Interobserver Agreement. Inter-observer agreement (IOA) checks were conducted for 87% of all ABLA assessments. In order to calculate an IOA, an observer and the tester

independently recorded the participant's response on each trial. A trial was defined as an agreement if both observers recorded the same response; otherwise it was defined as a disagreement. IOA scores were calculated by dividing the number of agreements in a session by the number of agreements plus the number of disagreements, and then multiplying by 100% (Martin & Pear, 2007). IOA scores were 100% across all sessions and participants.

Procedural Integrity. Procedural integrity (PI) checks were calculated for 88% of the ABLA assessments using a checklist of steps to be followed. An observer and the experimenter independently recorded the steps of the procedure that were performed correctly by the experimenter. A PI score for a session was calculated by dividing the number of steps recorded by the observer as correctly performed, by the total number of steps and multiplying by 100. PI scores were 100% across all participants. A procedural observer agreement (POA) score for a session was calculated by dividing the number of agreements between the experimenter and the observer on the steps that were performed correctly, by the number of agreements plus the number of disagreements, and then multiplying by 100% (Martin & Pear, 2007). POA scores were calculated for 88% of all sessions. The mean POA score across sessions was 100%.

Assessment on the VABS Communication Sub-Scale

The VABS assesses personal and social sufficiency of individuals from birth to adulthood and can be used with individuals with or without DD (Sparrow et al., 1984). The VABS does not require the direct administration of tasks to an individual, but instead requires a respondent who is familiar with the individual's behavior. For the participants with DD, the VABS Communication Subscale was administered to each participant's Adult Day Services teacher, provided that the teacher had worked with the selected participant for at least 6 months. If a teacher had not worked with a participant for at least six months, the subscale was

administered to another staff member (e.g., unit staff) who was familiar with the participant and had worked with him/her for 6 months or longer. For the children with autism, the VABS communication subscale was administered to a parent.

Assessment of Echoics and Tacts

Prior to the teaching phases, each participant was assessed on a test of echoics and tacts. The test of echoics evaluates a participant's ability to mimic common sounds and words (see Marion et al., 2003). The test of tacts assesses the participant's ability to name a variety of objects. The purpose of the echoics and tacts assessment was to evaluate a participant's baseline functioning.

Eleven words and items were used during the echoic and tact assessments (see Marion et al., 2003 for a description of how these items were selected). The echoic assessment consisted of a tester saying to a participant "Say ____" (e.g., "Say cup"). A participant was then required to vocally imitate the word that was spoken by the tester. The tact assessment consisted of the tester placing an item on the table and saying "What's this?" The participant was then required to name the item. For both the echoic and the tact assessments, a participant's response was recorded as either correct (pronouncing all syllables correctly), an approximation (vocalizing a part of the word), incorrect (not pronouncing any part of the word), or an omission (no response after 10 seconds; see Appendix B). If a participant said the word correctly or approximated the word, verbal praise was given (e.g., good job). If the response was incorrect, the tester said "Thank-you." When a participant did not respond (an omission) no feedback was given and the experimenter waited approximately 10 seconds before beginning the next trial. To maintain attention throughout testing, a participant was presented with an "easy" task following every third trial of the echoics and tact assessment, and praise was provided after completion of the

task. Specifically, a small blue ball was rolled to the participant after every third trial. The tester rolled the ball to the participant and said "pick it up." Praise was given upon completion of the task.

Scoring. A participant's score on the echoics and tacts assessment was calculated by dividing the number of correct responses by the number of incorrect responses and omissions and then multiplying by 100, resulting in a total percentage correct for the echoics and tacts assessment.

Interobserver Agreement. For each verbal assessment the tester and an assistant sat in the same room and recorded each response made by a participant. Once the assistant had scored a response from the participant, the assistant would then say, "Okay" to the tester. Upon hearing this cue from the assistant, the tester proceeded to deliver the appropriate consequence (e.g., praise, thank you, or saying nothing) to the participant. This ensured that the type of consequence delivered by the tester did not cue the assistant as to how the tester had scored the response. The delay between response and consequence was brief and lasted for approximately 1-2 seconds. IOA checks were conducted for approximately 66% of all sessions. A trial was defined as an agreement if both observers recorded the same response; otherwise, it was defined as a disagreement. IOA scores were calculated by dividing the number of agreements in a session by the number of agreements plus the number of disagreements, and then multiplying by 100% (Martin & Pear, 2007). IOA scores ranged from 61-100% across participants with a mean IOA score of 93%.

Procedural Integrity. PI and POA scores were calculated for 66% of the sessions using a checklist of steps to be followed. An observer and the experimenter independently monitored all parts of the procedure to ensure that they were carried out correctly. PI and POA scores were

calculated as described previously for the ABLA. The mean PI score across assessments was 97% (range 78-100). The mean POA score across sessions was 99% (range 94-100).

Research Design

Participants were divided into two groups Group 1(the Auditory Group) and Group 2 (the Visual Group). In addition, for tact training purposes participants were assigned to matched pairs (one participant from each group in each pair). Participants were assigned to matched pairs based on their initial scores on the Communication Subscale of the VABS. Two participants that formed a matched pair were taught the same six tacts (with one exception) although the tacts taught varied from one pair to the next. For example, participants 5 and 7 were paired and they were taught the same unknown tacts, however these tacts were different than those taught to participants 9 and 10, who formed another pair. Additionally, the teacher for each participant in a pair was consistent across testing and teaching sessions, but was not necessarily consistent across all pairs. That is, the teacher for a participant pair (e.g., participants 5 and 7) was the same individual, however a different teacher taught the unknown tacts to participants 9 and10.

Due to the labor-intensive nature of the study, three teachers were involved in data collection including preliminary assessments and tact training. All three teachers were graduate students in psychology. Teacher 1 conducted preliminary assessments and tact training with two participant pairs. Teacher 2 conducted preliminary assessments and tact training with three participant pairs and Teacher 3 conducted preliminary assessments and tact training with one participant pair. The standardized nature of the tact training procedure, and the fact that each trainer taught a participant pair (i.e. a Group 1 and Group 2 participant), minimized the likelihood of a trainer effect occurring across participants.

Selection of Vocal Tacts to be Taught (Unknown Tacts)

A list of potential unknown tact items was compiled from the list of the first 240 words recommended to be taught as first words to individuals with DD (Sundberg & Partington, 1998). In an attempt to control for word complexity, the maximum syllable length for a potential unknown tact was three syllables. The ability of each participant to tact the unknown object names was assessed as described previously. From the list of unknown tacts six tacts were chosen as targets for tact training for each of the pairs of participants. Four 2-syllable words and two 3-syllable words were identified for each pair of participants. See Appendix C for a list of unknown tacts and acceptable approximations.

Echoics Assessment for Unknown Tacts

Each participant was given a test of echoics for the unknown tacts targeted for training. The echoics assessment was conducted as described previously. As a requirement for tact training participants must have been able to echo or approximate the chosen tact. If a participant was unable to echo or approximate a potential unknown tact, then a new item was selected for tact training and again assessed on a test of echoics.

Assessment of Object Name Recognition

While not part of the research question, assessment of object name recognition was conducted to provide additional information about participants' baseline levels of functioning. The information did not affect assignment to a participant pair or selection of unknown tacts; however this information was available for post hoc analysis of the results. Once six objects for tact training were identified for each pair of participants, each participant was given an assessment of object name recognition for the chosen tacts (as described by Verbeke et al., 2007). Prior to the object name recognition assessment, the objects to be taught were randomly

assigned to a task pair; however, only objects that did not begin with the same letter were eligible for pairing together. During an assessment of the name recognition of a pair of objects, the experimenter placed two objects on the table in front of the participant. The testing procedures followed the ABLA procedures for testing Level 6, in that before the first trial each participant was given a demonstration, a guided trial, and the opportunity for an independent response with each of the objects. A demonstration consisted of the experimenter stating the name of one of the objects (e.g., "fork"). The experimenter then pointed to the correct stimulus. Following the demonstration a guided trial was given. In the guided trial, the experimenter again stated the name of one of the objects and then guided the participant's hand to point to the correct stimulus. Finally, the participant was given an opportunity for an independent response. The participant was required to point to the correct object named by the experimenter. If the participant responded correctly, an edible reinforcer and social praise (e.g., "good job") was given. If the response was incorrect, another demonstration, guided trial and opportunity for an independent response would occur until there had been a successful independent response. The demonstration, guided trial and opportunity for an independent response were given for each object with the objects presented on alternating sides. Test trials then began.

On a test trial, the experimenter stated the name of one of the objects. For example, if the pair of objects consisted of a cup and a plate, the experimenter said either "cup" or "plate". The participant was then required to point to the appropriate object when the tester said its name. Following a correct response a participant was given an edible and praise. After an incorrect response the experimenter said "no" and then proceeded with a demonstration, a guided trial and an opportunity for an independent response. The location (e.g., left or right side) of the two objects and the words (e.g., "cup" or "plate") spoken was randomly alternated across trials. For

each task pair, testing continued until the pass criterion of eight consecutive correct responses or the failure criterion of eight cumulative errors was met for that task pair. Then, testing was done on the next task pair, and so on, until all the pairs were tested. The task pairs were presented in random order.

Interobserver Agreement. IOA checks were conducted for approximately 82% of all sessions. In order to calculate an IOA, an observer and the tester independently recorded the object pointed to by a participant for each trial. A trial was defined as an agreement if both observers recorded the same response; otherwise, it was defined as a disagreement. IOA scores were calculated by dividing the number of agreements in a session by the number of agreements plus the number of disagreements, and then multiplying by 100% (Martin & Pear, 2007). The mean IOA score across all sessions was 100%.

Procedural Integrity. PI and POA checks were calculated for 82% of the sessions using a checklist of steps to be followed. An observer and the experimenter independently monitored all parts of the procedure to ensure that they were carried out correctly. PI and POA scores were calculated as described previously for the ABLA. The mean PI score across assessments was 100%. The mean POA score across sessions was 100%.

Overview of Procedure to Teach Tacts

Tact training was conducted using an interspersal training procedure in which tacts which are already known were alternated with tacts which were unknown (Rowan & Pear, 1985). Prior to beginning tact training, three items which the participant was correctly able to tact in the initial tact assessment were selected. These three items, referred to as the known tacts, were alternated with unknown tacts during training trials. During tact training, we attempted to teach

each participant to tact the names of six common objects. The tacts to be taught, referred to as the unknown tacts, were six objects chosen as described previously.

Prior to the beginning of a tact training session, a participant was presented with six edibles and asked to choose three. The three edibles chosen by the participant were then used along with praise to reinforce a correct response. The three edibles were randomly alternated across correct trials within a training session. Following incorrect trials the experimenter removed the task materials and refrained from interacting with the participant for approximately 5 seconds.

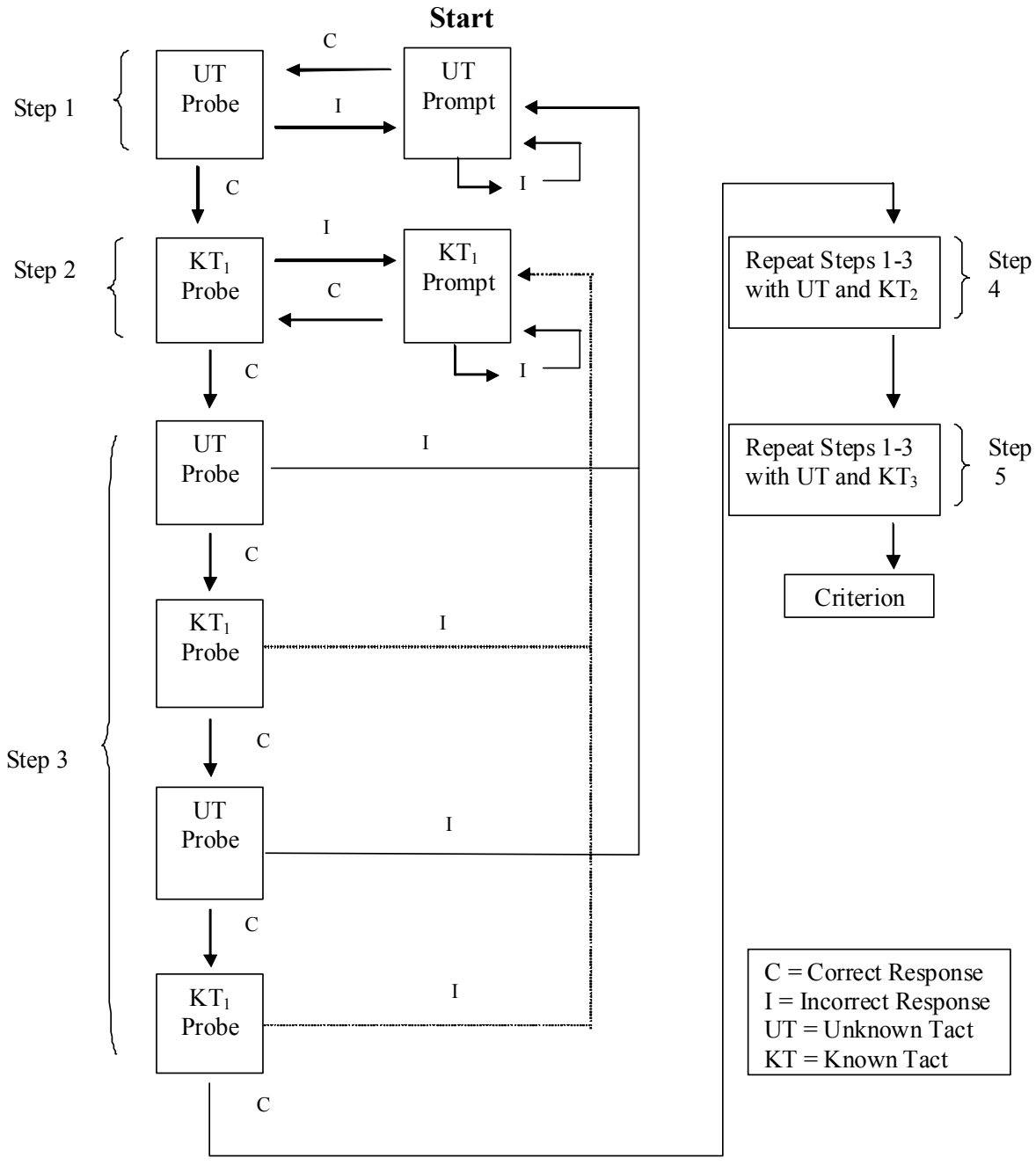
During interspersal training, a prompt trial referred to a trial in which the experimenter provided an imitative prompt following the S^D. For example, "What is it? Shoe." A probe trial referred to a trial in which no imitative prompt was given. For example, "What is it?" An unknown tact (UT) was taught by presenting a prompt trial followed by a probe trial. Assuming that a participant responded correctly on the two trials, the UT was then alternated three times with a known tact (KT_1), then with a second known tact (KT_2) and then with a third known tact (KT_3). When the entire sequence of probe and prompt trials was complete, the object was considered mastered.

Details of Interspersal Training Procedure

Step 1. The details of the interspersal training procedure are presented in Figure 1. A new UT to be taught was introduced on a prompt trial at "Start." If the participant made an error (incorrect response or omission) on this trial, the prompt was repeated on the next trial. The prompt was repeated on succeeding trials until the participant responded correctly. When a correct response to the prompt occurred, a probe was given

Interspersal Tact Training Procedure

Figure 1. Diagram of the interspersal tact training procedure. Adapted from Rowan & Pear (1985).



with the UT on the next trial. If the participant made an error on this probe trial, the prompt and probe trials were repeated.

Step 2. After the participant responded correctly to the probe for the UT, a probe for KT_1 was presented on the next trial (see Figure 1). If the participant made an error, a prompt for KT_1 was presented on the next trial, just as was done for the UT in Step 1. Then the probe trial for KT_1 was repeated.

Step 3. After the participant responded correctly on the probe trial for the UT and for the KT_1, probes for KT_1 and the UT alternated on succeeding trials (see Figure 1). If an error occurred on any of these trials, the participant returned to either Step 1 or Step 2, starting with a prompt trial in either case, depending on whether the error occurred to the UT or to KT_1.

Step 4. When the participant responded correctly on six probe trials, three for the UT and three for KT_1 with no intervening errors, KT_1 was replaced with KT_2 and Steps 1 to 3 were repeated, beginning at "START."

Step 5. When Step 4 had been completed, the KT_2 was replaced with a KT_3 and Steps 1 to 3 were carried out again, beginning at "START." When this process had been completed, the UT was said to have reached criterion and the procedure recycled to "Start" with a new randomly selected UT and KT_1.

If a participant emitted only correct responses, then the sequence of trials to learn a UT would be as follows: prompt UT (Start), probe UT, probe KT_1, probe UT, probe KT_1, probe UT, probe KT_1 and repeat the seven trials with UT and KT_2, and then repeat the seven trials with UT and KT_3. Thus, a new tact could be mastered in a minimum of 21 trials. If an unknown tact did not reach criterion within 150 trials, the object was considered failed.

Interobserver Agreement. IOA checks were conducted for approximately 76% of all sessions. In order to calculate an IOA, an observer and the tester independently recorded the participant's vocal tact for each trial (see Appendix D). A trial was defined as an agreement if both observers recorded the same response; otherwise, it was defined as a disagreement. IOA scores were calculated by dividing the number of agreements in a session by the number of agreements plus the number of disagreements, and then multiplying by 100% (Martin & Pear, 2007). The mean IOA score across all sessions was 97% (range 86-100).

Procedural Integrity. PI and POA scores were calculated for 76% of the sessions using a checklist of steps to be followed. An observer and the experimenter independently monitored all parts of the procedure to ensure that they were carried out correctly. PI and POA scores were calculated as described previously for the ABLA. The mean PI score across assessments was 99% (range 95-100). The mean POA score across sessions was 99% (range 95-100).

Retention Tests. Approximately two weeks following the completion of the interspersal training procedure for a mastered tact (i.e., a tact that was acquired in less than 150 trials), a participant was given a test of retention for that tact. The retention test consisted of presenting both a known tact and a mastered tact to the client in a random sequence for a total of ten trials (five trials with the mastered tact, five trials with the known tact). Participants were assigned a score out of five on the retention test (mastered tact trials only).

Interobserver Agreement. IOA checks were conducted for approximately 66% of all sessions. In order to calculate an IOA, an observer and the tester independently recorded the participant's vocal tact for each trial. A trial was defined as an agreement if both observers recorded the same response; otherwise, it was defined as a disagreement. IOA scores were calculated by dividing the number of agreements in a session by the number of agreements plus

the number of disagreements, and then multiplying by 100% (Martin & Pear, 2007). The mean IOA score across all sessions was 99% (range 97-100).

Procedural Integrity. PI and POA checks were calculated for 66% of the sessions using a checklist of steps to be followed. An observer and the experimenter independently monitored all parts of the procedure to ensure that they were carried out correctly. PI and POA scores were calculated as described previously for the ABLA. The mean PI score across assessments was 99% (range 97-100). The mean POA score across sessions was 99% (range 97-100).

Object Contact Questionnaire

Following the tact training procedures, staff members who were familiar with the individual were asked to rate the frequency with which the client encountered and heard the names of those objects chosen as unknown tacts (see Appendix E). The rating scale ranged from a 0 rating, "never encounters or hears the name of the object" to a rating of 4, "encounters and hears the name of the object 7 or more times a day." Objects that were encountered at least 3-4 times a day (rating of 2 or higher) were defined as encountered frequently. All unknown tacts were rated as "1" or lower.

Results

VABS Communication Subscale. All participants in the study were classified as "Low" on the Communication Subscale, with standard scores ranging from 20 to 42. A one-tailed paired samples *t*-test showed that the scores of the two groups were not significantly different (t [5] = -.536 $p > 0.05$). Group 1 participants had a mean score of 30.14 (*SD* 20.4) whereas Group 2 participants had a mean score of 26.17 (*SD* 9.6).

Object Name Recognition. Each participant was given a test of object name recognition (as described previously) for all of the unknown tacts. The Auditory-Visual group participants

could point to all six of the objects in the object name recognition assessments. The Visual group participants could point to an average of two of the six objects in the object name recognition assessments.

Tact Training. The main dependent variable was trials to criterion. If a participant did not learn a tact within 150 trials, then the trials to criterion was scored as 150 for that tact. It was predicted that there would be a large difference between the two groups in trials to criterion with the Auditory-Visual group (Group 1) showing significantly fewer trials to criterion than the Visual group (Group 2). All participants in Group 1 met the learning criterion on all 6 tacts, whereas Group 2 learned an average of 3.8 (*SD* 1.8) tacts. Only 1 participant in Group 2 met the learning criterion on all 6 tacts (see Table 1). The difference in number of tacts mastered was statistically significant (t [5] = 2.89, $p < .05$, one-tailed).

For tacts that met the learning criterion within 150 trials, Group 1 mastered the tacts in an average of was 24.9 trials (*SD* 5.2) and Group 2 in an average of 73.2 (*SD* 32.8) trials (Table 1). The difference in trials to mastery criterion was statistically significant (t[5] = –4.93, $p < .01$, one-tailed). In general, Group 1 participants required fewer trials than Group 2. The training trials to criterion for individual participants are shown in Appendices F and G.

Figure 2. Mean number of training trials to criterion for the two groups.

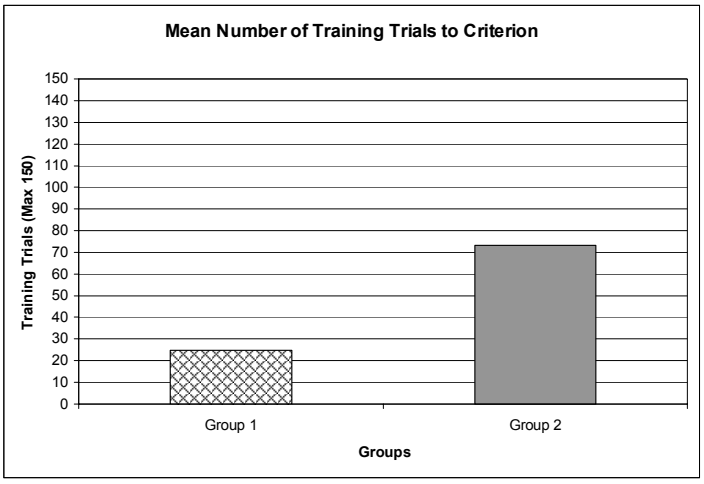
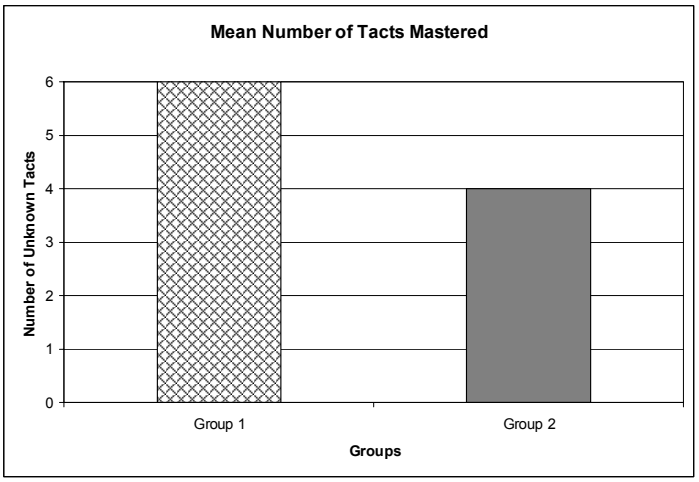


Figure 3. Mean number of tacts mastered for the two groups.



Retention Tests. All participants were given tests of retention for tacts that were mastered in fewer than 150 trials. The average score on the test of retention was 82% for Group 1 and 56% for the Group 2. The difference in retention scores between the two groups was statistically significant ($t\{5\} = 5.16$, $p < 0.1$). The mean retention score for Group 1 participants was 9.25 ($SD = 1.7$) and the mean score for Group 2 participants was 6.29 ($SD = 6.29$).

Discussion

A person's ability to perform auditory-visual discriminations predicts the ease or difficulty with which they will master new tacts. Results indicated that participants in the Auditory-Visual group (Group 1) were able to master new tacts in significantly fewer trials than participants in the Visual group (Group 2), even though the initial scores of both groups on the VABS Communication Subscale were in the "Low" range and were not significantly different. Furthermore, participants in Group 1 mastered more tacts overall than participants in Group 2 and this difference was statistically significant. For those tacts that were mastered, the overall retention rate of Group 1 participants was higher than that of Group 2 participants. Finally, consistent with previous research, Group 1 participants were able to receptively identify a greater number of objects than were Group 2 participants.

The results of this study suggest that mastery of ABLA Level 6 may facilitate the learning of tacts. Considering that everybody in Group 2 (the Visual group) learned at least one tact, and that everybody in Group 2 had some tacts prior to tact training we can't say that passing ABLA Level 6 is a prerequisite to learning tacts. Mastery of ABLA Level 6 does appear to facilitate learning of tacts in some way though. One possible explanation for the observed performance comes from examining the skills present in ABLA Level 6 that may have facilitated tact acquisition. Since Level 4 visual matching-to-sample encompasses the discriminations at Levels 2 and 3, it may be useful to examine the procedural differences and discriminations needed to pass Level 4 versus Level 6. First, although both ABLA Levels 4 and 6 are two-choice conditional discriminations, the sample and comparison stimuli at Level 4 involve one sensory modality, namely visual, whereas the sample and comparison stimuli at Level 6 involve two modalities, auditory and visual. Second, Level 4 is a quasi-identity matching task in that the

sample and comparisons could be matched based solely on color, whereas Level 6 is a nonidentity matching task in that the sample and comparison stimuli share no physical similarities. Lastly, Level 4 is a simultaneous matching task in that the sample is available, along with the comparisons, during responding, whereas Level 6 approximates a delay matching procedure in that the sample (spoken instruction) appears briefly along with the comparisons, but it is not available during responding. Some or all of these variables may have played critical roles in facilitating tact acquisition. Further research is needed to tease out their effects.

Another possible explanation is that the ABLA visual discrimination levels (Levels 2, 3, & 4) consist of three different types of visual discriminations. On the other hand, ABLA Level 6 consists of an auditory-visual discrimination. ABLA Level 6 requires an individual to make a discrimination between two words that are spoken by the instructor as well as a visual discrimination between two objects in front of the participant. Therefore, Level 6 requires an increasingly complex auditory and visual discrimination. While clients at visual discrimination levels have mastered the necessary visual discrimination skills, they have yet to acquire the necessary auditory discriminations required for Level 6.

The present results are correlational. Future research is also needed to examine the functional contribution of auditory-visual discrimination to naming. For example, future research might identify a group of individuals who fail ABLA Level 6 and then divide them into two groups. Group 1 participants would be taught ABLA Level 6 and then a selection of tacts, and Group 2 would be taught only a selection of tacts. When the subsequent training trials for mastering Level 6 and mastering tacts were combined for Group 1 and compared to the training trials for learning tacts for Group 2, would Group 1 learn more tacts in fewer total trials?

A possible limitation of the present study is that not all participants were taught the same tacts. That is, although each participant in a pair was taught the same tacts (with one exception), the tacts that were taught were not consistent across all pairs. Therefore, it could be argued that the difficulty of tacts taught was not consistent across participants. However, in an attempt to control for word complexity and tact difficulty, unknown tacts were limited to four 2-syllable and two 3-syllable tacts for each participant, all which were chosen from the list of the first 240 words recommended to be taught to individuals with DD and children with autism (Sundberg & Partington, 1998).

A second limitation is the relatively small sample size. That is, there were eight participants diagnosed with DD and four children diagnosed with autism. It would be interesting to replicate the study with a larger sample of DD participants and a larger sample of children with Autism to determine whether the results hold within each diagnostic category.

The small number of participants (six in each of the two groups), may also limit the generality of the results. On the other hand, it is important to note the high consistency of the data across the participants. For example, each matched pair was taught six unknown tacts, and therefore for each matched pair, the results were replicated six times across participant pairs (with one exception).

Finally, although participants were matched in terms of their initial scores on the VABS Communication Subscale, there were some differences between pair members within four of the pairs in terms of their initial echoics score, and between pair members of all six pairs on their initial tacting score as per their initial tact assessment. It is not known if these differences may have contributed to the different results that were obtained. However all participants were capable of echoing the particular components of each tact to be taught. Furthermore, visual

inspection of the data indicates that even for those participants who were similar in terms of initial echoics scores (e.g. Participants 10 & 9, 12 &13), this initial echoic ability did not appear to affect performance on the tact training procedure.

These results indicate that the ability to pass ABLA Level 6, an auditory-visual discrimination level, is a good predictor of the ease with which persons with DD and children with autism will learn to say the name of unknown objects. Assessing the ease or difficulty with which individuals are able to learn particular tasks is important for a number of reasons. First, it may be that certain tasks require a particular set of discrimination skills (e.g., auditory-visual vs. visual discrimination skills) and therefore individuals who have yet to acquire the discrimination skills necessary to successfully perform a particular task may be unable to (or have great difficulty with) completing tasks that require these skills . Previous research has demonstrated that mismatching the ABLA level of persons with DD with the ABLA difficulty of training tasks is likely to result in increased aberrant behavior (Vause, Martin, Cornick et al., 2000; Vause et al., 2000). Thus, knowing a person's ABLA level will allow staff to identify which persons are likely to readily learn tacts, and thereby decrease the likelihood of aberrant behavior by not attempting to teach tacts to persons who have not yet learned auditory-visual discriminations characteristic of ABLA Level 6. Second, identifying the discrimination skills necessary for successful completion of a particular task allows teaching staff to more effectively tailor their teaching programs. That is, staff can organize their teaching programs such that “easier” skills are taught prior to more “difficult” skills thereby making more effective use of teaching time.

Future research should examine methods of teaching auditory-visual discriminations to participants at ABLA Level 4. Given that ABLA Level 6 may be an important prerequisite skill to tacting, efficient methods of teaching auditory-visual discriminations to Level 4 participants

are needed. Furthermore, the teaching procedure used in this study was an interspersal training procedure in which unknown tacts were alternated with known tacts. This procedure was chosen based on previous research which demonstrated its effectiveness in teaching tacts to individuals with DD. At this time however, it is not known whether these results would generalize to other tact training procedures.

Appendix A

Participant Characteristics

Participant	Age	Diagnosis	ABLA level	Echoics score	Tacts score	VABS communication scale score
1 (Pair 1)	42	DD	6	88	93	Low
11 (Pair 1)	34	DD	3	73	49	Low
5 (Pair 2)	36	DD	6	100	90	Low
7 (Pair 2)	33	DD	4	81	3	Low
6 (Pair 3)	38	DD	6	96	84	Low
4 (Pair 3)	36	DD	4	72	27	Low
10 (Pair 4)	12	Aut	6	100	91	Low
9 (Pair 4)	6	Aut	4	100	33	Low
14 (Pair 5)	38	DD	6	98	66	Low
8 (Pair 5)	51	DD	2	42	19	Low
12 (Pair 6)	4	Aut	6	100	61	Low
13 (Pair 6)	7	Aut	4	100	49	Low

Note: DD stands for Developmental Disability. Aut stands for Autism. Vineland communication scale scores refer to scores for the adaptive level of the Communication Subscale.

Appendix B

Echoic and Tact Data Sheets

Participant ID: _____

Tester: _____ IOR: _____

Date:_____

Circle: Echoics or Tacts % correct ____ IOR _____

WORD	CORRECT	APPROXIMATION (indicate in the same box)	INCORRECT	OMISSION
1. box		bah, ox		
2. can/tin		cah, ann/tii, inn		
3. pen		en, peh		
4. juice		juu, uice		
5. cup		cuh, up		
6. pudding		pudd, puh, ding		
7. spoon		spoo, oonh		
8. bowl		boh, ohl		
9. foam/sponge		foh, ooam/sponn, onge		
10. puzzle/bear		puzz, zzle/bœaa, air		
11. paper		peh, perr, pape		
12. box		bah, ox		
13. can/tin		cah, ann/tii, inn		
14. pen		en, peh		
15. juice		juu, uice		
16. cup		cuh, up		
17. pudding		pudd, puh, ding		
18. spoon		spoo, oonh		
19. bowl		boh, ohl		
20. foam/sponge		foh, ooam/sponn, onge		
21. puzzle/bear		puzz, zzle/beaa, air		
22. paper		peh, perr, pape		
23. box		bah, ox		
24. can/tin		cah, ann/tii, inn		
25. pen		en, peh		
26. juice		juu, uice		
27. cup		cuh, up		
28. pudding		pudd, puh, ding		
29. spoon		spoo, oonh		
30. bowl		boh, oohl		
31. foam/sponge		foh, oam/sponn, onge		
32. puzzle/bear		puzz, zzle/beaa, air		
33. paper		peh, perr, pape		

Appendix C

Unknown Tacts and Acceptable Approximations

Participants	Tact	Approximation	Participants	Tact	Approximation
1 & 4	Tiger	iger, tig, ger	9 & 10	Pajamas	jamas, jammies, PJs
	Chicken	icken, chick		Minnie Mouse	minnie
	Lion	li, ion		Big Bird	Bird, ba bird, big ba
	Wagon	wa, gon		Play dough	dough, pay dough
	Baby Bop	bop		Tiger	iger, tig, ger
	Umbrella	brella, umbella, bella		Crayons	ayons, cray
6 & 11	Tiger	iger, tig, ger	8 & 14	Tiger	iger, tig, ger
	Button	utton, butt		Candle	andle, dle, cand
	Play dough	dough, pay dough		Airplane	plane, airpane
	Wagon	wa, gon		Scissors	issors, sciss
	Umbrella	brella, umbella, bella		Elephant	effant, phant
	Baby Bop	Bop		Baby Bop	bop

Appendix C continued

Unknown Tacts and Acceptable Approximations

Participants	Tact	Approximation	Participants	Tact	Approximation
5 & 7	Candle	andle, dle, cand	12 & 13	Napkin	nap, kin, apkin, nakin
	Elmo	mo, elm, emo		Bubbles	ubbles, bubb
	Big Bird	Bird, ba bird, big ba		Big Bird	Bird, ba bird, big ba
	Play Dough	dough, pay dough		Rabbit	bit, rab, abbit
	Minnie Mouse	minnie		Baby Bop	bop
	Pajamas	jamas, jammies, PJs		Donald Duck	donald, duck, don duck

Appendix D

Tact Training Data Sheet

Participant ID: **Date** **SD: "What's This"** **Approximations:**
Tester: **Known Tact:** **Reinforcer:**
IOR: **Unknown Tact:**

Trial	#	Circle One	Circle One	? or X or A or O	Approximations	Trial	#	Circle One	Circle One	? or X or A or O	Approximations
1		KT UT	I P			31		KT UT	I P		
2		KT UT	I P			32		KT UT	I P		
3		KT UT	I P			33		KT UT	I P		
4		KT UT	I P			34		KT UT	I P		
5		KT UT	I P			35		KT UT	I P		
6		KT UT	I P			36		KT UT	I P		
7		KT UT	I P			37		KT UT	I P		
8		KT UT	I P			38		KT UT	I P		
9		KT UT	I P			39		KT UT	I P		
10		KT UT	I P			40		KT UT	I P		
11		KT UT	I P			41		KT UT	I P		
12		KT UT	I P			42		KT UT	I P		
13		KT UT	I P			43		KT UT	I P		
14		KT UT	I P			44		KT UT	I P		
15		KT UT	I P			45		KT UT	I P		
16		KT UT	I P			46		KT UT	I P		
17		KT UT	I P			47		KT UT	I P		
18		KT UT	I P			48		KT UT	I P		
19		KT UT	I P			49		KT UT	I P		
20		KT UT	I P			50		KT UT	I P		
21		KT UT	I P			51		KT UT	I P		
22		KT UT	I P			52		KT UT	I P		
23		KT UT	I P			53		KT UT	I P		
24		KT UT	I P			54		KT UT	I P		
25		KT UT	I P			55		KT UT	I P		
26		KT UT	I P			56		KT UT	I P		
27		KT UT	I P			57		KT UT	I P		
28		KT UT	I P			58		KT UT	I P		
29		KT UT	I P			59		KT UT	I P		
30		KT UT	I P			60		KT UT	I P		

UT = Unknown Tact **I = Independent** ? = Correct
KT = Known Tact **P = Prompt** **X** = Incorrect
A = Approximation
O = Omission

Appendix E

Object Contact Questionnaire

We would like to assess the extent to which (name) is able to identify objects in his/her daily living environment. Below is a list of objects, which (name) may or may not encounter, in his/her daily living and/or working environment. Please estimate the frequency with which he/she encounters and hears the names of these objects, on a daily basis. The rating scale is as follows:

0 – Never encounters or hears the name of the object

1 – Encounters and hears the name of the object 1 – 2 times a day

2 – Encounters and hears the name of the object 3 – 4 times a day

3 – Encounters and hears the name of the object 5-6 times a day

4 – Encounters and hears the name of the object 7 or more times a day

Please assign a number from 0-4 for each object.

Object	Rating	Object	Rating	Object	Rating
Coat		Hat		Cup	
Chair		Spoon		Fork	
Book		Keys		Socks	
Shirt		Shoes		Pillow	
Bowl		Paper		Pants	
Soap		Blanket		Phone	
Toothbrush		Towel		Brush	
Ball		Pencil		Clock	

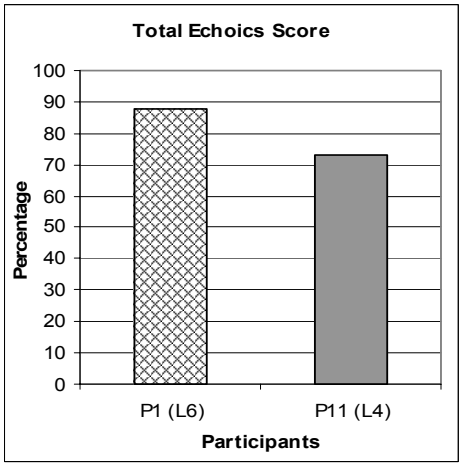
Appendix F

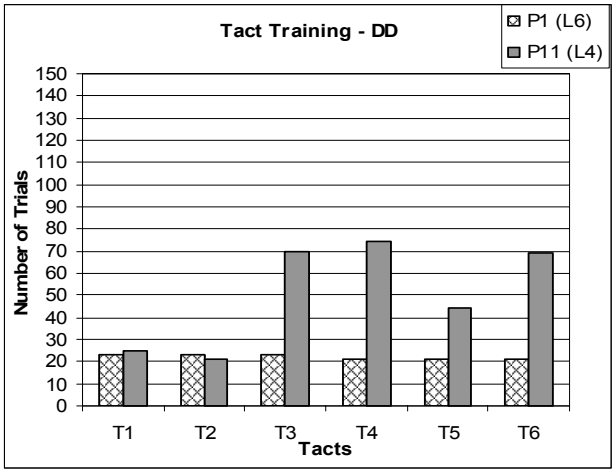
Tact Training Trials and Results from Object Contact Questionnaire

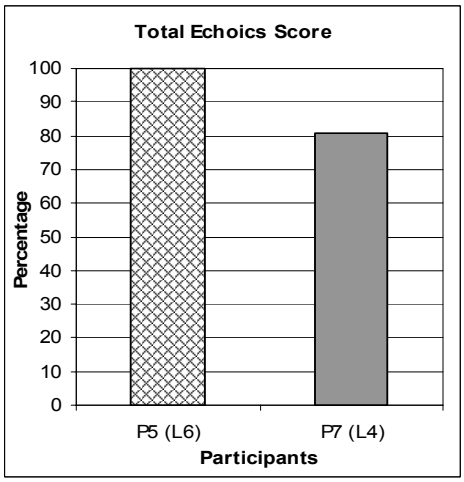
Participant	ABLA Level & Diagnosis	Tacts Learned	Total Trials	Object Name Recognition
1 (Pair 1)	6 - DD	6/6	132	P, P, P
11(Pair 1)	3 - DD	6/6	304	F, P, P
5 (Pair 2)	6 - DD	6/6	126	P, P, P
7 (Pair 2)	4 - DD	3/6	648	F, F, F
6 (Pair 3)	6 - DD	6/6	159	P, P, P
4 (Pair 3)	4 - DD	3/6	724	F, F, P
9 (Pair 4)	4 - Aut	5/6	369	P, P, P
10 (Pair 4)	6 - Aut	6/6	144	P, P, P
14 (Pair 5)	6 - DD	6/6	208	P, P, P
8 (Pair 5)	2 - DD	1/6	881	F, F, F
13 (Pair 6)	4 - Aut	5/6	433	F, P, P
12 (Pair 6)	6 - Aut	6/6	128	P, P, P

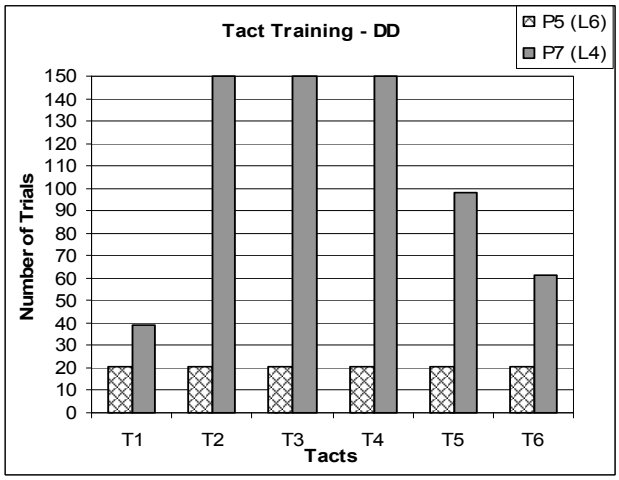
Appendix G

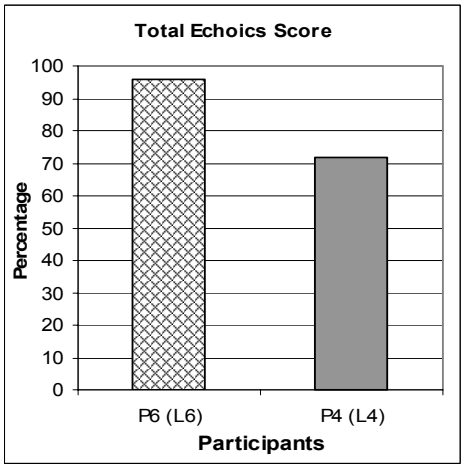
Graphs

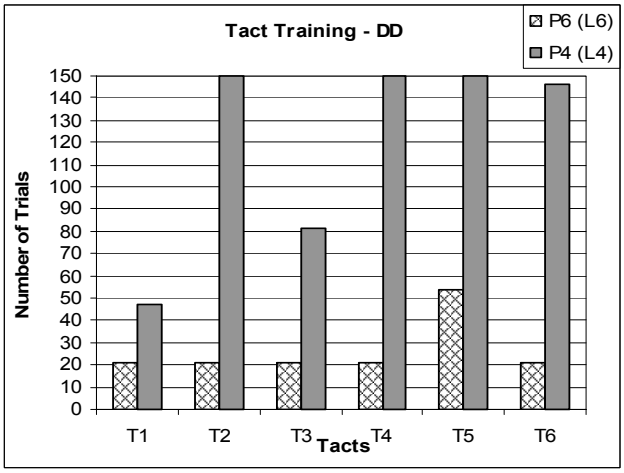








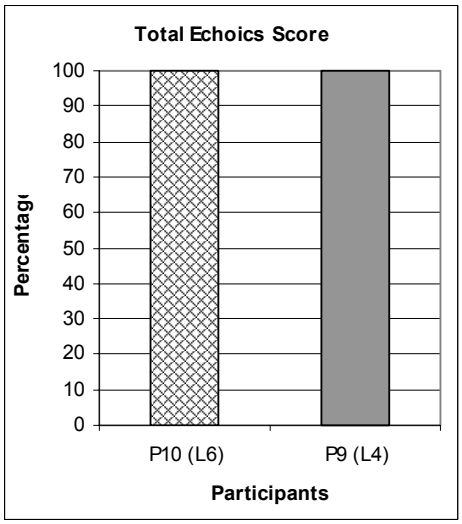


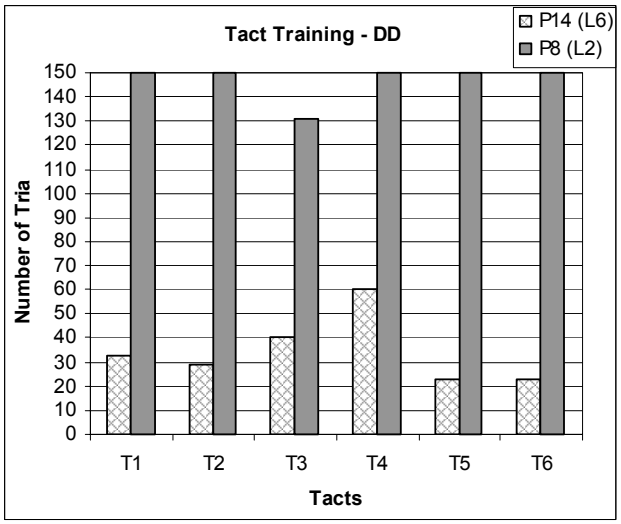


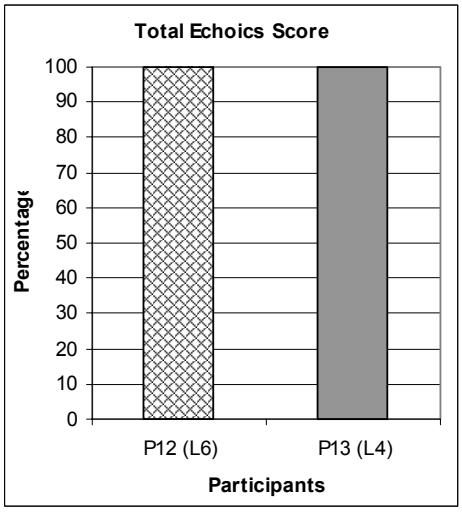
Note: Total echoics score refers to the participant's score on the pre-teaching test of echoics.

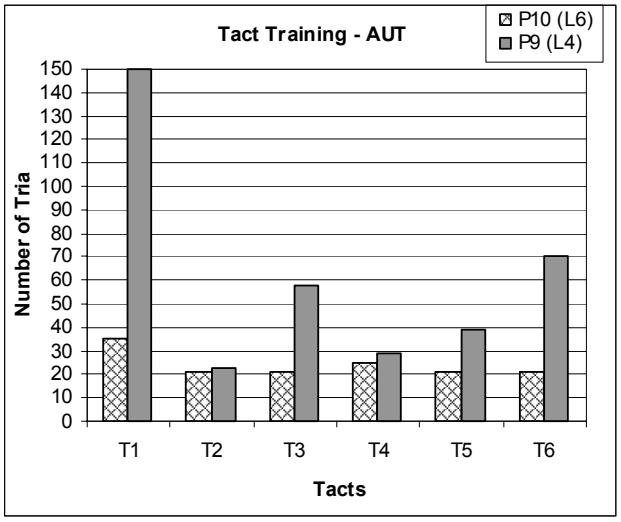
Appendix G continued

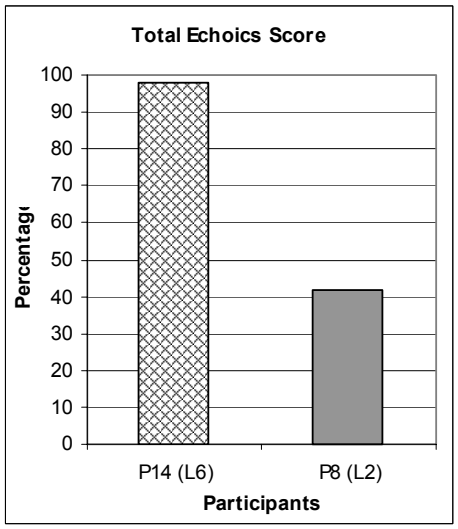
Graphs

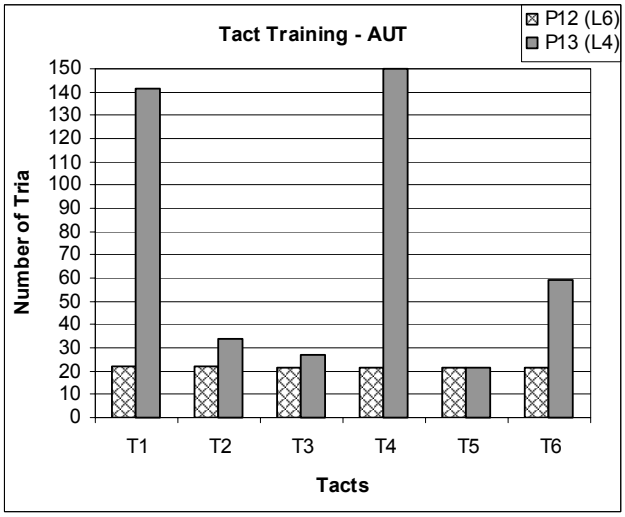












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